APPENDIX A

A HEALTH IMPACT ASSESSMENT (HIA) REPORT IN SUPPORT OF A SECOND SCHEDULE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) OF THE PROPOSED PENGERANG ENERGY COMPLEX, JOHOR
FOR CHEMONE HOLDINGS PTE LTD

SUBMITTED TO

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HEALTH IMPACT ASSESSMENT

Health impact assessment (HIA) is the process of estimating the potential impact of a chemical, biological, physical or social agent on a specified human population system under a specific set of conditions and for a certain time frame (EnHealth Council, 2001; DOE, 2012). The main approach in this HIA is to assess the impacts of the proposed Pengerang Energy Complex in Pengerang, Johor, on the health of residents of affected communities within the vicinity of the proposed project that may emanate from environmental impacts. The HIA reported here is based on the Guidance Document on HIA in EIA by the Department of Environment Malaysia (DOE, 2012). The impacts of the proposed project on workers' health are not included in this HIA, as it is not within the scope specified in the Guidance Document.

Health risk assessment (HRA) is a component of HIA. There are two forms of HRA, namely qualitative and quantitative HRA. Qualitative HRA merely characterizes or compares the hazard of a chemical relative to others, or in comparison to reference values or standards, or defines the hazard in only qualitative terms such as mutagen or carcinogen, which connotes certain risk or safety procedures. In qualitative HRA, only subjective and comparative assessment of environmental hazards are attempted without generating any quantitative estimate of the risks involved.

Quantitative HRA is a methodological approach in which the toxicities of a chemical are identified, characterized, analyzed for dose-response relationships, and the data generated are applied to a mathematical model to produce a numeric estimate representing a guideline or decision concerning allowable exposure (James, 1985a). Quantitative HRA generates a numerical measure of the risk or safety of a chemical exposure. The numerical measure of the risk generated is compared against a guideline value or an acceptable risk level. When conducting a quantitative HRA, there are two categories of risks being assessed, namely non-carcinogenic and carcinogenic health risk.

When interpreting the results of a quantitative HRA, and more so when it is applied for the purpose of a HIA, it should be cautioned that no mathematical modelling can simulate the human body with high accuracy. Therefore, the predictions made in this report are to be taken as a guideline, mainly for a more informed decision-making process, which in this case is whether the operation of the proposed project will incur potentially significant health impacts upon the exposed or affected population. This quantitative HRA will rely heavily on data generated from the air quality modeling study (Chapter 7, Section 7.5.1 of the Main Report). Uncertainties and assumptions made in the air quality modeling will also be translated into uncertainties in the quantitative HRA outcomes. It is the aim of quantitative HRA to minimise these uncertainties related to human health risks, but the fact remains that these uncertainties can never be totally avoided. With that background assumption, the results of quantitative HRA need to be interpreted with due limitations and a high regard for human health and safety.

For the purpose of this HRA, both qualitative and quantitative HRA were employed. There are 6 steps involved in the HRA methodology.

1.1 Issues Identification

This first step explores the source-pathway-receptor link, the component of each is essential in the expression of risk. Health impacts are mainly secondary impacts upon the human community that emanate from primary impacts upon the physical (air, water and soil); biological (animals and plants) and social environments. In the case of this proposed project, the main health impacts will emanate from human exposure to air pollutants that will be released during the construction and operational phases of the proposed project. The major pathway for human exposure to the released air pollutants during the construction and operational phases will be through direct inhalation. Indirect exposure to air pollutants through the ingestion route is highly unlikely in this case. The proposed project site is adjacent to the Petronas Refinery and Petrochemical Integrated Development (RAPID). There is no food crop grown in the vicinity of the proposed project. Therefore, there is low probability of human health risk from the consumption of contaminated foods.

1.2 Hazard Identification

This second step in HRA involves the identification of potential environmental hazards and characterization of their innate adverse toxic or health effects. The purpose is to scope for potential environmental and health hazards that may emanate from the operation of the proposed project. The review indicated that the major environmental hazards from the proposed project will be mainly particulate and gaseous air pollutants during the proposed project operational phase.

1.2.1 Project Construction Phase

It is estimated that at a maximum, 7,000 workers will be employed during the proposed project construction phase over a period of about 15 months. Some of these workers might be Malaysians and foreigners from outside of Johor. Workers who are not properly screened for infectious diseases may transmit them to the local population. These workers who will be mostly young males may present an increased risk in the transmission of sexually-transmitted diseases (STD). Common STDs includes human papillomavirus (HPV) infection, trichomoniasis, chlamydia, herpes simplex virus (HSV) infection, gonorrhea, syphilis, human immunodeficiency virus (HIV) infection and hepatitis B. In 2008, 31.5% of malaria cases were imported cases among foreigners (Ministry of Health, 2008). Immigrants who are likely to harbour malarial parasites can reintroduce the disease to previously malaria-free areas because the vectors may still be present there. Other diseases that may be brought in by foreign workers are tuberculosis, dengue fever and chikungunya. Therefore, it is imperative that proper pre-employment and periodic health screening be done on all workers

According to the Air Quality Modeling Report in Section 7.5.1 of the Main Report, no major earthwork is anticipated during the project construction phase as the industrial park developer will hand over the project site to the project proponent to the required platform. The sources of air pollution during the project construction phase would be heavy

equipment and vehicular emissions during process unit development, transportation, construction of road, and supporting facility. The air pollutants would be mainly combustion gases such as particulate matters (PM), nitrogen dioxide (NO_2), carbon monoxide (CO) due to incomplete combustion if any, and sulphur dioxide (SO_2) due to low sulphur content in the fuel. Dusty materials produced as a result of construction work being carried out may include cement, earth, aggregates, silt, stone fines, sand and debris.

Dust is expected to be generated during the construction phase of the project especially from the movement of vehicles on-site. However, dust pollution due to the construction activities is temporary and the local air quality is expected to return to its normal ambient levels when the construction ceases. Vehicle exhaust emissions on the local road network will be intermittent and transient in nature where associated impacts are considered minor. Exhaust emissions from the diesel engine driven equipment is also expected to result in insignificant impacts on air quality. Generally, the exhaust emissions for the project during construction will be minor.

The area of influence for fugitive dust is anticipated to be localized within the construction area (usually less than 50 m away) as the work area will be limited in nature. The duration of impact for the construction phase will be short-term to medium term. For this project, the nearest residential area is more than 500 m away from the project site. Hence, the air quality impact due to the construction activity is anticipated to be minimal or insignificant.

1.2.2 Project Operational Phase

1.2.2.1 Air Pollutants during the Project Operational Phase

During normal project operation, the main point sources would be mainly emissions from fuel burning equipment. Air pollutants emitted by the proposed project during the operational phase include particulate pollutants in the form of respirable particles (PM10) and fine particles (PM2.5), as well as gaseous pollutants as sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), hydrogen sulphide (H_2S) and hydrogen chloride (HCl). Minimal fugitive emission of volatile organic compounds (VOCs) is anticipated as these fugitive gases will be mainly collected and use as waste gas for fuel in its fuel burning equipment. Residual hydrogen sulphide (H_2S) will also be emitted from the SRU Stack and residual hydrogen chloride (HCl) emission from the CCR RCR Vent.

1.2.2.2 Health Hazards of the Air Pollutants Generated

Particulate matter, especially the fraction of PM2.5 and PM10, with an aerodynamic diameter of 5 μm and 10 μm, respectively, have great impact on human health as they can penetrate beyond the nasopharyngeal region and reach the lower human respiratory tract (Dockery and Pope, 1994; Dockery and Pope, 1996). Acute exposure may lead to asthmatic attack, respiratory infections and acute bronchitis (USEPA, 2003), as well as alveolar inflammation, increased blood coagulability and exacerbation of lung and cardiovascular diseases (Seaton *et al*., 1995).

Sulphur dioxide may cause bronchoconstriction and increased asthma symptoms among children, the elderly, and asthmatics (USEPA, 2013a). Nitrogen dioxide may lead to reduced lung function, airway responsiveness and respiratory symptoms (Searl, 2004), as well as airway inflammation in healthy people and increased respiratory symptoms in people with asthma (USEPA, 2013b). Carbon monoxide causes the formation of carboxyhaemoglobin and reduced oxygen transport by blood causing headache, nausea, rapid breathing, weakness, exhaustion, dizziness, confusion, neurological and cardiological effects including death (CDC, 2013).

Volatile organic compounds (VOCs) are a mixture of volatile organic chemicals which are generally neurotoxic (James, 1985b). They have high vapour pressure and are highly volatile. They may be related to asthma and chronic respiratory symptoms (Ware *et al.*, 1993).

Hydrogen sulphide (H_2S) is a potentially toxic gas. The gas can generate hydrogen sulphide anion (HS^-), which is a potent inhibitor of cytochrome oxidase, an enzyme responsible for cell respiration. This inhibition will interfere with the utilization of oxygen during cell metabolism, even in the presence of adequate blood supply of oxygen. High concentrations of H_2S will lead to a condition called cytotoxic hypoxia which may results in a respiratory arrest. At lower concentrations, H_2S is an irritant gas that may cause conjunctivitis, inflammation of the nasal mucosa and pulmonary edema (James, 1985c).

Hydrogen chloride (HCl) is irritating and corrosive to any tissue it comes into contact. Brief exposure to low levels causes throat irritation. Exposure to higher levels can result in rapid breathing, narrowing of the bronchioles, blue coloring of the skin, accumulation of fluid in the lungs, and even death. Exposure to even higher levels can cause swelling and spasm of the throat and suffocation. Some people may develop an inflammatory reaction to hydrogen chloride. This condition is called reactive airways dysfunction syndrome (RADS), a type of asthma caused by some irritating or corrosive substances (ATSDR, 2019).

1.3 Dose-Response Assessment

The probability of seeing a health effect from human exposure to a toxicant is dependent on the dose of exposure. The only possible human exposure to pollutants that may originate from the proposed project is inhalation exposure to air pollutants during the project construction and operational phase. However, for the project construction phase, exposure to air pollutants is anticipated to be minimal or insignificant. For inhalation exposure to air pollutants, the non-carcinogenic dose-response relationship is reflected in the reference concentration (RfC). RfC is an estimated daily concentration of a toxicant in air, with uncertainty spanning perhaps an order of magnitude, of which an inhalation exposure to the human population including sensitive subgroups, is likely to be without an appreciable risk of deleterious effect during a lifetime of 70 years (DOE, 2012). Therefore, the RfC is described in the form of an air concentration which may be safely inhaled by an exposed person over a lifetime exposure. Where applicable, the RfC is used as a direct comparison with the exposure concentration (EC) of the air pollutant. The unit for RfC is is usually in mg/m^3.

1.4 Exposure Assessment

1.4.1 During Project Construction Phase

As mentioned earlier, exposure to air pollutants during the project construction phase is anticipated to be minimal or insignificant.

1.4.2 During Project Operational Phase

Air pollutants that may be released from the proposed project during its operational phase include PM2.5, PM10, SO_2, NO_2, CO, H_2S and HCl. For the project operational phase, two air pollution emission scenarios were simulated. One is the normal emission scenario whereby all air pollution devices are functioning normally. The other is the abnormal emission scenario when there is a process upset or emergency situation, whereby the stream from the project will be routed to the proposed flare for flaring. For each of the emission scenario, two exposure scenarios were simulated. One exposure scenario is the highest predicted ambient air pollutant concentration. The other is the sensitive receptor ambient air pollutant concentration.

Six air sensitive receptor sites were identified and modeled as described below:

Table 1: **Identified Community Air Sensitive Receptors (ASRs).**

Point	Description	UTM Coordinates (x, y)	Approximate Distance from the Proposed Project Site (km)
ASR1	Open space near Kg. Lepau	405440.40, 153531.26	2.33
ASR2	Sebana Cove Resort	406368.00, 155680.00	2.20
ASR3	Sebana Golf Resort	408531.48, 155476.93	1.55
ASR4	Bukit Pelali	411003.52, 154757.55	1.90
ASR5	Open space near Kg. Bukit Gelugor	412239.45, 154143.02	2.70
ASR6	Open space near Lake View	412857.32, 153528.69	3.35

Table 2 is taken from the Air Quality Modeling Report. It shows the highest predicted maximum ambient incremental concentrations (MAICs) and ground level concentrations (GLCs) at the 6 air sensitive receptors (ASRs) for selected air pollutants during a normal project operational phase.

Table 3 is also taken from the Air Quality Modeling Report. It shows the highest predicted MAICs and GLCs at the 6 air sensitive receptors (ASRs) for selected air pollutants during an abnormal project operation. Here, the reference values used are the acute

exposure guideline levels (AEGLs) by the USEPA. AEGLs describe the human health effects from a once-in-a-lifetime, or rare, exposure to airborne chemicals. AEGLs are used by emergency planners and responders worldwide as guidance in dealing with rare, usually accidental, releases of chemicals into the air. AEGLS are expressed as specific concentrations of airborne chemicals at which health effects may occur. They are designed to protect the elderly and children, and other individuals who may be susceptible. The abnormal project operation scenario was simulated for SO_2 and H_2S.

1.5 Health Risk Characterization

1.5.1 Air Pollutant Exposure Guidelines

This involves a qualitative HRA, whereby the predicted exposure levels of the concerned air pollutants were compared to local and foreign ambient air quality guidelines.

1.5.1.1 During Project Construction Phase

As mentioned earlier, exposure to air pollutants during the project construction phase is anticipated to be minimal or insignificant.

1.5.1.2 During Project Operational Phase

During normal project operation (**Table 2**), all the predicted GLCs for PM2.5, PM10, SO_2, NO_2 and CO at the 6 ASRs will fall below their MAAQS 2013 (Standard 2020), while the predicted GLCs for H_2S and HCl will not exceed their Ontario' Ambient Air Quality Criteria 2012.

During abnormal project operation (**Table 3**), the GLCs for SO_2 at the 6 ASRs will be below its AEGL-2 limit, while the GLCs for H2S will be below its AEGL-1 limit. Therefore, public exposures to the resulting GLCs of either SO_2 or H_2S are not expected to cause any long-lasting adverse health effects, since AEGL-2 is the airborne concentration of a susbtance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

Table 2: Highest Predicted MAICs and GLCs at ASR for Selected Air Pollutants during Normal Project Operation.

Parameter	Averaging Time	Baseline Level (µg/m³) [Average]	Concentration (µg/m³)												MAAQS 2013 (Standard [2020]) (µg/m³)
			Highest Predicted MAIC	ASR1 Open Space Near Kampung Lepau		ASR2 Sebana Cove Resort		ASR3 Sebana Golf Resort		ASR4 Bukit Pelali		ASR5 Open Space Near Kampung Bukit Gelugor		ASR6 Open Space Near Lake View		
				MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	
PM_{10}	24-hours	ASR1 = 65.5 ASR2 = 41.0 ASR3 = 60.5 ASR4 = 23.0 ASR5 = 48.5 ASR6 = 41.0	2.92 (Outside PIP; Within PIC)	0.56	66.06	0.68	41.68	1.08	61.58	0.31	23.31	0.38	48.88	0.55	41.55	100
	Annual	-	0.47 (Outside PIP)	0.024	0.024	0.061	0.061	0.138	0.138	0.019	0.019	0.012	0.012	0.010	0.010	40
$PM_{2.5}$	24-hours	ASR1 = 34.3 ASR2 = 30.0 ASR3 = 25.7 ASR4 = 17.7 ASR5 = 34.0 ASR6 = 22.7	2.92 (Outside PIP; Within PIC)	0.56	34.86	0.68	30.68	1.08	26.78	0.31	18.01	0.38	34.38	0.55	23.25	35
	Annual	-	0.47 (Outside PIP)	0.024	0.024	0.061	0.061	0.138	0.138	0.019	0.019	0.012	0.012	0.010	0.010	15

Parameter	Averaging Time	Baseline Level (µg/m^3) [Average]	Concentration (µg/m^3)												MAAQS 2013 (Standard [2020]) (µg/m^3)
			Highest Predicted MAIC	ASR1 Open Space Near Kampung Lepau		ASR2 Sebana Cove Resort		ASR3 Sebana Golf Resort		ASR4 Bukit Pelali		ASR5 Open Space Near Kampung Bukit Gelugor		ASR6 Open Space Near Lake View		
				MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	
SO_2	1-hour	-	235.47 (Outside PIP)	12.11	12.11	13.81	13.81	15.93	15.93	12.75	12.75	11.88	11.88	14.61	14.61	250
	24-hours	ASR1= <5 ASR2= <5 ASR3= <5 ASR4= <5 ASR5= <5 ASR6= <5	23.32 (Outside PIP)	1.11	1.11	2.64	2.64	3.29	3.29	0.69	0.69	1.17	1.17	1.36	1.36	80
	Annual	-	1.84 (Within PIP)	0.048	0.048	0.157	0.157	0.304	0.304	0.043	0.043	0.025	0.025	0.023	0.023	-
NO_X as 100% NO_2	1-hour	-	359.34 (Outside PIP)	33.84	33.84	37.13	37.13	40.56	40.56	42.78	42.78	35.23	35.23	36.52	36.52	280
	24-hours	ASR1 = 4.5 ASR2 = <5 ASR3 = 5.0 ASR4 = 4.0 ASR5 = <5 ASR6 = <5	42.26 (Outside PIP, Within PIC)	6.20	10.70	8.14	8.14	10.96	15.96	3.22	7.22	4.16	4.16	6.01	6.01	70
	Annual	-	5.95 (Within PIP)	0.262	0.262	0.705	0.705	1.203	1.203	0.188	0.188	0.120	0.120	0.104	0.104	-

Parameter	Averaging Time	Baseline Level (µg/m^3) [Average]	Concentration (µg/m^3)												MAAQS 2013 (Standard [2020]) (µg/m^3)
			Highest Predicted MAIC	ASR1 Open Space Near Kampung Lepau		ASR2 Sebana Cove Resort		ASR3 Sebana Golf Resort		ASR4 Bukit Pelali		ASR5 Open Space Near Kampung Bukit Gelugor		ASR6 Open Space Near Lake View		
				MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	
CO	1-hour	-	1,118.97 (Outside PIP; Near ASR 4)	179.43	179.43	171.65	171.65	153.38	153.38	217.69	217.69	180.03	180.03	131.14	131.14	30,000
	8-hour	ASR1 = 1,250 ASR2 = 950 ASR3 = 800 ASR4 = 1,550 ASR5 = 2,600 ASR6 = 2,600	323.12 (Within PIP)	47.94	1,297.94	70.47	1,020.47	118.29	918.29	41.51	1,591 .51	27.95	2,627.95	33.00	2,633.00	10,000
	Annual	-	25.52 (Within PIP)	1.31	1.31	3.09	3.09	8.17	8.17	1.09	1.09	0.64	0.64	0.55	0.55	-
H_2S	8-hour	ASR1= <10 ASR2= <10 ASR3= <10 ASR4= <10 ASR5= <10 ASR6= <10	1.01 (Outside PIP)	0.02	0.02	0.08	0.08	0.12	0.12	0.04	0.04	0.04	0.04	0.03	0.03	-
	24-hour	-	0.44 (Outside PIP)	0.02	0.02	0.03	0.03	0.06	0.06	0.01	0.01	0.02	0.02	0.02	0.02	7 *(Ontario)*
	Annual	-	0.0323 (Within PIP)	0.0005	0.0005	0.0019	0.0019	0.0053	0.0053	0.0007	0.0007	0.0004	0.0004	0.0003	0.0003	-

Parameter	Averaging Time	Baseline Level (µg/m^3) [Average]	Concentration (µg/m^3)												MAAQS 2013 (Standard [2020]) (µg/m^3)
			Highest Predicted MAIC	ASR1 Open Space Near Kampung Lepau		ASR2 Sebana Cove Resort		ASR3 Sebana Golf Resort		ASR4 Bukit Pelali		ASR5 Open Space Near Kampung Bukit Gelugor		ASR6 Open Space Near Lake View		
				MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	
HCl	8-hour	-	2.02 (Outside PIP, Near ASR4)	0.10	0.10	0.16	0.16	0.16	0.16	0.12	0.12	0.11	0.11	0.09	0.09	-
	24-hour	-	0.83 (Outside PIP)	0.05	0.05	0.06	0.06	0.11	0.11	0.04	0.04	0.04	0.04	0.05	0.05	20 *(Ontario)*
	Annual	-	0.0540 (Within PIP)	0.0018	0.0018	0.0046	0.0046	0.0120	0.0120	0.0015	0.0015	0.0010	0.0010	0.0008	0.0008	-

Note: PM is conservatively assumed as 100% PM10 and PM2.5
Ground Level Concentration (GLC) = Baseline Level (BL) + Maximum Average Incremental Concentration (MAIC)
Average Baseline Levels were based on the Ambient Air Quality Monitoring Results carried out on April, May, June and July 2019
For calculation of average, values of Less than the Minimum Detectable Limit or not detected was assumed to be null
PIP = Pengerang Industrial Park
PIC = Pengerang Integrated Complex (Rapid)
Ontario = Ontario's Ambient Air Quality Criteria (April 2012)

Table 3: Highest Predicted MAICs and GLCs at ASR for Selected Air Pollutants during Abnormal Project Operation.

Para-meter	Averaging Time	Baseline Level (µg/m^3)	Percentile (%)	Concentration (µg/m^3)							AEGL-1 (Non-disabling)	AEGL-2 (Disabling)	AEGL-3 (Lethal)
				Highest Predicted MAIC	ASR1: Open Space Near Kampung Lepau	ASR2: Sebana Cove Resort	ASR3: Sebana Golf Resort	ASR4: Bukit Pelali	ASR5: Open Space Near Kampung Bukit Gelugor	ASR6: Open Space Near Lake View			
SO_2	1-hour	ASR1 = <5 ASR2 = <5 ASR3 = <5 ASR4 = <5 ASR5 = <5 ASR6 = <5 (24-hours averaging time)	100	7,543.9 (Outside PIP, Within PIC)	1,649.1	1,279.3	790.8	502.2	893.0	559.6	520 µg/m^3 (0.20 ppm)	1,950 µg/m^3 (0.75 ppm)	78,000 µg/m^3 (30 ppm)
			99.98	2,449.1 (Outside PIP, Within PIC)	748.2	697.9	506.3	308.6	466.9	274.0			
H_2S	1-hour	ASR1= 27.1 ASR2= 22.9 ASR3= 27.1 ASR4= 20.8 ASR5= 22.9 ASR6= 22.9 (8-hours averaging time)	100	419.6 (Outside PIP, Within PIC)	91.7	71.2	44.0	27.9	49.7	31.1	710 µg/m^3 (0.51ppm)	39,000 µg/m^3 (27 ppm)	71,000 µg/m^3 (50 ppm)

Note: PIP = Pengerang Industry Park
PIC = Pengerang Integrated Complex (RAPID)
AEGL = Acute Exposure Guidelines Level
AEGL-1 is the airborne concentration of a substance above which is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptimatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure;

AEGL-2 is the airborne concentration of a susbtance above which is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape; and
AEGL-3 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening adverse health effects or death..

1.5.2 Hazard Quotient for Air Pollutants

The hazard quotient (HQ) is a measure of the possibility of seeing chronic, non-carcinogenic health effects among the exposed population. The HQ due to chronic inhalation exposure to H_2S and HCl at the highest predicted GLC at ASR under normal project operation were calculated. This HQ was obtained by taking the ratio of the ambient air concentration or exposure air concentration (EC) to the reference concentration (RfC). The unit for EC and RfC is $\mu g/m^3$.

$$HQ = \frac{EC}{RfC}$$

$$EC = \frac{Ca \times EF \times ED}{AT \times 365\ days/yr}$$

Where, EC = Exposure concentration ($\mu g/m^3$)
RfC = Reference concentration ($\mu g/m^3$)
C_a = Ambient air concentration ($\mu g/m^3$)
EF = Exposure frequency = 350 days/year
ED = Exposure duration = 40 years for adults
AT = Averaging time = ED = 40years

A HQ of 1 or greater signifies a hazardous condition, whereby EC equals or exceeds RfC. A HQ of less than 1 is categorized as an acceptable risk for a chronic, non-carcinogenic health effect by the USEPA.

As shown in **Table 4**, the highest predicted GLC for H_2S (0.06 $\mu g/m^3$) and HCl (0.11 $\mu g/m^3$) at the Sebana Golf Resort (ASR3) during normal project operation gives a HQ of 0.029 and 0.005, respectively. Since the HQ is less than 1, it means that it is unlikely that a chronic, non-carcinogenic health effect will not be seen among those exposed over a lifetime.

Table 4: **Highest Predicted GLCs and Adjusted Exposure Concentrations at ASRs, RfC and HQ for Non-carcinogenic Health Effects of Hydrogen Sulphide and Hydrogen Chloride during Normal Project Operation**

Air pollutant	Highest predicted GLC at ASR ($\mu g/m^3$)	Adjusted exposure concentration (EC) ($\mu g/m^3$)	RfC [a] ($\mu g/m^3$)	HQ	Non-carcinogenic health effects
Hydrogen sulphide (H_2S) (24-hour)	0.06 [1]	0.058	2.0	0.029	Nasal lesions of the olfactory mucosa
Hydrogen chloride (HCl) (24-hour)	0.11 [1]	0.105	20.0	0.005	Hyperplasia of nasal mucosa larynx and trachea

Note: [1] ASR3, Sebana Golf Resort

Sources: [a] USEPA's Integrated Risk Information System (database accessed 6 May 2019).

1.6 Uncertainty Analysis

Quantitative HRA is not a tool that can emulate or model "reality" with unquestionable accuracy and precision. The model it generates is a representation of reality which the current scientific tools will render. Therefore, there is always a certain degree of uncertainty involved in the quantitative HRA process. This uncertainty is internalized in the form of assumptions made in generating parameters such as the RfC, exposure frequency, exposure duration and body weight. These assumptions are made with respect to the various default values used such as the average adult body weight of 70 kg, and inhalation rate of 20 m^3/day. These default values refer to an average person.

1.7 Summary of Assessment

Exposure to air pollutants during the project construction phase may happen but is anticipated to be minimal or insignificant.

During normal project operation (**Table 2**), all the predicted GLCs for PM2.5, PM10, SO_2, NO_2 and CO at the 6 ASRs will fall below their MAAQS 2013 (Standard 2020), while the predicted GLCs for H_2S and HCl will not exceed their Ontario' Ambient Air Quality Criteria 2012.

During abnormal project operation (**Table 3**), the GLCs for SO_2 at the 6 ASRs will be below its AEGL-2 limit, while the GLCs for H2S will be below its AEGL-1 limit. Therefore, public exposures to the resulting GLCs of either SO_2 or H_2S are not expected to cause any long-lasting adverse health effects, since AEGL-2 is the airborne concentration of a susbtance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

As shown in **Table 4**, the highest predicted GLC for H_2S (0.06 µg/m^3) and HCI (0.11 µg/m^3) at the Sebana Golf Resort (ASR3) during normal project operation gives a HQ of 0.029 and 0.005, respectively. Since the HQ is less than 1, it means that it is unlikely that a chronic, non-carcinogenic health effect will not be seen among those exposed over a lifetime.

1.8 Conclusion

During normal project operation, the particulate and gaseous pollutant GLCs at all ASRs will fall below their MAAQS 2013 (Standard 2020) and Ontario' Ambient Air Quality Criteria 2012 limits. During abnormal project operation, the GLCs for SO_2 at the 6 ASRs will be below its AEGL-2 limit, while the GLCs for H2S will be below its AEGL-1 limit. The highest predicted GLC for H_2S (0.06 µg/m^3) and HCI (0.11 µg/m^3) at the Sebana Golf Resort (ASR3) during normal project operation gives a HQ of 0.029 and 0.005, respectively, which means that a chronic, non-carcinogenic health effect will not be seen among those exposed over a lifetime.

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APPENDIX B

SOCIAL IMPACT ASSESSMENT REPORT

Pengerang Energy Complex, Pengerang, Johor

For Pengerang Energy Complex Sdn Bhd

Tan Yee Noon

1. INTRODUCTION

1.1 Project Background

The Pengerang Integrated Petroleum Complex (PIPC) covers about 20,000 acres, and is made up of several parts: the Pengerang Integrated Complex (PIC) by Petronas which comprises RAPID and other ancillary facilities; the Pengerang Deepwater Terminal (PDT), a joint-venture between Petroliam Nasional Bhd (Petronas), Dialog Group Bhd, the Johor state government and Royal Vopak; the Pengerang Integrated Development Project (PIDP) by Serba Dinamik Holdings Bhd, comprising the Pengerang Eco-Industrial Park (PEIP) and Pengerang International Commercial Centre (PICC) and the Pengerang Industrial Park (PIP) by Johor Corporation (JCorp).

The Pengerang Industrial Park (PIP) covers 786 acres of land located adjacent to PIPC. In developing the PIP, JCorp intends to lease industrial land to local and foreign investors with interest in the downstream O&G industry, typically in the production of high-value, high-demand products and by-products, such as polymers, pharmaceutical products and plastics, and using refined feedstock from RAPID Petronas. The PIP will become more significant as RAPID Petronas is nearing completion. Petronas is scheduled to complete construction by this year and the start-up of the refinery is expected to be conducted by the first quarter of 2019.

The Project Proponent, ChemOne, is an investor with interest in constructing an aromatics plant using feedstock or condensate from the refinery facilities in PIC. Called Pengerang Energy Complex (PEC), the key components of the proposed chemical complex comprise a condensate splitter and an aromatics complex. The plant is expected to produce petroleum products (e.g. LPG, jet fuel, light naphtha etc.), aromatics products (e.g. paraxylene and benzene) and sulphur as a by-product. The petroleum and aromatics products will be supplied to manufacturers of textiles, polymers, polycarbonates, plastics, synthetic rubber, surfactants and pharmaceuticals. Other support and ancillary facilities at the PEC include feed and product intermediate tanks, administration and laboratory buildings, warehouses, maintenance workshop and a waste water treatment facility. The footprint for the chemical plant facilities covers a land area of 250 acres.

The proposed Pengerang Energy Complex (PEC) is located at the PIP, along the southern PIP boundary which interfaces with the RAPID boundary near Gate 2. The site can be accessed from the Kota Tinggi-Pengerang Highway (Federal Route 92) via the recently upgraded Lebuhraya Pengerang (Route J52) and a new road that is under currently construction that will provide dedicated access to PIP and PIC from Route 52. (**Figure 1.1** and **Figure 1.2**)

Bandar Penawar and Kg Sungai Rengit are the main towns closest to the PEC project site and are located more than 10km and 5km away respectively.

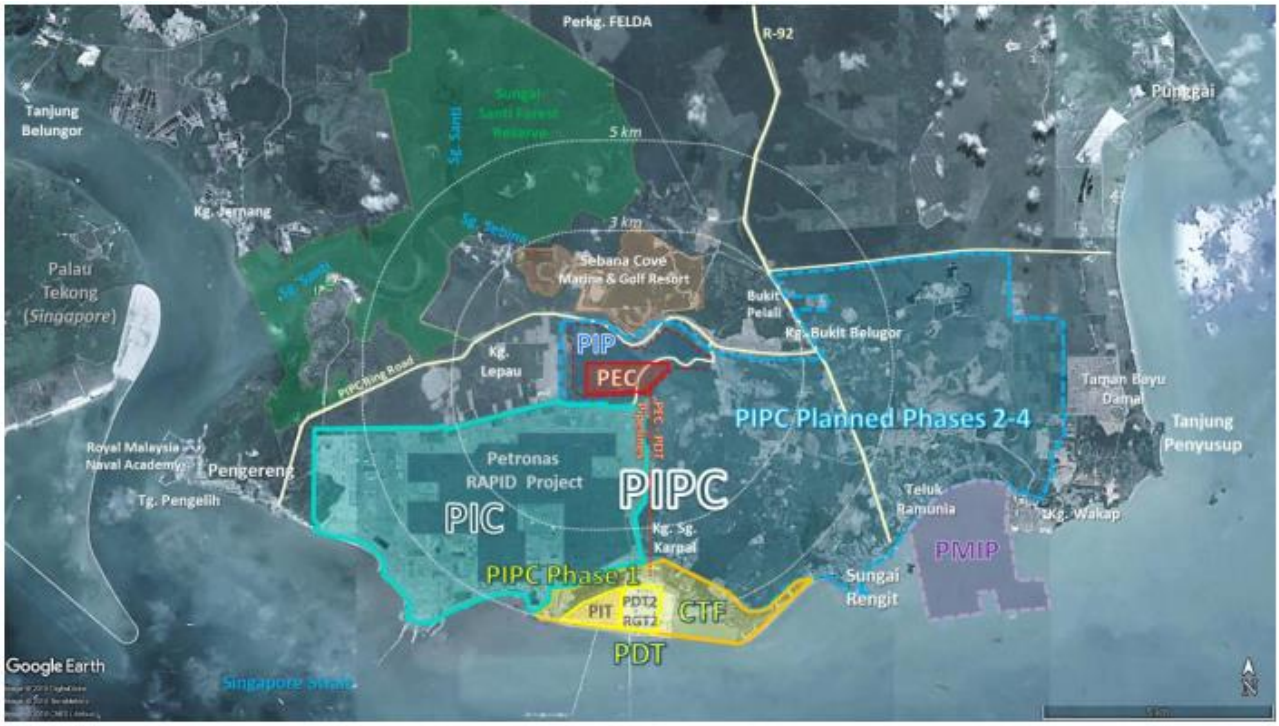


Figure 1.1: Location of PEC in PIPC

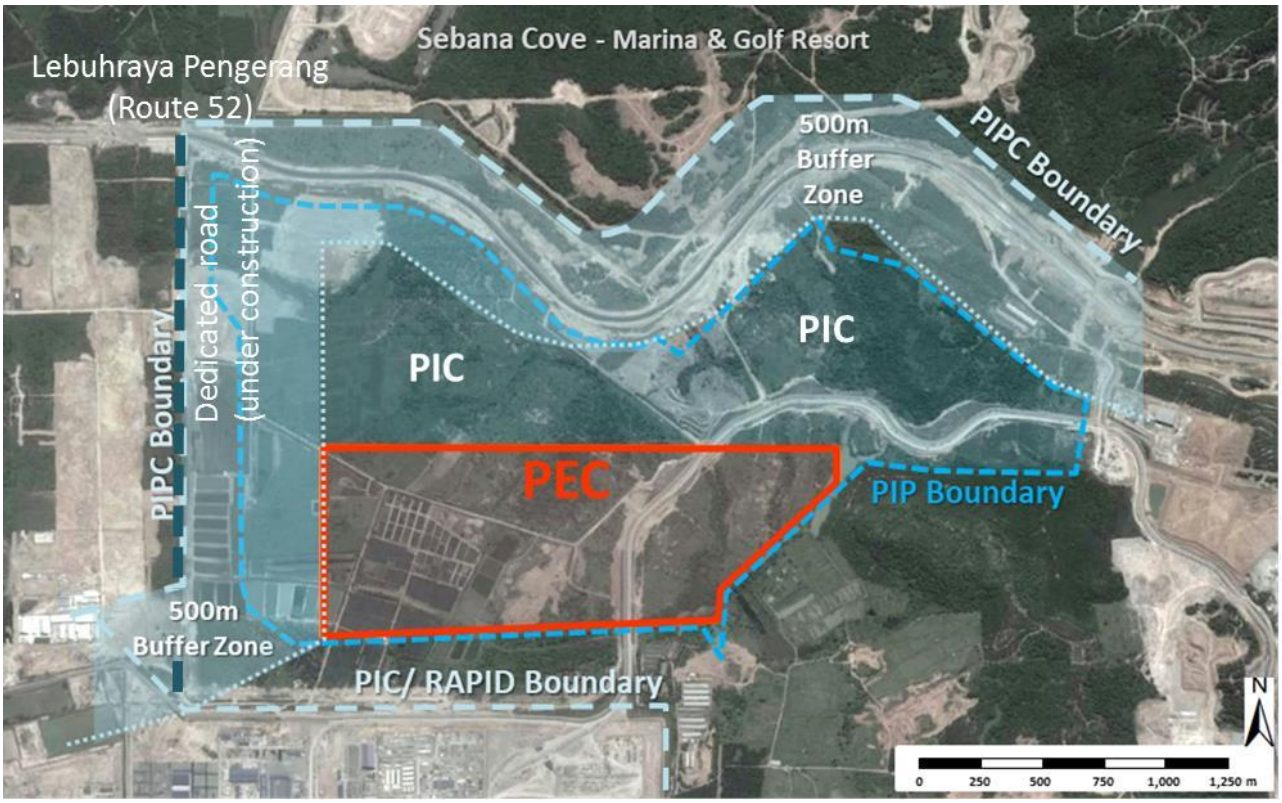


Figure 1.2: Location of PEC Project Site within PIC

1.2 Statutory Requirements for Public Consultation

Two levels of regulatory provisions are applicable to the proposed Project. The first level of provision applies to compliance with the Malaysian assessment and approval process for projects with respect to land use planning and environmental management. The second provision applies to compliance with the IFC Performance Standards for projects that have environmental and social risks and impacts and that require international project financing.

1.2.1 National Statutory Requirements

The legislations, guidelines and documents that have relevance to the proposed Project include:

Legislations

- Environmental Quality Act, 1974 (Act 127)
- Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015
- Town and Country Planning Act, 1976 (Act 172)
- Town and Country Planning (Amendment) Act, 2017 (Act A1522)

Guidelines

- Guidelines for Sitting and Zoning of Industry and Residential Areas, 2nd Revised Edition, Department of Environment (DOE), 2012)
- Manual for Social Impact Assessment for Projects (2nd Edition) 2018

Documents

- Rancangan Tempatan Daerah Kota Tinggi (RTD Kota Tinggi), 2010-2015
- Rancangan Kawasan Khas Pengerang (RKK Pengerang), 2013

Laws and regulations applicable to social impact assessment and stakeholder consultation is a requirement of the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015, under Section 34A (2C) of the Environmental Quality Act, 1974 (Act 127) and amendments thereof, of which an EIA is mandatory for Prescribed Activity 17: Development of industrial estate covering an area of 20 hectares or more.

The Environmental Impact Assessment (EIA) Guidelines in Malaysia prepared by the Department of Environment set out the process in the preparation of the EIA report. With respect to social obligation of the Project Proponent, the EIA Guidelines advocate that the Project Proponent is responsible and accountable to the relevant stakeholders and local residents who may be impacted by the proposed project. Public consultation, stakeholder interview and focus group meeting are some of the practical steps recommended in the EIA

Guidelines as a means to disseminate information to the stakeholders and the public and to identify issues of concern of the parties of interest.

With respect to planning and development approval for projects, the Town and Country Planning Act, 1976 (Act 172) and Town and Country Planning (Amendment) Act, 2017 (Act A1522) are applicable. Sub-section 20B of Act A1522 and sub-section 22(2A) of Act 172 make it a requirement to conduct public consultation, stakeholder engagement and an independent social impact assessment study for major projects that may have significant direct social impacts before these projects can be approved for development by the federal, state or local planning authorities. For projects that are not likely to have any significant social impacts, sub-section 21A(1) of Act A1522 requires social issues and impacts to be addressed nonetheless, and the analysis and findings to be incorporated into the planning development report which is to be submitted in tandem with the project layout plan to the local planning authority for their approval.

The Manual for Social Impact Assessment for Projects (2nd Edition) 2018 prepared by PLAN Malaysia (the Federal Town and Country Planning Department) is also relevant as it identifies the project types that require a social impact assessment (SIA) as well as the process and methodology in conducting the study. The Manual has identified three categories of projects for which public consultation and SIA are required under sub-section 20(B) and sub-section 21A(1) of Act A1522 as well as sub-section 22(2A) of Act 172. Clarification for the three categories of SIA are summarised as follows:

- Category 1 SIA is required for major infrastructure projects (e.g. airport, sea port, inland port, dam, toxic waste disposal facility, railway, highway and power plant) as well as coastal reclamation projects exceeding 50 hectares in area. These projects come under Section 20(B) of Act A1522 which requires an independent SIA report.
- Category 2 SIA is required for new developments that exceed 100 hectares in land area or involve a population catchment of more than 10,000 people or displacement/relocation of existing residents, infrastructure projects that are not identified as Category 1 as well as high density projects on hillslopes that exceed 20 hectares and where more than 50% the land are under subject to 25^0 slope. Category 2 SIA come under sub-section 22(2A) of Act 172 and requires an independent SIA report.
- Category 3 SIA is required for big scale industrial projects (other than the ones identified as Category 1 and Category 2) that may have direct impact on the health, safety and quality of life on the local community surrounding it. Although a full scale and independent SIA study is not required, nonetheless, the social issues, parties of interest, significance of impact and mitigating measures are to be addressed in the Development Proposal Report that will be submitted to the local planning authority in tandem with the Development Proposal Layout Plan under Section 21A(1) of Act A1522. Examples of these projects include theme park, casino, crematorium, columbarium, mining, industrial park,

aquaculture and animal husbandry farm, oil and gas refining facilities, incinerator, solid waste disposal site, big scale industrial area and any other projects that will be determined from time to time by PLAN Malaysia and the local planning authority.

The proposed Project falls under sub-section 21A(1) of Act A1522, that is projects that are not likely to have any significant social impacts, but nonetheless requires social issues and impacts to be addressed under Category 3 SIA. The implication is the findings and recommendations of the social impact assessment are to be incorporated into the development planning report which is to be submitted in tandem with the project layout plan for approval by the local planning authority.

1.2.2 International Standards and Best Practice

When the environmental and social impacts associated with an investment are significant, financial institutions apply the IFC Performance Standards on Environmental and Social Sustainability (2012) as a benchmark to identify and manage risks. IFC's Environmental, Health and Safety (EHS) Guidelines provide technical guidelines with general and industry-specific examples of good international industry practice to meet IFC's Performance Standards.

The IFC Performance Standards encompass eight topics, and the scope and intent of the IFC Performance Standards may be fully or partially addressed and met throughout the life of an investment. The topics comprise:

PS 1: Assessment and Management of Environmental and Social Risks and Impacts

PS 2: Labour and Working Conditions

PS 3: Resource Efficiency and Pollution Prevention

PS 4: Community Health, Safety, and Security

PS 5: Land Acquisition and Involuntary Resettlement

PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

PS 7: Indigenous Peoples

PS 8: Cultural Heritage

The IFC Performance Standards (PS) that is triggered by this Project is given below:

IFC PS	Name of Performance Standard (PS)	Triggered by Project
PS 1	Assessment and Management of Environmental and Social Risks and Impacts	Yes
PS 2	Labour and Working Conditions	Yes
PS 3	Resource Efficiency and Pollution Prevention	Yes
PS 4	Community Health, Safety, and Security	Yes
PS 5	Land Acquisition and Involuntary Resettlement	No

IFC PS	Name of Performance Standard (PS)	Triggered by Project
PS 6	Biodiversity Conservation and Sustainable Management of Living Natural Resources	Yes
PS 7	Indigenous Peoples	No
PS 8	Cultural Heritage	No

IFC PS 1 and PS 4 are particularly relevant to the proposed Project. IFC PS 1 applies to projects that have environmental and social risks and impacts. It underscores the importance of managing environmental and social performance throughout the life of the project through engagement between the project proponent, its workers and the local communities and vulnerable groups who may be directly affected by the project.

IFC PS 4 recognises that project activities can increase the potential for community exposure to risks and impacts arising from equipment accidents, structural failures and releases of hazardous materials as well as impacts on a community's natural resources and exposure to diseases. While acknowledging the public authority's role in promoting health, safety and security of the public, PS 4 addresses the Project Proponent's responsibility to minimise the risks and impacts to community health, safety and security that may arise from project-related activities.

The proposed Project will not address PS 5: Land Acquisition and Involuntary Resettlement, PS 7: Indigenous Peoples and PS 8: Cultural Heritage as these specific issues are not encountered at the Project site.

1.3 Objectives of the Study

The main objectives of the SIA study are to:

1) Analyse the baseline social environment in the Project area and the requirements for impact assessment in compliance with the national statutory requirements and IFC guidelines;
2) Perform a social impact assessment on available data and field survey with the purpose of understanding the existing social situation in the Project area and to assess potential positive and negative impacts of the Project;
3) Identify and recommend measures to minimise or mitigate adverse social impacts arising from the Project during the construction and operation phases, and
4) Recommend a grievance mechanism and monitoring measures to receive, record, investigate and resolve community stakeholders' concerns and complaints during Project implementation.

2. PROJECT DESCRIPTION

2.1 Project Location

The proposed Pengerang Energy Complex (PEC) is located at the Pengerang Industrial Park (PIP), along PIP's southern boundary which interfaces with the RAPID boundary near Gate 2. The 250-acre Project site is accessible from the Kota Tinggi-Pengerang Highway (Federal Route 92) via the recently upgraded Lebuhraya Pengerang (Route 52) and a dedicated road that is under currently construction and which will provide direct access from Route 52 into RAPID and the industrial plots adjoining/adjacent to RAPIS's northern boundary.

2.2 Project Site

The Project site is located on part of a piece of land that was previously owned by KEJORA. It was subsequently acquired in 2018 by Johor Corporation, an investment arm of the Johor state government (Warta Kerajaan Negeri Johor, July 2018) for the proposed Pengerang Industrial Park. Currently, ownership of the Project site is in the process of being transferred to the Project Proponent for the PEC project. No further acquisition of land is necessary for this Project. Under its previous owner, KEJORA, a small part of the Project site along the southern boundary was leased out by way of a Temporary Occupation Licence (TOL) for a fish farm and cultivation of orchids and ornamental plants. At a meeting with Johor Corporation on 28th October 2018, it was informed that notice to vacate and termination of the TOL has been given to the tenants. Since then, the orchid farm has ceased operation and the fish farm is also expected to cease operation soon. Otherwise, the Project site is largely cleared and abandoned. No houses were observed inside the Project site during the site visits made in July and September 2018, so that no physical relocation is foreseen during construction phase.

The proposed Pengerang Energy Complex (PEC) is an aromatics complex where the key facilities comprise a condensate splitter and an aromatics plant. Support and ancillary facilities at the PEC include feed and product intermediate tanks, administration and laboratory buildings, warehouses, maintenance workshop and a waste water treatment facility. The plant is expected to produce at least 2 million tons of aromatics and about 3.6 million tons of oil products annually. All of these chemicals will be supplied to manufacturers of textiles and polymers in the Far East.

2.3 Social Setting of the Project Area

The main towns closest to the PEC project site are Bandar Penawar (located about 10km away to the northeast) and Kg Sungai Rengit (located about 6km away to the south east). Six villages are located inside 5km radius of the Project site boundary: Kg Lepau is the nearest, located more than 2km to the west; Kg Bukit Pelali, located about 3km to the east whilst Kg Bukit Gelugor, Kg Bukit Buloh and Taman Rengit Jaya are about 3.5km to the southeast and Kg Bukit Raja more than 4.5km to the south east (**Figure 1.3**). These six villages have a total of 326

households (**Table 1.1**). The existing Sebana Cove Resort and Marina and the proposed Sebana mixed development township are sited about 2km and 1km respectively to the north and the new township at Bukit Pelali (under construction) is about 3km to the east.

Figure 1.3: The Project Site in Relation to Existing Towns and Villages within 5km Radius

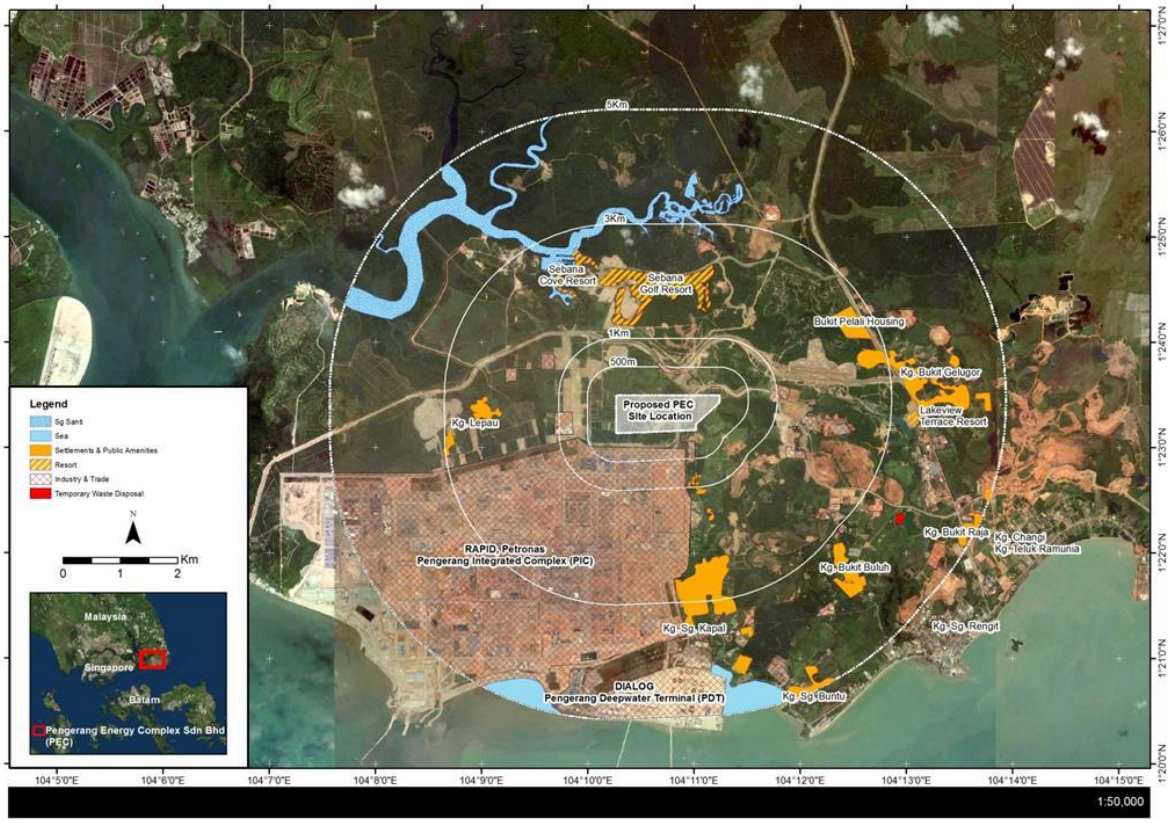


Table 1.1: Distribution of Households inside 5km Radius of Project Site

Village	Distance from Project Site (km)	Direction from Project Site	Households (frequency)
Kg Lepau	>2km	west	50
Kg Bukit Pelali	3	northeast	40
Taman Rengit Jaya	3.5	south	60
Kg Bukit Gelugor	3.5	east	56
Kg Bukit Buloh(1)	3.5	southeast	30
Kg Bukit Raja	4.5	east	100
Total			**326**
Kg Sg Rengit(2)	>5km	southeast	442
Kg Sg Buntu(3)	>5km	south	NA

Source: Former village heads of Kg Lepau, Kg Bukit Buloh and Kg Bukit Raja, Sept. 2018
Pejabat Penghulu of Mukim Pengerang and Pantai Timur, Sept. 2018

Notes:

(1) Kg Bukit Buloh is currently under land acquisition process and the residents will be resettled to an alternative site once compensation has been paid.

(2) Kg Sg Rengit is more than 5km away from the Project site and is unlikely to be impacted significantly during the construction or operation phase of the Project.

(3) Kg Sg Buntu is not included in the study as all the local residents have been relocated and resettled 20km away in Taman Bayu Damai. The village is currently used as a worker basecamp for PIC.

A major part of the area located to the east and south of the Project site was acquired for PIPC, RAPID and the Pengerang Independent Deepwater Petroleum Terminal in 2013. The exercise involved relocating and resettling more than 3,100 smallholders and fishermen and their families from seven villages to Taman Bayu Permai, about 20km away in Mukim Pantai Timur. Muslim and Chinese graves had to be exhumed and relocated to alternative sites in Mukim Pantai Timur and Tanjung Surat as part of the process.

Prior to the relocation, the area within 5km radius of the Project site was under agriculture, namely, oil palm and rubber smallholdings, fruit orchards, poultry farms and fish ponds. Currently, however, much of the once cultivated areas and poultry farms around Kg Bukit Buloh, Kg Sg Buntu and Taman Rengit Jaya have been unworked or abandoned. A similar observation was made in Kg Lepau where oil palm smallholdings previously under FELCRA's management were found to be abandoned or unworked despite the village not being affected by land acquisition. In fact, large tracts of land inside the 5km zone of impact as well as adjacent to and south of Kg Lepau have being cleared to make way for new industrial facilities that hardware machinery, formwork and fabrications materials storage and warehousing.

3. STUDY APPROACH AND METHODOLOGY

3.1 Screening

Screening is required to ascertain whether or not a SIA report is required for the proposed Project and the category of SIA which the Project comes under in accordance with the Manual for Social Impact Assessment 2018 that has been prepared by PLAN Malaysia.

The screening exercise conducted for the proposed Project confirmed that it comes under Category 3, as the proposed project activities are not listed as Category 1 or Category 2 in the Manual for Social Impact Assessment 2018 prepared by PLAN Malaysia.

3.2 Scoping

Once the SIA category is determined, the scoping process is initiated. Scoping is a pre-project stage, usually undertaken through an on-site visual survey, to obtain a preliminary appraisal of the demographic, social, cultural and institutional context, as well as to perform a preliminary identification of the immediate impact zone, the main stakeholders, vulnerable groups and potential social issues that could arise from the Project. Scoping is also done to ascertain the study methodology to be used, with respect to stakeholder engagement, stakeholder interview, meetings, dialogues, household social survey and stakeholder perception survey.

With respect to this Project, three (3) on-site investigations as well as consultation with an officer of Pihak Berkuasa Tempatan (PBT) Pengerang were undertaken in March, July and September 2018. The site visits allowed the study team to visually survey the immediate impact zone and to identify potential sensitive receptors and vulnerable stakeholders. A stakeholder is defined as individuals, communities, groups and institutions who:

- Are most likely to experience, at significant levels, any potential negative and/or positive impacts of the proposed Project;
- Has the mandate over the various elements of the project's activities (such as government institutions); and
- Are vulnerable members of the community within the proposed Project area

Two categories of stakeholders identified for this Project include:

1) **Affected parties** are directly affected by or have interest in the Project and who need to be engaged to identify impacts and their significance, as well as in decision-making or advice on mitigation and management measures. They include:
   - Local government/*mukim* or sub-district representatives;
   - Village heads or village representatives;
   - Local residents potentially exposed to impacts due to the Project construction and operation. Focus is on Kg Lepau since it is the village closest to the Project site;

- Fishermen living in Kg Lepau who conduct their fishing activities along Sg Lepau, Sg Santi and Sg Johor. (Fishing is no longer their main livelihood and main source of income due to difficulties in securing fishing licence as well as declining fish catch. As an alternative source of income, a number of fishermen are engaged in the night market, food supply and catering to the workers of RAPID);
- Floating fish cage farmers operating along Sg Santi. (Their fish stock has declined by more than 30% since the start of the reclamation works in Pengerang and also due to declining water quality of Sg Santi and Sg Johor).

2) Other interested parties who may have interested in the Project and who could affect or benefit from the Project in some way, namely:

- Cooperatives (e.g. KOPEJA and KOJAYA)
- Bukit Pelali township (Astaka) (under construction)
- Sebana Cove mixed development (earthworks in progress)
- Sebana Cove resort and marina (existing)

3.3 Sample Size and Selection

Although the study area inside the 5km radius impact zone covers an extensive land area, the overall population constitute only 326 households. The information is obtained during an engagement with the former village heads of Kg Lepau, Kg Bukit Buloh and Kg Bukit Raja and the Pejabat Penghulu of Mukim Pengerang and Pantai Timur held in September 2018. The decline in the number of households is primarily due to the resettlement of more than 3,100 people to Taman Bayu Damai between 2013 and 2016.

The sample size is determined according to Raosoft sample size formula:

$$n = \left[\frac{t^2 \mathrm{p}\,(1-\mathrm{p})}{\mathrm{m}^2}\right]$$

Where

n	=	required sample size
t	=	confidence level
p	=	estimated population
m	=	margin of error

Assuming a confidence level of 95% and accepting a margin of error of 8%, the minimum sample size obtained through the Raosoft sample size formula is 98. A total of 100 respondents from the six villages were selected using stratified random sampling whereby a larger sample was taken from the village nearest to the Project site. Kg Lepau being the nearest to the Project

site (more than 2km to the west) is regarded the most vulnerable towards any impact from the activities of the proposed Project site. Thus the largest sample was drawn from Kg Lepau **(Table 1.2)**. The second largest sample was obtained from Kg Bukit Pelali located about 3km from the Project site. Smaller samples were taken from villages located within 3.5km to 5km radius from the proposed plant. The demographic and social profile as well as the views and perceptions of the respondents from these villagers will serve as a benchmark and representative of the impacted population.

Table 1.2: Distribution of Respondents by Villages

Village	Distance from Project Site (km)	No. of households	% of village households
Kg Lepau*	>2.0	50	60
Kg Bukit Pelali	3	20	50
Taman Rengit Jaya	3.5	12	20
Kg Bukit Gelugor	>3.5	6	10
Kg Bukit Buloh	>3.5	3	10
Kg Bukit Raja	>4.5	9	9

Note: * The perception survey in Kg Lepau covered 60% (i.e. 30 respondents) of the 50 households residing there as well as 10% (i.e. 20 respondents) of the 200 non-local residents (Malaysians from other states) who are renting living quarters in the village and working in RAPID and the PIPC. The total population of Kg Lepau in Sept. 2018 was close to 400 people (i.e. 200 locals and 200 non-locals), based on feedback from the former village head of Kg Lepau. The 50 respondents who were interviewed in Kg Lepau represent 12.5% of the population.

3.4 Social Impact Assessment Methods

A combination of methods was used to gather qualitative baseline socio-economic data of the communities that might be affected by the Project as well as information from individuals and stakeholder groups who have interest in the area within 5km radius of the proposed Project. In tandem, the baseline data gathering exercise also provided the stakeholders an opportunity to raise issues that they would like to see addressed as well as the opportunity to suggest alternatives. The baseline information gathering methods used include undertaking semi-structured interviews, focus group engagement, one-to-one meetings as well as stakeholder perception and socio-economic survey (UNEP 2002, Manual SIA PLAN Malaysia 2018). These tools were supplemented by desktop reviews of secondary information and checked through communication with key local stakeholders and officers at the Planning Department of the Pihak Berkuasa Tempatan (Local Authority) Pengerang.

An unstructured interview/dialogue was conducted with the sub-district (mukim) head, village heads, ex-village heads and representatives from two cooperatives, all of whom had interest in Pengerang and the villages located therein. (The setting up of the cooperatives was initiated

by the Johor state government with collaboration from Petronas to serve as a platform for the resettled residents to be trained and to engage in business and the provision of services and goods to PIC). The dialogue was unstructured to allow for a free discourse between the SIA study team and the EIA coordination team to introduce the Project and for the stakeholders to raise and discuss matters that they consider to be relevant to the community.

A focus group engagement was held with the community that is located nearest to the Project site, and therefore, most likely to be impacted by the Project, that is, Kg Lepau. It was also attended by the Penghulu of Mukim Pengerang and Pantai Timur and representatives from Kg Bukit Raja and Kg Bukit Buloh. The engagement session served as a platform for information disclosure to the villagers, addressed stakeholder concerns as well as built community consensus over certain issues. Additionally, the engagement also allowed the study team to cross-check information with stakeholders including obtaining reactions to the proposed Project.

A household and perception survey was conducted over a 4-week period in September and October 2018 and from 8th to 21st January 2019. The aim was to collect socio-economic data of the households as well as to obtain feedback and views of the residents on the proposed Project. A total of 100 respondents were interviewed, of whom 80 are local residents (owner occupiers) and 20 were non-locals (Malaysians) who are renting houses in Kg Lepau and working either in RAPID or on other projects in PIPC. The survey covered villages located within the 5k zone of impact from the Project site, namely, include Kg Lepau, Kg Bukit Buloh, Kg Bukit Pelali, Kg Bukit Gelugor, Kg Bukit Raja and Taman Rengit Jaya.

One-to-one meetings were also convened with institutional and other stakeholders. These meetings allowed the individual stakeholders to share and verify information, as well as to voice their views, preferences and aspirations.

Identification of issues and concerns raised by the stakeholders and evaluation of the significance of issues were undertaken to determine which should be evaluated further in the SIA study. The focus is to decide whether the Project is likely to cause significant adverse impact resulting from construction and operation. **Table 1.3** below summarises the approach method used with respect to engagement with the various stakeholders.

Table 1.3: Approach Method used in Stakeholder Engagement

Date	Approach Method Used	Stakeholders
18 July 2018	Direct one-to-one interview	• Planning and Development Officer, PBT Pengerang, Bandar Penawar • Manager, Project Planning, Bukit Pelali Properties Sdn Bhd • Sales Manager, Cypress Potential Sdn Bhd, Sebana Cove Mixed Development

Date	Approach Method Used	Stakeholders
22 Sept 2018	Direct one-to-one interview	• Manager, Sebana Cove Resort
22 Sept 2018	Unstructured interview Use of printed handouts of the Project	• Penghulu of Mukim Pengerang & Pantai Timur • Ex-village head of Kg Lepau • Ex-village head of Kg Bukit Buloh • Village head of Kg Bukit Raja, Kg Bukit Gelugor and Kg Bukit Pelali • Chairman and representatives of Koperasi Pengerang Jaya Johor Berhad (KOPEJA) • Chairman and representatives of Koperasi Jaya Teluk Ramunia (KOJAYA)
27 Oct 2018	Focus Group Engagement (briefing using slide presentation, printed material and Q&A session)	• Residents of Kg Lepau (nearest receptors) • Penghulu of Mukim Pengerang and Pantai Timur • Former village head of Kg Lepau • Former village head of Kg Bukit Buloh • Village head of Kg Bukit Raja, Kg Bukit Gelugor and Kg Bukit Pelali • Fishermen of Kg Lepau
28 Oct 2018	Meeting	• Johor Corporation
21 Dec 2018	Direct one-to-one interview	• Owner, fish cage farm, Sg Santi
13th Sept to 9th Oct 2018 8th to 21st January 2019	Household and Perception Survey (questionnaire survey)	• 68 respondents randomly selected from Kg Lepau, Kg Bukit Pelali, Kg Bukit Gelugor, Kg Bukit Raja and Kg Bukit Buloh. • 12 respondents from Taman Rengit Jaya and 20 respondents (Malaysians from outside the Pengerang region, living and working in Pengerang) randomly selected from Kg Lepau.

4. BASELINE DATA AND FINDINGS

4.1 Demographic and Socio-economic Profile of Respondents in the Study Area

4.1.1 Demographic Character

A total of one hundred respondents were interviewed between September and October 2018 and in January 2019 to obtain an understanding of the demographic and socio-economic character of the local communities and non-locals residing inside the 5km impact zone. Eighty of those interviewed are local residents and owner-occupiers whilst twenty are non-locals (Malaysians from the other parts of Johor and the other states, namely Sabah, Sarawak, Terengganu, Kelantan, Selangor and Pahang) who have opted to use these villages as their interim home. The non-locals are recent arrivals to Pengerang to work in RAPID or to start their own business or work in businesses and industries that are related to RAPID and the Dialog deepwater terminal. The majority of the non-local respondents are males (85%) with the rest females (15%). **(Table 1.4)**

Table 1.4: Distribution of Respondents by Gender

Gender	Kg Lepau	Kg Bukit Pelali	Kg Bukit Buloh	Kg Bukit Gelugor	Kg Bukit Raja	Taman Rengit Jaya	Total
Male	39*	20	3	6	9	8	85
Female	11	0	0	0	0	4	15
Total	50	20	3	6	9	12	100

Note * The 39 male respondents from Kg Lepau include 19 local residents and 20 non-locals (Malaysian).

The breakdown of the local respondents by age group is as follows: between 20 to 39 years (23%), between 41 to 59 years (34%) and 60 years and above (43%). It is evident here that there is a very high aging population in the villages within the zone of impact. In contrast, the twenty non-local (Malaysian) residents are aged between 20 to 39 years. When the two groups of respondents are combined, the respondents in the 20 – 39 age group represent the majority group (39%). Those aged 60 years and above (34%) is the second largest **(Table 1.5).**

Table 1.5: Distribution of Respondents by Age Group

Age Group (years)	Frequency	%
20 – 39	39*	39
40 - 59	27	27
60 and above	34	34
Total	100	100

Note: *) More than half (51%) from this age group are non-locals

The demographic character of Kg Lepau, in particular, has changed over the past 5 years. Based on information from its former village head, the village is currently home to 50 families with an estimated population of less than 200 people and an exceptionally high aging population. About 43% of Kg Lepau's population are aged 60 years and above in comparison to Mukim Pengerang (12%), Daerah Kota Tinggi (8.3%) and Johor state (8.3%). (Malaysia Census 2010). A high aging population is also evident in the five other villages located inside the 5km impact zone. The likely explanation for this character is that prior to RAPID and Dialog's deepwater port project in Pengerang, the villages in Pengerang faced outmigration of the younger population to the other parts of Johor, particularly to Pasir Gudang, for employment and economic reasons. On the other hand, the non-locals (Malaysians) who have made Kg Lepau their interim home are primarily younger with an average age of 32 years. They are economically active and number about 200 persons.

The changing demographic character of Kg Lepau and the other villages is also reflected in the declining enrolment of students. In 2015, Sekolah Kebangsaan Lepau (the only primary school in Kg Lepau) recorded an enrolment of 14 students and 13 teachers. In 2018, however, the school had only 6 students and 4 teachers.

With respect to the level of education attained amongst the local respondents, a high proportion has a primary school education (43%), secondary school education (56%) and tertiary/diploma (1%). In contrast, the non-local (Malaysian) respondents have a better educational level. Those with a primary school education (10%), secondary school education (30%) and tertiary education (60%).

Ethnically, the local respondents from Kg Lepau, Kg Bukit Pelali, Kg Bukit Gelugor, Kg Bukit Raja and Kg Bukit Buloh are predominantly Malays (100%). Taman Rengit Jaya, on the other hand, is a mixed community, where those interviewed include Chinese (40%), Indians (40%) and Malays (20%). The ethnic breakdown of the non-locals (Malaysian) comprises Malays and other *bumiputera* (85%), Indians (10%) and Chinese (5%).

4.1.2 Employment Status

The majority (34%) of the local respondents run their own business, typically in the domestic food service sector and provision of other services to workers from RAPID, followed by those who are employed in RAPID (14%), and those who are employed locally (14%). Due to the job opportunities provided by RAPID and its flow-on effects on the local economy in Pengerang, a number of respondents have recently returned to Kg Lepau and Kg Bukit Buloh from Pasir Gudang and Johor Bahru to work in RAPID or to start their own business in the food sector and in the night market catering to workers from RAPID. Only 10% are engaged in fishing, albeit not on a full time basis, due to declining fish catch, restricted fishing grounds and the opportunity to engage in the night market and supply of other services to workers from RAPID to supplement their income. Another 15% are retirees and homemakers. Only one respondent

reported that he is still engaged in fruit cultivation, though mainly for subsistence. Unemployment amongst the local respondents is only 1%.

Of the non-locals who have relocated to Kg Lepau in the past 5 years, the majority (45%) are engaged in RAPID; others (35%) operate their own business whilst some (20%) are employed in the various industries and businesses newly set up in PIPC.

4.1.3 Income Level

About 63% of the respondents from Kg Lepau reported having a monthly household income ranging between RM1,000 to RM2,500, whilst 32% reported between RM2,500 to RM4, 000. However, about 5% of those interviewed indicated a monthly household income of less than RM1, 000. This is not unexpected given that it is a village with a high aging population and retirees. Overall, 40% of the local respondents living inside the 5km zone of impact reportedly have a monthly household income of between RM2,500 to RM4,000; 37% having less, i.e. between RM1,000 to RM2,500 and another 15% having more than RM4,000.

For comparison, over 50% of the non-local residents reported having a monthly income ranging between RM 2,500 to RM4,000, and another 45% earning more than RM4,000 per month. Only 5% reported earning less than RM2, 500.

4.1.4 Dependence on Natural Resources in the Project area

The villagers of Kg Lepau were once dependent on their oil palm smallholdings (to an extent) as one of the sources of income. Located at the fringe of the village, these smallholdings were previously managed by FELCRA (Federal Land Consolidation and Rehabilitation Authority, a federal agency set up specially to develop the rural areas by assisting the farmers in the management and replanting of their agricultural land). Based on feedback from the respondents during the social and perception survey, it is understood that FELCRA has ceased its management role (for a number of reasons that include declining commodity price). Since then, the smallholdings have remained idle and occasionally inundated due to drainage issues and during the wet season.

Fruit cultivation around the village is pursued, albeit on a small scale and mainly for personal subsistence.

Dependence on fishing as a source of livelihood has declined considerably since work started on the coastal reclamation for a deepwater terminal and development of Pengerang as a petroleum processing hub. The fishermen who were interviewed in the social survey reported a drastic plunge in earnings and having to go further out to drop their nets. This could be due to a number of reasons that include reduced water quality along the rivers and near shore areas (thus affecting the mangroves and the fish and prawn spawning areas along the riparian areas) and restrictions placed on traditional fishing grounds to accommodate vessel movement.

The villagers realise that while old livelihoods like fishing and dependence on the land are diminishing, new incomes are available from the new developments in Pengerang.

4.1.5 Cultural Heritage Sites

No cultural heritage site was detected inside the 5km zone of impact during the field surveys nor was the matter highlighted at meetings with the former village heads and institutional stakeholders (i.e. the Planning Department of the Pengerang Local Authority and the Kota Tinggi District Land Office).

4.1.6 Housing

The houses in Kg Lepau and the other five villages are a mix of modern single-story brick structures (30%), brick and wood structures (50%) and traditional wooden kampong houses (20%). With respect to water and electricity supply, the area appears to be well served by SAJ and TNB. Pending the implementation of a central sewerage treatment plant and a solid waste collection and management system for Pengerang, individual septic tanks are largely used for sewerage treatment in Kg Lepau and the other five villages whilst solid waste disposal is still by burning and burying.

Perhaps the most significant change in the character of housing in Kg Lepau and the other five villages is the escalated demand for rental accommodation. The recent influx of workers, both local and foreign, arising from the activities in RAPID and the DIALOG Deepwater Terminal, has led to substantial increase in rental rates (typically, between RM5,000 to RM8,000 per living quarter a month) and land prices. Attractive rental rates have encouraged the upgrading of a number of derelict or underutilised kampong as well as half-timber and brick houses particularly in Kg Lepau, and a general physical improvement was observed during the sites visits (**Figure 1.4).**

Figure 1.4: Housing Condition in Kg Lepau



Existing part brick part timber house



Existing kampong house



An upgraded house



A new house under construction



House rented to workers from RAPID



House rented to workers from RAPID

Source: Photographs of houses in Kg Lepau taken on 18th July and 22nd Sept. 2018

4.2 Perceptions and Views of Stakeholders

A perception survey was conducted in tandem with the household socio-economic survey undertaken in September - October 2018 and January 2019 for the purpose of obtaining the community's views with respect to the proposed Project. Generally, the majority of the residents (60%) were aware that the ownership of a large tract of agricultural land located between Lebuhraya Pengerang and the northern boundary of RAPID is in the process of being transferred from KEJORA to Johor Corporation (JBCorp), an investment arm of the Johor state government. Additionally, the residents were also aware of JCorp's intention to convert the land for industrial use.

Awareness of the Project

With respect to the proposed Project in particular, 98% the 100 respondents interviewed reported that they were not aware of the proposal. Only 2% indicated that they heard about the proposed Project from friends, but did not know the details or where the plant would be located.

Support for the Project

The respondents cited increase in the movement of heavy vehicles, poor road conditions, road safety along the public roads coupled with dust and noise from the activities in RAPID as problems that they currently faced. In terms of support for the proposed Project, 86% of the respondents viewed the Project favourably and indicated they were willing to support it as the Project would generate economic benefits. This is possibly because the respondents have seen or experience the spill-over effects and economic growth around them in Pengerang, improved infrastructure and road upgrading works in the region and new mixed housing and township projects under construction as a result of the PIPC project. The respondents concurred that the Project would (1) promote business and other spin-offs opportunities (100%); (2) sustain the increase in house rental and land value (97%); (3) generate new job and employment opportunities (93%); and (4) stimulate further development in Pengerang and the other regions in the Kota Tinggi district (87%) **(Table 1.6).**

Table 1.6: Support for the Proposed Project

	Reasons for supporting the Project	**Frequency (n=86)**	**%**
1	Stimulate further development in Pengerang and Kota Tinggi district	75	87
2	Generation of employment and job opportunities	80	93
3	Generation of flow-on or spill-over effects	86	100
4	Sustain increase in house rental and land value	83	97
5	Other reasons	0	0

Those who did not view the Project favourably accounted for 14% of the respondents. The main reasons cited pertain to air pollution (86%), noise and dust nuisance (64%), increase in heavy vehicles and road safety issue (93%), influx of foreign workers and social/health problems that might arise (71%) and declining water quality in the rivers (21%). **(Table 1.7)**

Table 1.7: Non-support for the Proposed Project

	Reasons for not supporting the Project	Frequency (n=14)	%
1	The Project might further pollute the air	12	86
2	Noise and dust from increased road traffic and activities of the industrial plant	9	64
3	The Project might lead to further decline in river water quality	3	21
4	Social / health concerns due to influx of foreign workers	10	71
5	Increase in traffic movement and road safety issue	13	93
6	Other reasons	0	0

Perceived Impacts during Construction and Operation Phases of the Project

With respect to their perception of likely impacts during the construction and operation phases of the Project, the respondents admitted the Project could bring both positive and adverse impacts **(Table 1.8** and **Table 1.9).**

A value is assigned to each perceived impact which ranges from High, Moderate, Low or No Effect. Values range from 0 for 'No Effect' to respondent/s to 3 for 'High' if the impact is regarded to have a higher effect on the respondent/s. Severity of impact is a measurement of the seriousness of the impact to the respondent/s and is quantified using a scale of 0 to 3: 0 referring to no effect, 1 for minor impact, 2 for moderate impact and 3 referring to high impact.

Table 1.8: Respondents' Perceived Impacts during Construction Phase

	Perceived Impacts		High	Moderate	Low	No effect	Severity of Impact
	Value		**3**	**2**	**1**	**0**	
	During construction: positive impact						
1	Employment opportunities	F	16	52	32	0	2
		S	48	104	32	0	
2	Spill-over effects, e.g. business	F	48	62	0	0	**3**
		S	144	124	0	0	
3	Increase in house rental & land value	F	74	26	0	0	**3**
		S	222	52	0	0	
4	Better quality of life	F	8	32	35	25	1
		S	24	64	35	0	
5	Stimulate regional growth	F	32	56	12	0	2
		S	96	112	12	0	

	Perceived Impacts		High	Moderate	Low	No effect	Severity of Impact
	Value		**3**	**2**	**1**	**0**	
	During construction: negative impact						
6	Increase in heavy vehicular movement, and road safety on public roads	F	90	10	0	0	**3**
		S	270	20	0	0	
7	Dust and noise nuisance from traffic movement	F	19	78	3	0	2
		S	57	156	3	0	
8	Dust and noise pollution from construction activity	F	37	63	0	0	2
		S	111	126	0	0	
9	Flooding and drainage issue	F	22	68	10	0	2
		S	66	136	10	0	
10	Social/health concerns from influx of foreign workers	F	83	17	0	0	**3**
		S	249	34	0	0	

Note: F= frequency
S = score (frequency x value)
Severity of impact = (Score x Frequency) ÷ Total number of respondents
(Severity of an impact is a measure of the seriousness of the impact to the respondent/s)

Table 1.9: Respondents' Perceived Impacts during Operation Phase

	Perceived Impacts		High	Moderate	Low	No effect	Severity of Impact
			3	**2**	**1**	**0**	
	During operation: positive impact						
1	Employment opportunities	F	18	59	23	0	2
		S	54	118	23	0	
2	Spill-over effects, e.g. business opportunities in F&B, homestay/rental Business opportunities related to the activities of the Project and along its supply chain	F	82	18	0	0	**3**
		S	246	36	0	0	
3	Increase in house rental & land value	F	80	20	0	0	**3**
		S	240	40	0	0	
4	Increase in population and change in the demographic character	F	37	56	5	0	2
		S	111	102	5	0	

	Perceived Impacts		High	Moderate	Low	No effect	Severity of Impact
			3	2	1	0	
5	Increase in development of new housing and commercial areas	F	48	52	0	0	2
		S	144	104	0	0	
6	Stimulate regional growth & more investments	F	28	70	2	0	2
		S	84	140	2	0	
	During operation: negative impact						
7	Increase in heavy vehicular movement, general traffic (due to increase in population) and public road safety	F	90	10	0	0	**3**
		S	270	20	0	0	
8	Noise nuisance and dust from traffic movement and plant activities	F	25	62	8	0	2
		S	75	124	8	0	
9	Declining air quality as a result of plant activities	F	62	38	0	0	**3**
		S	186	76	0	0	
10	Flooding and drainage issue	F	22	68	10	0	2
		S	66	136	10	0	
11	Social/health problems due to influx of foreign workers	F	87	13	0	0	**3**
		S	251	26	0	0	

Note: F= frequency
S = score (frequency x value)
Severity of impact = (Score x Frequency) ÷ Total number of respondents
(Severity of an impact is a measure of the seriousness of the impact to the respondent/s)

Among the perceived positive impacts that have the highest effect during the construction and operation phases of the Project are:

(1) Spill-over or flow-on effects arising from activities on site and in the chemical plant complex as well as along the supply chain related to the Project; and

(2) An increase in house rentals and land value as demand for housing increases with the incoming of construction, technical and professional workers, both local and foreign.

The respondents are equally concerned with the adverse impacts the Project could bring to the community. The impacts that are perceived to have the highest level of detriment or adversity are:

(1) An increase in the movement of heavy vehicles and associated with it road safety along public roads;

(2) Social and health concerns due to an influx of more foreign workers; and

(3) Decline in air quality.

4.3 Feedback from Dialogue with Stakeholders

4.3.1 Stakeholders and Village Heads

Interviews and dialogues were conducted with stakeholders in July, August and September 2018. The following is a summary of their views and feedback **(Table 1.10).**

Table 1.10: Views and Feedback from Stakeholders

Date	Stakeholders	Key Views and Feedback
18 July 2018	Planning and Development Officer, PBT Pengerang, Bandar Penawar	Johor state has not fully adopted PLAN Malaysia's requirement for an independent SIA study; therefore, a standalone SIA report for the Project is not required at this time. Notwithstanding this, PBT Pengerang requested for the findings of the SIA study to be extended to them (i.e. via the EIA report) for their information. (Appendix 1: Letter from PBT Pengerang, 5th August 2018) PBT Pengerang highlighted some key matters: • Increase in road traffic movement and road accidents • Increase in informal F&B premises, especially in Kg Lepau catering to RAPID • Increase in household income for the community through house rental • More economic opportunities for local residents • Increase in disposable income for local residents • Increasing incidence in diseases, e.g. TB
18 July 2018	Manager, Project Planning, Bukit Pelali Properties Sdn Bhd	The developer is aware of the industrial intention of JCorp, though without information on the details. The township development in Bukit Pelali is meant to provide housing and other services and

Date	Stakeholders	Key Views and Feedback
		amenities to workers and their families in Pengerang. Therefore, the developer will support further industrial development in Pengerang.
18 July 2018	Sales Manager, Cypress Potential Sdn Bhd, Sebana Cove	The developer is aware that the land south of their property and Lebuhraya Pengerang is earmarked for industry. The developer's township masterplan has been amended from resort living to mixed development with the commercial town centre fronting Lebuhraya Pengerang (Route J52) and the residential components set further away from the highway and the future industrial areas. The aim of their township is to address the housing and retail demand of the workers in RAPID and other O&G projects in Pengerang.
22 Sept 2018	Manager, Sebana Cove Resort and Marina	The current occupancy rate at the resort is over 80% (weekdays) and 40% (weekends), compared to 20% (weekdays) and 30% (weekends) prior to RAPID. Currently, facilities and restaurants are well patronised in the evenings. Guests are both long and medium-term. Demand for rooms is very high.
22 Sept 2018	Penghulu of Mukim Pengerang & Pantai Timur • Ex-village head of Kg Lepau, And Kg Bukit Buloh • Village head of Kg Bukit Raja, Kg Bukit Gelugor and Kg Bukit Pelali • Chairman of Koperasi Pengerang Jaya Johor Berhad (KOPEJA) • Representative from Koperasi Pengerang Jaya Johor Berhad (KOPEJA	The local communities have benefitted from RAPID and the other associated support industries that have emerged. The proposed Project can benefit the local communities through similar spillover effects. However, although most EIA reports state that local residents will be given priority to work in the industrial plant, it is seldom realised once the plant is in operation. The stakeholders in the Pengerang area have the benefit of experience through their involvement in RAPID via four cooperatives set up by the Johor government with collaboration from Petronas. As part of

Date	Stakeholders	Key Views and Feedback
	• Chairman of Koperasi Jaya Teluk Ramunia (KOJAYA) • Representative from Koperasi Jaya Teluk Ramunia (KOJAYA)	Petronas' outreach programme, the cooperatives, whose members are members of the local communities, are supplying water, lubricating oil, manpower, building materials, diesel, etc. to RAPID. Other services include carwash, night market, etc. At least 30% of RAPID's auxiliary contracts are accorded to the local cooperatives. Appendix 2: Meeting Minutes, MOM_6
28 Oct 2018	Johor Corporation	Notice has been served on tenants in PIP (former KEJORA land) to vacate. These tenants have either vacated or are in the process of doing so. The sheds in the orchid and ornamental plant farm have been dismantled and vacated. The fish ponds have ceased operation, with the exception of 3 ponds which will be vacated once the fish are harvested by end 2018.

4.3.2 Feedback from Fish Cage Farmers

A one-to-one interview was conducted on 21 December 2018 with Encik Jaafar bin Yahya, one of the owners of the floating fish cages along Sg Santi, located about 1.2km from the confluence of Sg Santi and Sg Lepau (**Figure 1.5**). Encik Jaafar and two others from Kg Pasir Gogok and Kota Tinggi respectively used to own and operate 32 floating fish cages in Sg Santi; however, the number of cages has reduced to 24 due over the past 2 years to a number of factors. Grouper *(siakap),* Red Snapper *(ikan merah)* and prawns are the main species bred in the fish cages and targetted for the local market, restaurants and KipMart (a local hypermarket chain) in Kota Tinggi. The farm has been in operation for the past 10 years, but production has declined by about 30% over the past 2 years. This decline is reflected in the annual average gross revenue is about RM 42,000 over the past two years, compared to over RM120, 000 previously.

The main contributing factor for the reduction in the number of fish cages and production is reduced water quality, and increased levels of silt and turbidity along Sg Santi which Encik Jaafar attributes to land clearing, sand dredging and reclamation along Sungai Johor. The second factor is the loss of mangroves along Sg Santi and its tributaries, namely, Sg Sebina and Sg Lepau which have traditionally served as the spawning and breeding grounds for prawns and fish. The wave wake from increased movement of marine traffic from sand barges and other vessels along Sg Santi and the mouth of the Johor River is the third contributing factor that has also affected production of the fish cages, according to Encik Jaafar. Certainly, there is fear that

the increasing industrialisation at Pengerang, further loss of natural vegetation (on land and along the river bank) as more land is opened up for development, and discharge of industrial waste water and other materials into the water channels might further affect production of the fish cages.

Figure 1.5: Floating Fish Cages along Sg Santi



4.4 Focus Group Discussion

A focus group discussion was held with the local community of Kg Lepau and representatives from Kg Bukit Buloh and Kg Bukit Raja on 27th October 2018. (Appendix 3: Meeting Notes, MOM_07). Key issues and concerns are summarised as follows **(Table 1.11).**

Table 1.11: Summary of Feedback Raised at the Focus Group Discussion

Key Concerns	Views and Feedback
Inshore fishing	1. Fishing licenses were frozen during the construction period of RAPID and newly applied licenses have not been issued since then. Fishing licenses are issued by the Department of Fisheries (DoF). It is understood that the decision to freeze licenses is for an interim period aimed at regulating the number of inshore fishermen due to declining fish population and traditional fishing areas. This is an issue which the stakeholders would have to raise with DoF. (Note: This issue of frozen fishing licence is not related to the proposed PEC project. It is believed

Key Concerns	Views and Feedback
	the fishermen were using the FGD as a platform to express their grievances). 2. The fishermen of Kg Lepau requested for priority to be given work and business opportunities available at the proposed plant. 3. Fish and prawn catch have declined by as much as 80% after the construction of RAPID. Average monthly income for the fishermen has declined significantly from RM3, 000. 4. There is concern that industrial wastewater from the proposed plant would be discharged into Sg Lepau and eventually into Sg Santi.
Noise pollution	Noise nuisance during construction of RAPID. Activities went on for 24 hours, especially at night which caused discomfort to residents of Kg Lepau. (Note: RAPID's northern boundary is located 500m away from Kg Lepau. In contrast to this, there is a buffer distance of 1.5km or more between Kg Lepau and the western boundary of the proposed plant. Noise from construction and operation activities are not anticipated)
Air quality	Stakeholders are unable to access DOE's air quality monitoring station that is located in the Kg Lepau school compound. (Note: DoE would not be able to give out any data as it is a new station and the data need to be verified before release to the public).

5. ASSESSMENT OF IMPACTS

5.1 Probability and Significance of Impact

5.1.1 During Pre-construction Phase

JCorp is committed to be responsible for the cut and fill of the project site and hand over the site that has been regraded and finished to a platform level that is compatible with the finished level at RAPID. Furthermore, the Project site is surrounded by Lebuhraya Pengerang that has been upgraded and the site can be directly accessed from Lebuhraya Pengerang via a dedicated road (under construction) that leads directly into RAPID. Therefore, impact to the local community during pre-construction stage is not expected to be significant.

5.1.2 During Construction and Operation Stage

Significance of impact is dependent on its severity and probability of occurrence. Severity is a measure of the seriousness of the identified impact upon the stakeholder. It can be quantified using a numerical value scale by assigning a value to each perceived impact. Values range from High, Moderate, Low or Minor/No Effect. A Value of 0 is assigned to an impact that has 'Minor/No Effect' to a respondent to a higher value, for example, 3 for 'High' if the impact is regarded to have a higher effect on the respondents.

Probability of impact occurrence is also measured using a numerical value scale, where a probability scale of 1 is assigned to one-off occurrence; a scale of 2 assigned to rare occurrence; a scale of 3 is assigned to occasional occurrence and a 4 is assigned to an occurrence that is continuous.

Impact significance is determined based on its severity and probability of occurrence, and using the formula advocated in the Manual for Social Impact Assessment for Projects (PLANMalaysia, 2018).

Significance score = Severity x Probability of occurrence

Using the variable identified in Table 1.8 and Table 1.9, the significance score for each impact for each variable is determined **(Table 1.12)**.

Table 1.12: Significance of Social Impact

Social Impact	Severity	Probability	Severity Level	Probability Level	Significance Score
Employment & business	Increased employment & business opportunities, leading to higher household income & improved quality of life	Will occur continuously during construction & operation	3	4	**12**
Housing	Increased housing demand from workers, local and non-local, leading to rental of local homes at high rental and worker camps and hostels	Will occur continuously during construction & operation	3	4	**12**
Population increase & changes to demographic character	Migration of former residents back to the Project area, in addition to new migrants from other states and regions in Johor	Will occur continuously throughout all phases of the Project	2	4	8
Development of Pengerang region and Kota Tinggi district	Spill over effect for the local population and improvement to income and quality of life	Will occur continuously throughout all phases of the Project	2	4	8
Road safety	Increase in traffic volume, vehicle movement and road accidents	Will occur continuously throughout all phases of the Project	3	4	**12**
Health and safety	Inflow of local and foreign workers leading to health concerns and issues regarding security, crime, integration, social conflict	Will occur occasionally throughout all phases of the Project	3	3	9
Displacement or relocation of population,	None involved. No action required.	-	-	-	-
Relocation of cultural heritage sites	None involved. No action required.	-	-	-	-

To facilitate assessment and to decide the level of action required for mitigation, the Manual for Social Impact Assessment for Projects (PLANMalaysia, 2018) advocate the grouping of significance scores into classes, as indicated below.

Rating scale of 0 to 4:	No or minimal impact, low priority, and therefore, no or minimum action is needed
Rating scale of 5 to 8:	Low impacts; prevention actions recommended;
Rating scale of 9 to 12:	Medium impact; preventive or mitigating measures are required
Rating scale of 13 to 16:	High impact; mitigating measures are required

Although the grouping system is largely subjective, it is nonetheless a system that has been consistently used in SIA studies. If used judiciously, the level of partiality may not be a fatal flaw. Thus, with the grouping system, it is possible to assess whether the variables for this Project require:

(1) No or minimal action if the impact is minor or low; or

(2) Preventive action to reduce impacts if significance of the impacts are deemed medium; or

(3) Mitigating measures to overcome or reduced the impact during planning, construction or operation stage if the significance level is considered to be medium or high **(Table 1.13).**

Table 1.13: Level of Significance of Probable Impacts

Social Impact Variable	Significance Score		Significance Level
	Positive Impact	Negative Impact	
Employment & business	12	-	medium
Housing	12	-	medium
Population increase & changes to demographic character	8	-	low
Development of Pengerang region and Kota Tinggi district	8	-	low
Road safety	-	- 12	medium
Health and safety	-	- 9	medium

5.2 Potential Impacts during Construction Phase

5.2.1 Employment and Business

JCorp is responsible for land clearance, cut and fill, installing the main external infrastructure and utilities, and getting the platform to an acceptable level before hand over to the Project Proponent for construction. Most of the new construction related jobs on site would require both skilled and unskilled labour and contract work for construction of the internal infrastructure, buildings and facilities within the 250-acre site. Where feasible and based on skill sets, the proposed Project should maximise local employment.

The project is also expected to generate a number of spin-off businesses along the supply value chain related to the Project construction, some of which could be taken up by the local community businessmen or small-scale entrepreneurs. These spin-off business opportunities would include supply of contract workers, supply of diesel, opening up new F&B premises and food stalls, catering service to the construction workers, provision of personal services like laundry, barber shops, transportation, etc. Indeed, this would contribute towards much needed income in the region. However, the income generation opportunity is not of long-term duration, as it would be mostly limited to the construction period.

5.2.2 Housing the Workforce

No worker camps will be needed for the local workforce from Pengerang and the surrounding region should they be employed as they will return home daily. On the other hand, using foreign workers during the construction phase requires them to be housed, in worker camps/hostels to be located within or outside the project site. JCorp has earmarked a 22-acre site in their PIP master plan as a “village” for foreign workers, and this site can be used to accommodate the Project’s foreign workers.

5.2.3 Traffic Volume, Movement and Road Safety

Increased traffic movement, especially of heavy vehicles, is potentially a safety concern. During construction, deliveries of heavy equipment and supplies will occur via Lebuhraya Pengerang (Route 52) and the dedicated access (currently under construction) that leads directly to RAPID. Due to the scale of the Project, a significant volume of vehicle movement, traffic congestion and disruption is expected along these main public transport routes. Transport requirements for the Project are estimated as:

- Movements of heavy and wide loads requiring temporary road closures and traffic disruption; and
- Significant truck movements associated with the movement of construction materials and workers to the construction location.

5.2.4 Health and Safety

Safety and the increasing incidence of disease is one of the concerns local communities have towards the influx of workers to RAPID and the surrounding area. Based on their experience in RAPID and DIALOG deepwater terminal, the local communities are wary of the incidence of robbery, unhealthy influence of outsiders, unacceptable behaviour by foreign workers, conflicts due to misunderstanding and to a lesser extent sexual harassment and unapproved marriages (ISEAS, 2018). With respect to health, research studies have indicated a high prevalence of parasitic infections and infectious disease observed amongst the foreign worker community in Malaysia (Sahimin, 2016). The prevalence is possibly acquired due to the lack of sanitation and clean water in their home country and compounded with behavioural factor such as poor personal hygiene, sanitation and cleanliness that continues to persist after entry into the country. This is a probable significant concern at the Project site given the scale of the construction activities and the likelihood that the majority of the workers will be foreigners.

5.3 Potential Impacts during Operation Phase

5.3.1 Employment and Business Opportunities

Usually, economic changes and new employment opportunities marginalise long-term, older local residents. During operation of the proposed Project, most jobs will be for professional and technically skilled workers like engineers and technicians which require specific training. These specific skills are not readily found in the villages around the Project area or in the surrounding region in Pengerang. These skilled workers are likely to comprise Malaysians from other parts of Johor and other states, including foreign professionals where relevant and a large number of foreign contractors and workers.

The local communities have already questioned the possibility of their residents getting jobs in the proposed Project. By their lack of numbers and the required skill sets, the local population of Kg Lepau and the other villages located inside the Project's zone of impact and the wider Pengerang area are insufficient to meet the needs and requirements of the proposed Project. However, ancillary jobs and support services (for example supply of food, supply of diesel, housekeeping, barber and laundry services, transportation, homestay, etc.) could be generated by the Project and its activities and would be available for people from the surrounding settlements or villages. This would create additional income for the local community.

5.3.2 Changes in Demographic Character

One of the variables that are often correlated with adverse social impacts of development is demographic changes, such as in the size and composition of the resident population or the influx of a temporary workforce. With the influx of foreign workers, Kg Sungai Rengit is now derogatively referred to as "Pekan Bangla" (Bangladeshi Town); residents complain that local

mosques are overrun with foreigners who have also set up shops and homes there. This is in spite of Temporary Workers' Villages built and already being used within the PIPC. A drive through the edges of Kg Sungai Rengit reveals a number of workers' quarters fashioned out of refurbished containers and other improvised facilities.

In respect to Kg Lepau, change in the demographic pattern is already evident through the inflow of Malaysian workers from the other parts of Johor and Malaysia. At the moment, the Malaysian new comers comprise about 50% or more of the total population of Kg Lepau. The inflow of Malaysian workers into the village is fortuitous as it allows for easier social integration and interface with the local residents. Comprising mainly males in the 20 to 40 age group with a higher level of education and higher disposable income, the arrival of the new residents has favourably changed the demographic pattern of Kg Lepau, which is trending towards an aging population. It would be considered a positive impact if the proposed Project is able to attract younger, educated and professional/technical people into the region.

5.3.3 Housing the Workforce

Increasing cost of living is a significant issue in Pengerang since the construction of RAPID. Cost of food and daily needs are said to be as high as in Johor Bahru town. Added to this is the high house rental for new workers in the area, given the shortage of local rental facilities. The problem is so severe that jobseekers are offered substantial food and housing allowance to encourage them to take up the many available but unfulfilled positions in Pengerang.

While the demand for worker housing has initiated the development of new townships and other associated facilities to address the needs of the new migrant working population, it has also prompted a trend amongst the local communities to upgrade and rehabilitate some of the otherwise abandoned, underutilised or dilapidated kampong houses into rentable living quarters. In Kg Lepau especially, a number of such houses have been upgraded to take advantage of rentals that range between RM5,000 to RM8,000 a month. Due to shortage of rentable quarters, each living quarter accommodates as many as 20 to 30 workers per living quarter. New housing demand from the proposed Project could sustain or even escalate the rental trend in Kg Lepau, and consequently, lead to further upgrading of the local community and household income.

With respect to housing the foreign workers, they can be housed in the 22-acre site in PIP that has been earmarked as a 'village' for foreign workers. Located at the junction of Lebuhraya Pengerang and the new dedicated access road that leads to RAPID, the 22-acre site is easily accessible to the Project site.

5.3.4 Traffic Volume and Movement

Increased traffic volume and movement of heavy vehicles along the public roads is inevitable due to the transportation of feedstock, petroleum and aromatics products and by-products to and from the proposed Plant. However, most of the feedstock, products and by-products will be piped into or out of the Project site, thereby reducing a considerable amount of land traffic movement.

5.3.5 Public Health and Safety

Public health and safety are not anticipated to be an issue to residents and workers living and working inside the 1km to 2km impact zone. The air modelling and health impact assessment have indicated that the particulate and gaseous emissions are generally within acceptable limits during normal operation phase of the plant.

However, should an abnormal situation, e.g. process upset or emergency situation occur at the plant, part of the Sebana Cove mixed development township that fronts Lebuhraya Penangerang (Route J52) may be subject to an increased concentration for SO_2. The predicted level of seriousness pertaining to health is between AEGL-1 (non-disabling to receptors) and AEGL-2 (disabling to receptors) and exceeding AEGL-2 for medium and high-rise buildings; however, the predicted probability of non-compliance i.e. exceeding AEGL-2, is about 0.02%.

The town centre of Sebana Cove mixed development township is an area earmarked primarily for 2 to 3-storey shop offices and retail premises and supported by a police station, low-rise low-cost walk-up flats, utility facilities and a polyclinic. It is understood that JCorp is in communication with the township developer to relocate the polyclinic to an alternative site that is closer to the residential components. Further, as a town centre, the residential content inside it is likely to be low.

With respect to the safety and health of workers and residents in the town centre, i.e. the area of concern, the impact may be slight based on its predicted low likelihood and provided that the stipulated control measures are followed and only condensate with low sulphur must be used to reduce the risks.

Overall, impact to health and safety of residents and students of the future Sebana Cove township is not anticipated to be highly significant during abnormal operation as the residential areas and school reserves are located outside the predicted area of concern.

Notwithstanding the low likelihood of an abnormal situation and that the major areas of residential and education are outside the area of concern, it is expedient that an Emergency Response Plan be developed for the Sebana Cove mixed development township.

5.4 Summary of Impacts

There would be no severe social impacts from the Project as no land acquisition or relocation of settlers is necessary. Positive impacts are related to employment and job opportunities, spill-over effects along the supply value chain related to the proposed Plant and its activities, overall development of the Pengerang region and other regions in Kota Tinggi district and to the local housing market. The negative social impact is on health and safety of workers and the public that is related to an increase in volume and movement of heavy vehicle traffic. The significance of the negative impact is generally low to medium and can be addressed or mitigated through a number of measures during the construction and operation phases.

6. Mitigating Measures

6.1 Mitigating Measures for the Construction Phase

6.1.1 Traffic and Transport

Impact of construction traffic loads during the transportation of heavy equipment to site is a potential concern, especially along public roads. One of the measures to address public concern on safety on public roads is to communicate with the community on a regular basis the traffic routing plan and movement schedule of heavy vehicle movement, especially of super and abnormal loads. This needs to be done in advance of the commencement of any construction activity.

6.1.2 Housing the Workers

Foreign workers will have to be accommodated in worker camps or purpose-built dormitories to be located either inside or near the Project site. This is also to minimise potential social conflict between the locals and the foreigners. Housing foreign workers in purpose built hostels or dormitories is also be in compliance with the amendments to the Employment Act 1955 (Act 265) that the federal government is currently drafting that requires employers to provide workers' accommodation for their foreign workers for all sectors. Renting temporary accommodation in the local villages, as currently practised, is only an interim option. Although its capacity is yet to be confirmed, the worker basecamp for the proposed Project has to be installed with water and electricity supply, toilets and also waste collection and disposal options.

6.1.3 Health and Safety of Workers

In addition to health education on the importance of personal hygiene, camps or hostels for foreign workers have to be properly equipped with sanitary facilities to control infections within the community.

With respect to safety of workers and the general public, adequate security measures to prevent accidents and injury have to be taken when transporting construction equipment and materials along the main roads. The construction site would need to be fenced and the entrance gates guarded by security staff to prevent any unauthorised access to the site, thus also minimising possible impacts on community health and safety.

6.2 Mitigating Measures for the Operation Phase

6.2.1 Jobs, Employment and Skills Training for the Local Community

The proposed Project has positive benefits for the local communities (for example, job creation, up-skilling and enhancement of the local economy by increasing business with local suppliers). Despite that, the local community has questioned the possibility of the local residents getting jobs in new industrial projects as few have the required skill sets.

The Johor Petroleum Development Corporation (JPDC) runs a number of programmes with a variety of entities to train and certify vocational and supervisory staff as well as provide entrepreneurial training assistance and financing. Since its incorporation in 2012, JPDC has worked in tandem with Perbadanan Usahawan Johor Berhad to hold seminars and courses on marketing and entrepreneurship for locals of all ages. Through the collaboration, they have set up cooperatives to provide food catering services to worker camps in PIPC. Working in cooperation with Petronas, both entities have set up KOPEJA (Koperasi Pengerang Jaya Johor Berhad), a cooperative with membership comprising mostly displaced residents from Taman Bayu Damai. The cooperative operates a retail station within the PIPC and members are provided with entrepreneurial and job training. Thus, along similar line, the Project Proponent could consider participating in JPDC's entrepreneurship programme to identify existing or set up new cooperatives that could service the Project's workers and the plant's activities, for example, in the provision of logistics and housing for its non-professional and technical staff.

With respect to skills training, JPDC offers training through IKBN Bandar Penawar, with the cooperation of the Youth and Sports Ministry, Petronas and SIRIM-AWS. The training aims to produce workers within a short period of time and certification that is recognised by O&G industries. Similarly, the Project Proponent could consider participating in the skill training and certification programme for locals to ensure that they have local workers with the right skill set.

6.2.2 Health and Safety in Sebana Cove Town Centre

Overall, impact to health and safety of residents and students of the future Sebana Cove township arising from emergency or abnormal situations is not anticipated to be highly significant as the residential areas and school reserves are located outside the predicted area

of concern, i.e. the town centre. However, with respect to the safety and health of workers and residents in the town centre, the impact to their health and safety in the event of an abnormal situation may be slight based on its predicted low likelihood and provided that the stipulated control measures are followed and only condensate with low sulphur must be used to reduce the risks.

Notwithstanding the low likelihood of an abnormal situation and that the major areas of residential and education are located outside the area of concern, it is expedient that an Emergency Response Plan be developed for the Sebana Cove mixed development township.

7. Grievance Mechanism

Throughout the life cycle of the Project queries and grievances related to project activities may arise from community stakeholders. These queries or complaints need to be addressed and resolved in an appropriate manner. Therefore, the Project Proponent needs to set up a grievance mechanism:

(1) To provide a mechanism and process through which community stakeholders and other interested parties to raise their concerns, complaints or observations and for the Project Proponent to address genuine items in a timely and agreeable manner;
(2) To demonstrate the organisation's willingness to take community/stakeholder's concerns seriously, thereby maintaining good relationships with stakeholders;
(3) To identify concerns early and resolve the concerns expeditiously so that operational impacts can be managed better and potential harm avoided; and
(4) To reduce the potential for complaints to escalate into protests, security incidents, regulatory challenge or litigation that could result in project delays.

To receive, address and resolve stakeholder complaints and concerns, the grievance mechanism should have the following activities or steps:
(1) To receive the grievance;
(2) To record the grievance, and assign or delegate it to a delegated staff for resolution;
(3) To investigate the complaint, including gathering inputs and perspectives from parties involved;
(4) To resolve/implement remedial actions as well as to remain open for potential appeals;
(5) To get feedback from the aggrieved stakeholder/s and to close the case if a satisfactory outcome or resolution is concluded.

Typically, the position of a Community Liaison Officer needs to be created by the Project Proponent to receive, record, investigate and resolve stakeholder concerns. Petronas, for

example, has also set up a grievance mechanism through which Pengerang residents can channel complaints directly to an assigned Community Liaison Officer.

The Project Proponent would also need to set up an internal monitoring process to monitor the effectiveness of the grievance mechanism. Internal monitoring can be done on a quarterly or half yearly basis. The monitoring process should be designed to identify areas of high performance as well as areas for improvement. Its reporting can be aligned with the EMP reporting.

Disclosure and communication with the local community/stakeholders is important and this can be done through the assigned community liaison officer as well as by posters, pamphlets or community meetings. It is important the institutional stakeholders are included and understand the mechanism to enable them to communicate with the affected stakeholders, especially in the case where the grievances are submitted or channelled to them for resolution.

The Project Proponent is also advised to provide a grievance mechanism for workers, including sub-contractors, to raise reasonable workplace concerns. Similar to the affected people's mechanism, appropriate resources and budget should be allocated to address matters in a transparent and understandable process that provides feedback to the workers without any retribution.

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APPENDIX 1

Letter from Bahagian Perancang Bandar, PBT Pengerang
5th August 2918

قِيَابَتِ فَعَرَاغ

PBT PENGERANG

JABATAN
PERANCANGAN & PEMBANGUNAN
(BAHAGIAN PERANCANG BANDAR)

Ruj. Kami : (/) dlm. PBTP:JPP/BPB/1/1/2018
Tarikh : 8 hb. Ogos 2018
26 *Zulkaedah 1439H*

Pengurus Projek,
ENVIROSOLUTIONS & CONSULTING SDN BHD
65B, Jalan SS21/60,
Damansara Utama,
47400 Petaling Jaya, Selangor.

Tuan/Puan,

PERMOHONAN PENGECUALIAN KAJIAN PENILAIAN IMPAK SOSIAL (SIA) UNTUK CADANGAN PEMBANGUNAN KOMPLEKS KIMIA AROMATIK DAN PEMISAH PELUWAP DI PENGERANG, JOHOR, MALAYSIAN BAGI PIHAK PENGERANG ENERGY COMPLEX SDN BHD

Merujuk perkara di atas dan surat tuan bertarikh 18 Julai 2018 adalah berkaitan.

2. Kami maklum akan cadangan pembangunan yang hendak dijalankan, pihak kami pada dasarnya tiada halangan terhadap permohonan ini. Walaubagaimanapun jika terdapat keperluan penyediaan Kajian Penilaian Impak Social (SIA) pihak kami akan maklumkan kemudian.

Dengan hormatnya,
PIHAK BERKUASA TEMPATAN PENGERANG

(NOR RAHMAN BIN MUSTAFFA)
Pengarah
Jabatan Perancangan dan Pembangunan
b.p. Yang Dipertua
PBT Pengerang

[illegible]

NO. 7, JALAN KEMPAS 1, TAMAN DESARU UTAMA, 81930 BANDAR PENAWAR, JOHOR, MALAYSIA
Tel : (07) - 886 2692 **Faks :** (07) - 886 2636 / 2656 **Laman Web :** www.pbtpengerang.gov.my

APPENDIX 2

Meeting Minutes_MOM 6
22nd September 2018

PEC ESC

MEETING MINUTES

Project No.	:	J18 780	**Date**	:	22nd September 2018
Time	:	12.30 pm – 3.30 pm	**MOM**	:	MOM_06
Venue	:	Aman Sari Hotel, Bandar Penawar, Johor			
Subject	:	Meeting with Village Heads and Representatives			

List of Attendees:

1.	Mohd Khaidir Ismail (MKI)	Penghulu Mukim Pengerang & Pantai Timur
2.	Zainal Abidin Abd Rahim (ZAAR)	Ex-Village Head, Kg. Lepau
3.	Abd Latif Sirat (ALS)	Village Head, Kg. Bukit Raja, Bukit Gelugor, Bukit Pelali
4.	Saban bin Ahmad (SA)	Ex-Village Head, Kg. Bukit Buloh
5.	Rahim bin Umar (RA)	Representative, Kg. Bukit Buloh
6.	Syed Bahrim Syed Ibrahim (SBSI)	Chairman, Koperasi Jaya Teluk Ramunia (KOJAYA)
7.	Zebree Hashim (ZH)	Chairman, Koperasi Pengerang Jaya Johor Berhad (KOPEJA)
8.	Khairul Anukal (KA)	Representative, KOJAYA
9.	Zai Abdul Rahman (ZAR)	Project Manager, EnviroSolutions & Consulting Sdn Bhd (ESC)
10.	Chiew Teck Wee (CTW)	EIA Team Lead, ESC
11.	Tan Yee Noon (TYN)	Principal EIA Consultant – Social, ESC
12.	Salim Mat Isa (SMI)	Associate – Social
13.	Chuah Li Mor (CLM)	Project Coordinator, ESC
14.	Raira Yuana Isnin (RY)	Consultant, ESC



Key decisions/ key points from the meeting are summarised below:

Item No.	Subject/Details	Action By	Date Due
1.	**Introduction** ZAR introduced the ESC team to ~~all~~ the Penghulu Mukim, village head, ex- village heads and representatives from the local community and cooperatives. The ~~(ex)~~ village heads ~~also~~ did a brief introduction which included explanation of their area of coverage. The former village heads are still considered the heads of their respective areas pending the appointment of new village heads by the current state government. ZAR explained that the meeting is just an initial informal "breaking the ice" for the consultants and the community stakeholders to get to know each other. The consultants explained the nature of the project, the project site, the proposed construction and operations schedule, as well as potential impacts during the project construction and operational periods. The discussions were conducted in an informal manner which allows for initial concerns to be aired freely.	Info only	
2.	**Key Issues of Concern** Even though the discussions were held informally, a number of key issues were identified of importance to the stakeholders as described below: 1. Economic Opportunity • The stakeholders stressed on ensuring that the local communities are affected beneficially either directly or indirectly from the PEC project. They further explained that although most EIAs state that there would be economic benefits through job and work opportunities to the local communities, it is seldom realised once the actual construction starts. • The stakeholders in Pengerang and the surrounding areas have the benefit of experience through their involvement in the PETRONAS RAPID project. As part of their community outreach program, PETRONAS RAPID has helped the communities in the area to form cooperatives as the vehicle for the communities, through which PETRONAS RAPID gives economic opportunities. • The cooperatives that had been formed comprise the following: ○ Koperasi Pengerang Jaya Johor Berhad (KOPEJA) – Raw water & water supplier, lubricating oil supplier & etc ○ Koperasi Jaya Teluk Ramunia (KOJAYA) – Night market in RAPID ○ Koperasi Pemuda Patriot Pengerang Kota Tinggi Berhad (KOPETRI) – Lubricant warehouse and supplier ○ Koperasi Pengerang Kota Tinggi Berhad (KOPETI) – Manpower supplier, building materials supplier & etc		

Item No.	Subject/Details	Action By	Date Due
	However, only representatives from KOPEJA and KOJAYA were present in the initial discussion. The main purpose for the cooperatives is to give the communities ways and support to benefit from the developments in the area. • PETRONAS RAPID has an enforced mandate where at least 30% of its external and auxiliary contracts are accorded to the local cooperatives. • The stakeholders hope that a similar directive will be enforced in the PEC project to ensure economic opportunities to the locals through direct or indirect employment. • Other potential business opportunities for the locals include support services during construction/ operations phases e.g. food supplier, canteen operator, transportation provider etc. • Current business/ projects under the cooperatives include carwash (under Koperasi Kg. Lepau), night market (under KOJAYA) and diesel supplier (under KOPEJA) • The stakeholders further emphasised that the EIA report must mention usage of local talents whenever possible. The stakeholders requested Project Proponent to set up a formal channel communication with the community during project implementation stage, similar to PETRONAS' monthly meetings 2. Fishermen Concerns • Fishermen concerns were mainly aired by their representative En. Rahim Umar and the Kg. Lepau representative and ex-village head En. Saban Ahmad. • The key areas of concern for the fishermen are Sg. Lepau and Sg. Santi which have been and still are the traditional fishing area for Pengerang. • The fishermen utilise Sg. Lepau for small-scale fish and hook fishing activities while Sg. Santi houses a number of commercial aquaculture cages. The aquaculture farming includes crabs and *ikan kitang* (Spotted Scat). All the fishermen and aquaculture farmers are local residents. • Currently Sg. Lepau and Sg. Santi are relatively unpolluted with Sg. Santi classified as a Class II river under the National Water Quality Standards which allows for it to be used for recreational use with body contact and may house sensitive aquatic species. The stakeholders reported that there have been sightings of dugong (*Dugong dugon*) which is classified as Vulnerable[1] in the IUCN Red List[2]. • The stakeholders firmly insisted that the Project Proponent ensure that the fishermen activities are not disrupted in any way. • The stakeholders strongly discourage discharge of effluent into Sg. Lepau, Sg. Santi or any of the tributaries that feed into the two rivers as it may affect the river water quality and the fishing industry. It is suggested that	ESC to liaise with JCorp and DID on how to address the effluent	

[1] Vulnerable means species that are likely to become endangered unless the circumstances that are threatening its survival and reproduction improve

[2] IUCN Red List is the world's most comprehensive inventory of the global conservation status of plant and animal species

Item No.	Subject/Details	Action By	Date Due
	the effluent discharge to be directed straight into the sea as currently being done by PETRONAS RAPID. At the moment, PETRONAS RAPID do not discharge any effluent into Sg. Lepau or Sg. Santi at all. • According to ZAAR, there are currently 3 fish farmers in Sg. Lepau who operate the fish cages in Sg. Santi. 3. Kg. Lepau • Kg. Lepau is currently one of the few villages in the area that still houses local residents, many of whom are believed to be descended from the Bugis. The village is also under the purview of the Johor royal family where it is reported that the Johor Sultan makes regular informal appearances and periodically receives feedback from the residents of the village. • Currently, Kg Lepau houses about 50 local families and at least 200 non-locals who are working at Petronas RAPID, living and renting houses in the village. • Kg. Lepau is at risk from floods due to its low-lying location close to Sg. Lepau. There are 2 tidal gates along Sg. Lepau but both are reportedly not working. • The representative of Kg. Lepau, ZAAR, the former village head, voiced his concern about the effluent discharge from PIP in general into Sg. Lepau. His concerns include flooding possibility due to discharge from the PIP especially during emergency situations. He also agrees with the fishermen's concerns (as above) and requested to divert the discharge from PIP away from Sg. Lepau. • As Kg. Lepau is one of the closest residential areas to the PEC project site, the representative voiced his concerns for health, air, odour and noise impacts and asked to ensure that suitable and effective mitigation measures are implemented to minimise the aforementioned impacts. • ZAAR also requested that Prof. Jamal, the health impact specialist in the EIA team to give a more detailed explanation on what are the probable impacts to health from the project. He states that Kg. Lepau will be sandwiched between PETRONAS RAPID and PEC and as such may experience cumulative impacts. 4. Others • The stakeholders agree that there are no owner residents within the project site. Both fish ponds and orchid farms in the project site hold Temporary Occupation Licence (TOL) leased from Lembaga Kemajuan Johor Tenggara (KEJORA) who owns the land. • There are active chicken farms in Kampung Bukit Saga (outside of PEC site). There are 4 chicken coops reportedly owned by Pertubuhan Peladang Negeri Johor & Haji Shafie. These coops are just outside the PIP boundary, but within 1 km from the PEC boundary. • SMK Tg. Datuk (at the 5-km boundary to the south of the project site) will be closed by end of this year and all the students will be transferred to SMK Taman Bayu.	discharge concern. ESC to liaise with JCorp and DID on how to address the drainage plan and PIP's final discharge location. Prof. Jamal to give a briefing at the forthcoming FGD	

Item No.	Subject/Details	Action By	Date Due
	• PETRONAS RAPID conducts monthly water quality monitoring at Sg. Lepau and submits a copy of the report to the Kg. Lepau Village Head. • Kg. Lepau villages are of Bugis descent, similar with the Johor Royal family, and hence the special attention it enjoys as "Kampung Angkat Sultan" (Sultan's adopted village). • Previously the price for land compensation during early days of RAPID development was RM3 per sq ft (psf) (by Johor Govt). Since then the land price and compensation have significantly increased. Currently, the land price is about RM52 psf, while land compensation by JKR is about RM80 psf.	ESC to request data from PETRONAS RAPID (if possible)	
3.	**Follow Up** ESC will arrange for a Focus Group Discussion (FGD) with the villagers of Kg. Lepau in the next few weeks.	ESC to arrange the FGD.	Tentative date proposed is 20th Oct 2018 at 2.30pm

Prepared by,

(Raira Yuana Isnin)

Approved by,

(Zai Abdul Rahman)

APPENDIX 3

Meeting Minutes_MOM 7

PEC ESC

MEETING MINUTES

Project No.	:	J18 780	**Date**	:	27th October 2018
Time	:	3.00 pm – 5.30 pm	**MOM**	:	MOM_07
Venue	:	Balai Raya Kg. Lepau, Johor			
Subject	:	Focus Group Discussion in Kg. Lepau, Johor			

Key Persons:

1.	Mohd Khaidir Ismail (MKI)	Penghulu Mukim Pengerang & Pantai Timur
2.	Zainal Abidin Abd Rahim (ZAAR)	Ex-Village Head, Kg. Lepau
3.	Mohamad Zakuan Yacob (ZY)	Fisherman, Kg. Lepau
4.	Ali Haji Mantek (AHM)	Fisherman, Kg. Lepau
5.	Johar Abdullah (JA)	Villager, Kg Lepau
6.	Zai Abdul Rahman (ZAR)	Project Manager, EnviroSolutions & Consulting Sdn Bhd (ESC)
7.	Chiew Teck Wee (CTW)	EIA Team Lead, ESC
8.	Ng Hon Wei (NHW)	Associate, ESC
9.	Tan Yee Noon (TYN)	Principal EIA Consultant – Social, ESC
10.	Salim Mat Isa (SMI)	Associate – Social
11.	Chuah Li Mor (CLM)	Project Coordinator, ESC
12.	Raira Yuana Isnin (RY)	Consultant, ESC
13.	Hafiz Zakaria (HZ)	Assistant Consultant, ESC

Full list of attendees from Kg. Lepau is attached at the end of the minutes.





Key decisions/ key points from the meeting are summarised below:

Item No.	Subject/Details	Action By	Date Due
1.	**Introduction** ZAAR welcomed all the attendees to the meeting. ZAAR explained that the meeting is a platform for the villagers to learn more about the PEC project and any enquiries and feedbacks regarding the project are welcomed. He apologised for the low turnout; several other villagers had to attend to other events. ZAR introduced the ESC team to the attendees. ZAR then proceeded to give a brief introduction on PEC project which includes the nature of the project, the project site, the proposed construction and operation schedule, the material that will be used and produced by the project, as well as the potential impacts during the project construction and operational periods. MKI highlighted to the attendees regarding the location of the site. He stressed on the fact that PEC project will not be in Kg. Lepau and will be located 1.5km away from Kg. Lepau. He further explained the route to the PEC site and highlighted that the road in Kg. Lepau will not be used during the construction and operation periods of the project.	Info only	
2.	**Key Issues of Concern** A number of key issues were brought up and discussed during the Q&A session. The identified issues are summarised below.		

2.1	**Fishermen Concerns**
	• The fishermen concerns were mainly brought up by En. Zakuan Yacob (ZY) and En. Ali Haji Mantek (AHM).
	• Their main concern is regarding the fishermen's license. ZY claimed that their licenses were frozen during the construction period of RAPID and newly applied license are not issued since then. 12 – 14 names of the affected fishermen from Kg. Lepau have been submitted to Persatuan Nelayan Pengerang regarding this matter but no actions were taken.
	• In regards to this matter, JHH recommended that a letter concerning this issue to be prepared by ZY to be included as attachment in the EIA.
	• CTW suggested that the letter should include the following details:
	  • Total number of fishermen in Kg. Lepau.
	  • Total number of affected fishermen in Kg. Lepau.
	• CTW further explained that the role of ESC is solely as consultant and has no jurisdiction in the matter. However, ESC will note the concern and forward it to relevant authorities.
	• Besides that, the fishermen of Kg. Lepau are also concerned about the work opportunities for the future generations of Kg. Lepau. According to En. Johar Abdullah (JA), the villagers of Kg. Lepau should be given the priority whenever there are wok and businesses opportunities available in PEC.
	• CTW responded by explaining that work opportunities will be offered to those with the correct academic qualification.		

2.2	**Water Quality in Sungai Santi** • Another issue that was highlighted in the FGD is regarding the potential		

Item No.	Subject/Details	Action By	Date Due
	pollution of Sg. Santi due to the discharge of wastewater from the site during the operation period. According to AHM, there are less fish and shrimp catches in Sg. Santi after the construction of RAPID. He further explained that their total catch has reduced by 80% and the crabs that were caught were red in colour due to sediment. • This statement is supported by ZY in which he claimed that the monthly income of the local fishermen was previously in the range of RM3,000 – RM3,500 but it is much lesser now. • In regards to this, ZAR responded by stating that the point of discharge is not confirm to be in Sg. Lepau or Sg. Kapal. However, ZAR assured that the wastewater will be treated to Standard B of the Environmental Quality (Industrial Effluent) Regulations 2009 before being discharged into the PIP retention pond and thus, it will not contaminate Sg. Lepau.		
2.3	**Noise Pollution** • There is also a concern regarding the noise pollution during the construction period of PEC. ZY explained that during the RAPID construction period, the construction activities went on for 24 hours. The noises that were coming from the site caused significant discomfort to the villagers of Kg. Lepau especially at night. • ZAR responded by explaining that there will be buffer zones of 1km and Kg. Lepau itself is located 1.5km away from the site. Therefore, it will not be affected by the noise from the PEC site during the construction and operational period. • However, ZY insisted that Kg. Lepau is located less than 1.5km from the PEC boundary. He further explained that there is a new residential area to the eastern side of the village and it located nearer to PEC site. • CTW suggested that the coordinate of the new residential area to be recorded and included in the EIA report.		
2.4	**Air Quality Monitoring Data** • Several villagers mentioned that they are not able to access information from the DOE's air quality monitoring station, located in the Kg. Lepau school compound. • ZAR replied that ESC had contacted DOE to obtain the information. DOE is not able to give out any data as it is a new station.		
3.	**Follow Up** ESC will note all of the concerns and bring forward to the project proponent.		

List of Attendees:

	Name
1.	Supesman Abu
2.	Zainal Abidin Abdul Rahim
3.	Norazlin Binti Abdul Rahim
4.	Bekik Binti Pelanderon
5.	Mohd Azizi Bin Idris
6.	Aminah Mohammad
7.	Haniah Abdullah
8.	Nur Suhada
9.	Muhamad Zakuan Yacob
10.	Azli Jaafar
11.	Ali Haji Mantek
12.	Rahim Bin Umar
13.	Saban Ahmad
14.	Daud bin Kalam
15.	Bacok bin Kalam
16.	Rosmadi Melun
17.	Johar Abdulah
18.	Rauf bin Abd Ratib
19.	Muhammad Nur
20.	Syarifudin
21.	Mohammad Khaidir Ismail

Prepared by,

(Hafiz Zakaria)

Approved by,

(Zai Abdul Rahman)

APPENDIX C

AIR QUALITY MODELLING

Pengerang Energy Complex Sdn Bhd

July 2019

1. INTRODUCTION

1.1 Project Background

The Pengerang Integrated Petroleum Complex (PIPC) covers about 20,000 acres, and is made up of several parts: the Pengerang Integrated Complex (PIC) by Petronas which comprises RAPID and other ancillary facilities; the Pengerang Deepwater Terminal (PDT), a joint-venture between Petroliam Nasional Bhd (Petronas), Dialog Group Bhd, the Johor state government and Royal Vopak; the Pengerang Integrated Development Project (PIDP) by Serba Dinamik Holdings Bhd, comprising the Pengerang Eco-Industrial Park (PEIP) and Pengerang International Commercial Centre (PICC) and the Pengerang Industrial Park (PIP) by Johor Corporation (JCorp).

The Pengerang Industrial Park (PIP) covers 786 acres of land located adjacent to PIPC. In developing the PIP, JCorp intends to lease industrial land to local and foreign investors with interest in the downstream O&G industry, typically in the production of high-value, high-demand products and by-products, such as polymers, pharmaceutical products and plastics, and using refined feedstock from RAPID Petronas. The PIP will become more significant as RAPID Petronas is nearing completion. Petronas is scheduled to complete construction by this year and the start-up of the refinery is expected to be conducted by the first quarter of 2019.

The Project Proponent, ChemOne, is an investor with interest in constructing an aromatics plant using feedstock or condensate from the refinery facilities in PIC. Called Pengerang Energy Complex (PEC), the key components of the proposed chemical complex comprise a condensate splitter and an aromatics complex. The plant is expected to produce petroleum products (e.g. LPG, jet fuel, light naphtha etc.), aromatics products (e.g. paraxylene and benzene) and sulphur as a by-product. The petroleum and aromatics products will be supplied to manufacturers of textiles, polymers, polycarbonates, plastics, synthetic rubber, surfactants and pharmaceuticals. Other support and ancillary facilities at the PEC include feed and product intermediate tanks, administration and laboratory buildings, warehouses, maintenance workshop and a waste water treatment facility. The footprint for the chemical plant facilities covers a land area of 250 acres.

The proposed Pengerang Energy Complex (PEC) is located at the PIP, along the southern PIP boundary which interfaces with the RAPID boundary near Gate 2. The site can be accessed from the Kota Tinggi-Pengerang Highway (Federal Route 92) via the recently upgraded Lebuhraya Pengerang (Route J52) and a new road that is under currently construction that will provide dedicated access to PIP and PIC from Route 52 (Figure 1 and Figure 2).

Bandar Penawar and Kg Sungai Rengit are the main towns closest to the PEC project site and are located more than 10 km and 5 km away respectively.

Figure 1: Location of PEC in PIPC

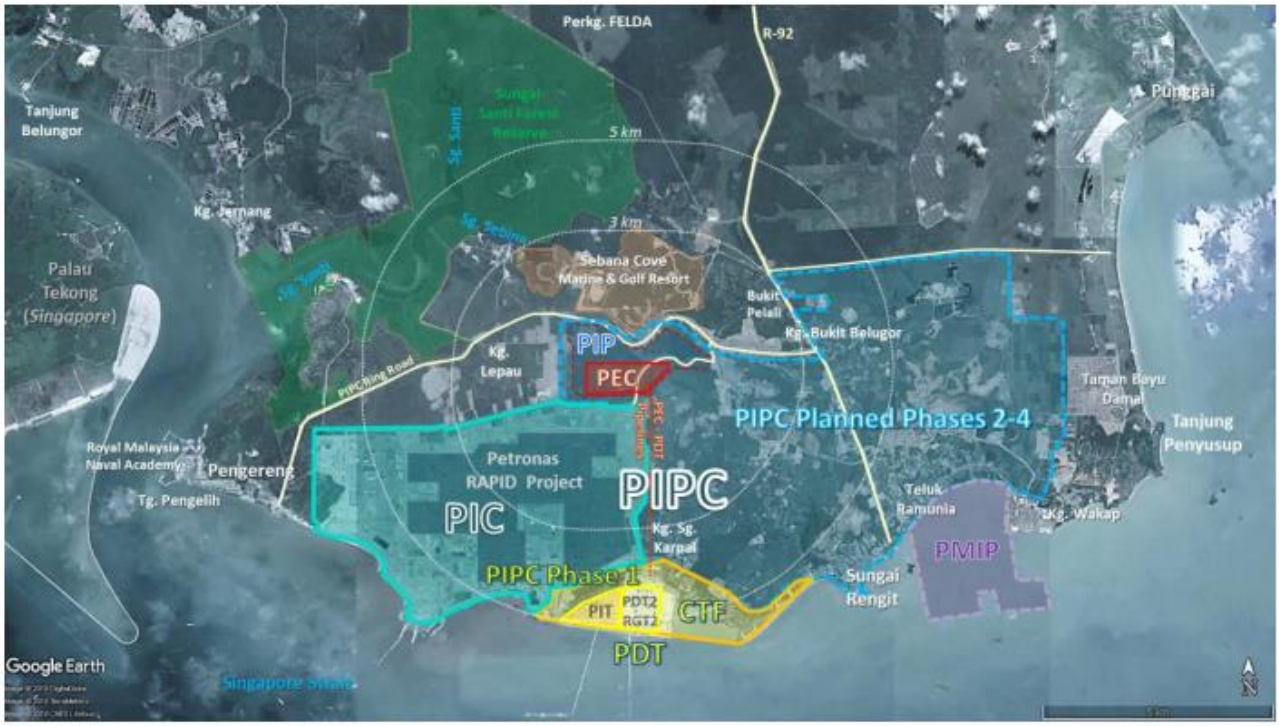
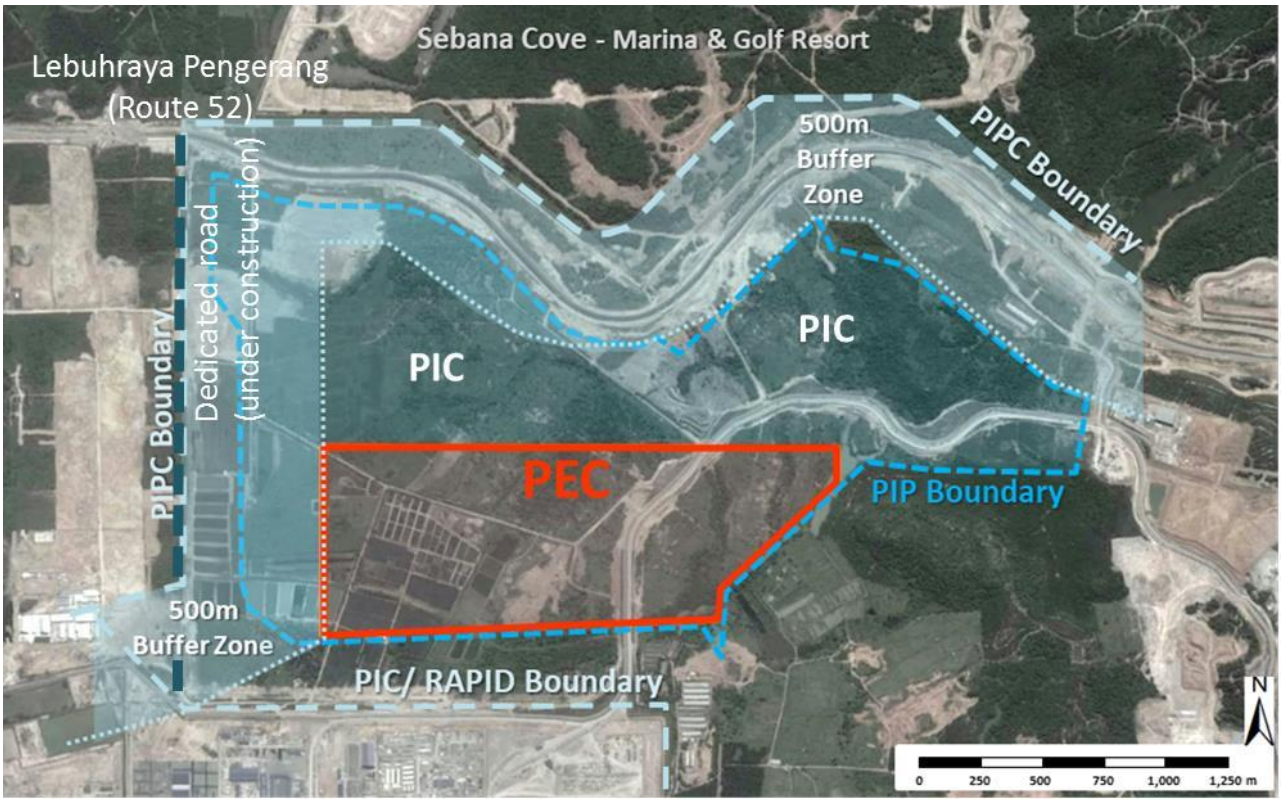


Figure 2: Location of PEC Project Site within PIC



1.2 Statutory Requirements

The legislations, guidelines and documents that have relevance to the proposed Project include:

National

- Environmental Quality (Clean Air) Regulations, 2014
    - Third Schedule [Regulation 13]: Limit Values and Technical Standards (By Activity or Industry): E. Oil and Gas Industries: Refineries (All Sizes): natural gas Processing and Storage and Handling of Petroleum Products; and
    - Third Schedule [Regulation 13]: Limit Values and Technical Standards (By Activity or Industry): A. Heat and Power Generation: 1. Boilers under Gaseous Fuels.

International

- World Bank Group

1.3 AERMOD Modelling System

The American Meteorological Society/ Environmental Protection Agency Regulatory Model Improvement Committee (AERMIC) was formed to introduce state-of-the-art modelling concepts into the EPA's air quality models. Through AERMIC, a modelling system, AERMOD, was introduced that incorporated air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, both simple and complex terrain.

There are two input data processors that are regulatory components of the AERMOD modelling system: AERMET, a meteorological data pre-processor that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, and AERMAP, a terrain data pre-processor that incorporates complex terrain using USGS Digital Elevation Data.

2. IMPACTS ON AIR QUALITY

2.1 Impacts during Construction Phase

For this Project, no major earthwork is anticipated as the industrial park developer will hand over the Project Site to the Project Proponent to the required platform.

2.1.1 Source of Impacts

The sources of air pollutant during the Project construction activity would be heavy equipment and vehicular emissions during process unit development, transportation, construction of road, and supporting facility. The air pollutants would be mainly combustion gases such as Particulate Matters (PM), Nitrogen Dioxide (NO_2), Carbon Monoxide (CO) – due to incomplete combustion (if occur) and negligible Sulphur Dioxide (SO_2) - due to low sulphur content in the fuel.

Dusty materials produced as a result of construction work being carried out may include cement, earth, aggregates, silt, stone fines, sand and debris. Fugitive dust mainly Total Suspended Particulates (TSP) which includes Particulate Matters less than 10 micron and 2.5 micron (PM_{10} and $PM_{2.5}$) is small airborne particulates such as dust, fumes and smoke with a diameter of less than 100 micrometres. The observed human health effects of TSP include breathing and respiratory symptoms, aggravation of existing respiratory disease and damage to lung tissues.

The area of influence for fugitive dust is anticipated to be localized within the construction area (usually less than 50 m away) as the work area will be limited in nature. The duration of impact for the construction phase will be short-term to medium term. For this Project, the nearest residential area is more than 500 m away from the Project Site, hence, the air quality impact due to the construction activity is anticipated to be minimal or insignificant.

2.1.2 Impact Assessment

Dust Emissions

Dust is expected to be generated during the construction phase of the Project especially from the movement of vehicles on-site. However, dust pollution due to the construction activities is temporary and the local air quality is expected to return to its normal ambient levels when the construction ceases.

Vehicle/Equipment Exhaust Emissions

Vehicle exhaust emissions on the local road network will be intermittent and transient in nature where associated impacts are considered minor. Exhaust emissions from the diesel engine driven equipment is also expected to result in insignificant impacts on air quality. Generally, the exhaust emissions for the Project during construction will be minor.

2.2 Impact during Operation Phase

For the Project, during normal operation, the main point sources would be mainly emissions from fuel burning equipment. The emitted flue gas consists of combustion gases namely Particulate Matters (PM), Carbon Monoxide (CO), Nitrogen Dioxide (NO_2) and Sulphur Dioxide (SO_2). The PEC facility and the support facilities will have 10 reboiler and heater stacks, 3 vent stacks, 3 steam boiler stacks and 1 flare stack (listed in ***Error! Reference source not found.***). All of the stacks will be fired with low sulphur natural gas and the concentration of gaseous emission will meet or be lower than the requirements under the *Environmental Quality (Clean Air) Regulations 2014* as per the following:

- Third Schedule [Regulation 13]: Limit Values and Technical Standards (By Activity or Industry): E. Oil and Gas Industries: Refineries (All Sizes): Natural Gas Processing and Storage and Handling of Petroleum Products; and
- Third Schedule [Regulation 13]: Limit Values and Technical Standards (By Activity or Industry): A. Heat and Power Generation: 1. Boilers under Gaseous Fuels.

For the Project, the Project Proponent will be adopting the World Bank Group recommended limit of 150 mg/Nm^3 of SO_2 for its SRU process unit emission concentration and also adoption of Ultra-low NOx (Nitrogen Oxides) Burners for its proposed Steam Boilers and Process Heaters with expected emission concentration of 110 mg/Nm^3 for NOx. Minimal fugitive emission of Volatile Organic Compounds (VOCs) is anticipated for the Project as these fugitive gases will be mainly collected and use as waste gas for fuel in its fuel burning equipment. While, negligible residual Mercury (Hg) is anticipated from the NHT stack emission and CRP stack emission as there will be pre-treatment of Hg in the raw material to be processed for the Project.

In the case of Process upset or Emergency situation i.e. abnormal situation, the stream from the Project will be routed to the proposed flare for flaring.

For residual Hydrogen Sulphide (H_2S) emission from SRU Stack and residual Hydrogen Chloride (HCl) emission from CCR RCR Vent, the emission concentrations for these pollutants are expected to comply with the prescribed limit of 7.5 mg/Nm^3 (H_2S) and 200 mg/Nm^3 (HCl) of the Third Schedule [Regulation 13]: Limit Values and Technical Standards (By Activity or Industry): I. Chemical and Petrochemical Industry in All Sizes of CAR 2014.

Table 1: PEC Stacks

Source	Main Air Emission	Proposed Abatement Equipment
Flare – Combustion	CO_2, N_2 (Continuous emission of purge gas), negligible residual VOCs	Discharge to flare system STACK 1
Charge Heater – Unit 320-H1	Flue gas: O_2, N_2, H_2O, CO_2, SO_2, NO_X, negligible residual VOCs	Discharge to STACK 2
Xylene Splitter Reboiler	Flue gas: O_2, N_2, H_2O, CO_2, SO_2, NO_X, negligible residual VOCs	Discharge to STACK 3
Charge Heater Toluene Column	Flue gas: O_2, N_2, H_2O, CO_2, SO_2, NO_X, negligible residual VOCs	Discharge to STACK 4
Charge Heater – Unit 200-H1 (NHT)	Flue gas: O_2, N_2, H_2O, CO_2, SO_2, NO_X, negligible residual VOCs, negligible residual Hg	Discharge to STACK 5
Charge Heater & NO1 Interheater – CCR Unit 300-H1	Flue gas: O_2, N_2, H_2O, CO_2, SO_2, NO_X, negligible residual VOCs	Discharge to STACK 6
Charge Heater & NO1 Interheater	Flue gas: O_2, N_2, H_2O, CO_2, SO_2, NO_X, negligible residual VOCs	Discharge to STACK 7
CCR RCR Vent – Unit 312-ME8	Flue gas: O_2, N_2, H_2O, CO_2, SO_2, NO_X, negligible residual VOCs	Discharge to STACK 8
Feed Fractionator Reboiler – 100-H1 and H2 (combined)	Flue gas: O_2, N_2, H_2O, CO_2, SO_2, NO_X, negligible residual VOCs	Discharge to STACK 9
Combined Feed Heater DHT	Flue gas: O_2, N_2, H_2O, CO_2, SO_2, NO_X, negligible residual VOCs	Discharge to STACK 10
KHT Furnaces – Units 120-H1 and H2	Flue gas: O_2, N_2, H_2O, CO_2, SO_2, NO_X, negligible residual VOCs	Discharge to STACK 11
SRU Furnace – Unit 610-H1	Flue gas: O_2, N_2, H_2O, CO_2, SO_2, NO_X, negligible residual VOCs	Discharge to STACK 12
CRP Vent – Unit 230-ME1	Flue gas: O_2, N_2, H_2O, CO_2, SO_2, NO_X, negligible residual VOCs, negligible residual Hg	Discharge to STACK 13
SRU tail gas vent – Unit 610-ME1	Flue gas:	Discharge to STACK 14

Source	Main Air Emission	Proposed Abatement Equipment
	O_2, N_2, H_2O, CO_2, SO_2, NO_X, negligible residual VOCs	
3 X Steam Boiler	Flue gas: O_2, N_2, H_2O, CO_2, SO_2, NO_X, negligible residual VOCs (Continuous)	Discharge to STACKS 15, 16, 17

2.2.1 Impact Assessment

For the evaluation of impact during normal operation and abnormal situation, the USEPA AERMOD air quality model was utilized. The description and approach taken to model the emissions from the Project are as discussed below:

Air Dispersion Modelling

AERMOD is an air dispersion model that incorporates concepts such as planetary boundary layer theory and advanced methods for handling complex terrain. There are two input data processors that are regulatory components of the AERMOD modelling system namely AERMET and AERMAP. AERMET provides AERMOD with the meteorological information the latter needs to characterise the planetary boundary layer (i.e. the turbulent air layer next to the earth's surface that is controlled by the surface heating and friction and the overlying stratification); AERMAP characterises the terrain and generates receptor grids and elevations for AERMOD from digital elevation data.

A. Source Information

Table 2 shows the stack specifications for the Project which were used as the source information for the modelling study. While, the proposed flare specification is as shown in Table 3. Inputs to the AERMOD model include emission rates of gaseous pollutants released from the stacks of the Project and other source information such as stack height and internal diameter, source type, exit velocity and temperature, and coordinates of each source with respect to the receptor grid.

Table 4 and Table 5 show the emission rates for the criteria air pollutants identified for this modelling exercise.

Table 2: Proposed Stacks' Specification

Stack	Stack Numbering	Height (m)	Diameter (m)	Base Elevation (m)	Temperature (°C)	Exit Velocity (m/s)
Charge Heater 320-H1	Stack 2	50	1.90	12	251	8
Xylene Splitter Reboiler	Stack 3	60	4.50	12	180	8
Charge Heater Toluene Column	Stack 4	52	3.20	12	180	8
Charge Heater 200-H1	Stack 5	53	1.80	12	324	8
Charge Heater & NO1 Interheater	Stack 6	99	3.70	12	162	8
NO2 Interheater & NO3 Interheater	Stack 7	99	2.90	12	162	8
CCR RCR Vent	Stack 8	80	0.37	12	138	8
FFR + DFFH	Stack 9	55	3.50	12	149	8
Combined Feed Heater/ DHT	Stack 10	31	1.10	12	367	8
KHT Furnaces	Stack 11	31	1.10	12	367	8
SRU Stack	Stack 12	46	1.00	12	205	8
CRP	Stack 13	46	1.00	12	238	8
Steam Boiler	Stack 14	40	2.60	11	166	8
Steam Boiler	Stack 15	40	2.60	11	166	8
Steam Boiler	Stack 16	40	2.60	11	166	8

Source: PEC (2019)

Note: Exit velocity is assumed to meet DOE minimum requirement as recommended in the Guidance Document for Fuel Burning Equipments and Air Pollution Control Systems issued by DOE under the CAR 2014. The sighted documents on similar facility in Singapore indicate that most of the exit velocities were below the DOE minimum requirement of 8 m/s and the design for this Project will meet the local requirement i.e. 8 m/s.

Table 3: Proposed Flare Specification

Flare's Parameter	Unit	Value
Ground Elevation	m	10
Flare Height	m	161
Flare Diameter	m	2
Average Molecular Weight	-	66.7
Calculated Lower Heating Value	kcal/kg	10,849
Default Flare Temperature	°C	1,000
Default Flare Exit Velocity	m/s	20
Exit Flowrate	Nm^3/s	Normal Operation: 0.25 Abnormal Situation: 3.40 (Calculated)

Source: PEC (2019)

Exit flowrate during abnormal situation was conservatively calculated based on the effective flare height of 20% of the physical flare height. The calculation is as shown below:

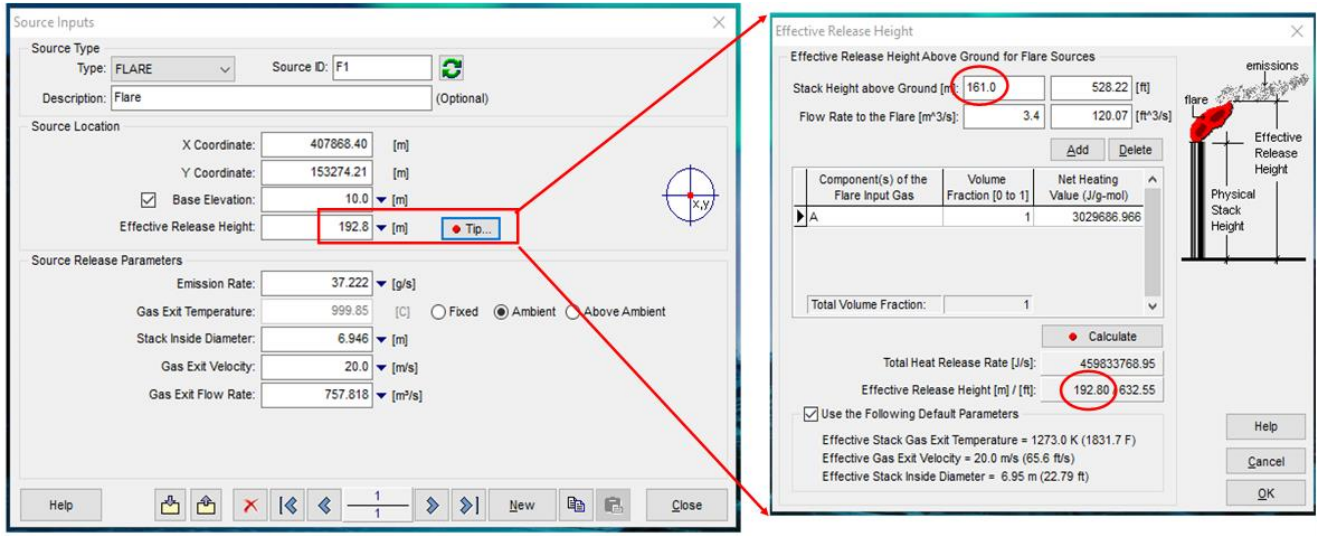


Table 4: Stacks' Emission Rates for Identified Criteria Air Pollutants

Stack	Stack Numbering	PM		SO_2		NOx		CO		H_2S		HCl	
		kg/hr	g/s	kg/hr	g/s	kg/hr	g/s	kg/hr	g/s	kg/hr	g/s	kg/hr	g/s
Charge Heater 320-H1	Stack 2	0.78	0.22	-	-	3.72	1.03	54.75	15.21	-	-	-	-
Xylene Splitter Reboiler	Stack 3	3.80	1.06	-	-	22.74	6.32	288.99	80.27	-	-	-	-
Charge Heater Toluene Column	Stack 4	1.92	0.53	-	-	9.98	2.77	126.86	35.24	-	-	-	-
Charge Heater 200-H1	Stack 5	0.80	0.22	-	-	2.41	0.67	40.46	11.24	-	-	-	-
Charge Heater & NO1 Interheater	Stack 6	2.47	0.69	-	-	15.74	4.37	192.08	53.36	-	-	-	-
NO2 Interheater & NO3 Interheater	Stack 7	1.52	0.42	-	-	9.74	2.71	118.90	33.03	-	-	-	-
CCR RCR Vent	Stack 8	-	-	-	-	-	-	-	-	-	-	0.91#	0.25
FFR + DFFH	Stack 9	2.14	0.59	-	-	11.28	3.13	133.57	37.10	-	-	-	-
Combined Feed Heater/ DHT	Stack 10	0.32	0.09	-	-	0.94	0.26	16.95	4.71	-	-	-	-
KHT Furnaces	Stack 11	0.32	0.09	-	-	7.06	1.96	3.21	0.89	-	-	-	-
SRU Stack	Stack 12	0.20	0.06	5.94	1.65	4.36	1.21	1.98*	0.55	0.30#	0.08	-	-
CRP	Stack 13	0.21	0.06	14.01	3.89	2.81	0.78	33.88	9.41	-	-	-	-
Steam Boiler	Stack 14	1.23	0.34	-	-	27.05	7.51	12.29*	3.42	-	-	-	-
Steam Boiler	Stack 15	1.23	0.34	-	-	27.05	7.51	12.29*	3.42	-	-	-	-
Steam Boiler	Stack 16	1.23	0.34	-	-	27.05	7.51	12.29*	3.42	-	-	-	-

Source: PEC (2019)

Note: NOx (Nitrogen Oxides) is conservatively assumed as 100% NO2 (Nitrogen Dioxide)

Particulate Matters (PM) emission concentration is assumed to meet 5 mg/Nm^3 and PM is conservatively assumed as 100% PM10 and PM2.5

**Carbon Monoxide (CO) emission concentration for those indicated is assumed to meet 50 mg/Nm^3*

#H_2S and HCl emission concentration is assumed to meet the CAR 2014 prescribed limit of 7.5 mg/Nm^3 and 200 mg/Nm^3 respectively

Volatile Organic Compounds (VOCs) were assumed to undergo complete combustion, negligible residue

Table 5: Flare's Emission Rates for Identified Criteria Air Pollutants

Flare	SO_2		NOx as 100% NO_2		CO		H_2S	
	kg/hr	g/s	kg/hr	g/s	kg/hr	g/s	kg/hr	g/s
Normal	4.39	1.22	1.58	0.44	8.64	2.40	-	-
Abnormal	2,409.0	669.17	-	-	-	-	134.00	37.22

Source: PEC (2019)

Note: PM will be designed to be smokeless, negligible residue
NOx is conservatively assumed as 100% NO_2
VOCs were assumed to undergo complete combustion, negligible residue
NOx and CO during abnormal situation are relatively insignificant in comparison with SO_2 and H_2S, hence not modelled

B. Receptor Grid System

A 5 km x 5 km Cartesian grid with 200 m spacing was used for the impact modelling, the Cartesian grid was gridded from the centre of the study area at the UTM coordinate of 408694.15 m (x-coordinate), 153496.77 m (y-coordinate). The discrete Air Sensitive Receptors (ASRs) identified for this study is as shown in Table 6.

Table 6: Identified Air Sensitive Receptors (ASRs)

Point	Description	UTM Coordinates (x, y)
ASR1	Open Space Near Kg. Lepau	405440.40, 153531.26
ASR2	Sebana Cove Resort	406368.00, 155680.00
ASR3	Sebana Golf Resort	408531.48, 155476.93
ASR4	Bukit Pelali	411003.52, 154757.55
ASR5	Open Space Near Kg. Bukit Gelugor	412239.45, 154143.02
ASR6	Open Space Near Lake View	412857.32, 153528.69

C. Meteorological Data

The site specific AERMET processed from 2015 to 2017 hourly meteorological data was used in the AERMOD modelling. The windrose for this modelling period is as shown in Figure 3.

This meteorological data set comprised hourly records mainly wind speed, wind direction, ambient temperature and cloud cover. In addition, AERMET allows entry of three land-use sensitive parameters of the Project Site – the surface roughness length, the Bowen ratio (a measure of the moisture available for evaporation) and the albedo (a measure of how much of the solar radiation is reflected) - to calculate boundary layer scaling parameters (such as surface friction velocity, mixing height and Monin-Obukhov length), reference-height winds and temperature, etc.

D. Topography

Local topography (i.e. ground elevation above MSL) can have a significant influence on the dispersion of air pollutants. Local topography (terrain effects) within the defined receptor grid has therefore been incorporated into the model simulation from the terrain elevation data of the Shuttle Radar Topography Mission (SRTM) obtained from the National Aeronautics and Space Administration (NASA). The rural mode was chosen as roughness parameter in view of the terrain and landuse of the area.

2.2.2 Results

The predicted Maximum Average Incremental Concentrations (MAICs) and also the Ground Level Concentrations (GLCs) for all the identified air pollutants are summarized in Table 7 (Normal Operation) and Table 11 (Abnormal Situation) while the iso-contours for the air dispersion modelling exercise are as shown in Figure 4 to Figure 20 (Normal Operation) and Figure 24 to Figure 25 (Abnormal Situation).

A. Normal Operation

Particulates Matters as PM_{10}/$PM_{2.5}$

The highest predicted MAICs of PM_{10}/$PM_{2.5}$ for 24-hours averaging time and annual average were at 2.92 µg/m^3 and 0.47 µg/m^3 respectively. At the identified ASRs, the predicted MAICs ranged from 0.31 µg/m^3 to 1.08 µg/m^3 (24-hours averaging time) and 0.01 µg/m^3 to 0.14 µg/m^3 (annual average).

For PM_{10}, the calculated 24-hours averaging time GLCs (i.e. addition of Baseline Level and MAIC) at the identified ASRs ranged from 23.31 µg/m^3 to 66.06 µg/m^3, which met the MAAQS, 2013 (Standard [2020]) prescribed limit of 100 µg/m^3.

While for $PM_{2.5}$, the calculated 24-hours averaging time GLCs at the identified ASRs ranged from 18.01 µg/m^3 to 34.86 µg/m^3. Based on the calculated GLC, all the ASRs met the MAAQS, 2013 (Standard [2020]) prescribed limit of 35 µg/m^3.

The iso-contour for 24-hours averaging time and annual average is as shown Figure 4 and Figure 5 respectively.

Sulphur Dioxide (SO_2)

The highest predicted 1-hour averaging time, 24-hours averaging time and annual average MAICs of SO_2 were predicted at 235.47 µg/m^3, 23.32 µg/m^3 and 1.84 µg/m^3 At the identified ASRs, the predicted MAICs ranged from 11.88 µg/m^3 to 15.93 µg/m^3 (1-hour averaging time), 0.69 µg/m^3 to 3.29 µg/m^3 (24-hour averaging time) and 0.023 µg/m^3 to 0.304 µg/m^3 (annual average).

At the identified ASRs, the calculated 24-hours averaging time GLCs ranged from 0.69 µg/m^3 to 3.29 µg/m^3, which met the MAAQS, 2013 (Standard [2020]) prescribed limit of 80 µg/m^3.

The iso-contour for 1-hour averaging time, 24-hours averaging time and annual average is as shown Figure 6, Figure 7 and Figure 8 respectively.

Nitrogen Dioxide (NOx as 100% NO_2)

The highest predicted 1-hour averaging time, 24-hours averaging time and annual average MAIC of NO_2 was 359.34 µg/m^3, 42.26 µg/m^3 and 5.95 µg/m^3. At the identified ASRs, the predicted MAICs ranged from 33.84 µg/m^3 to 42.78 µg/m^3 (1-hour averaging time), 3.22 µg/m^3 to 10.96 µg/m^3 (24-hours averaging time) and 0.104 µg/m^3 to 1.203 µg/m^3 (annual average).

At the identified ASRs, the calculated 24-hours averaging time GLCs ranged from 4.16 µg/m^3 to 15.96 µg/m^3, which comply to the MAAQS 2013 (Standard [2020]) prescribed limit of 70 µg/m^3.

The iso-contour for 1-hour averaging time, 24-hours averaging time and annual average is as shown Figure 9, Figure 10 and Figure 11 respectively.

Carbon Monoxide (CO)

The highest predicted 1-hour averaging time, 8-hours averaging time and annual average MAIC of CO was 1,118.97 µg/m^3, 323.12 µg/m^3 and 25.52 µg/m^3. At the identified ASRs, the predicted MAICs ranged from 131.14 µg/m^3 to 217.69 µg/m^3 (1-hour averaging time), 27.95 µg/m^3 to 118.29 µg/m^3 (24-hours averaging time) and 0.55 µg/m^3 to 8.17 µg/m^3 (annual average).

At the identified ASRs, the calculated 8-hours averaging time GLCs ranged from 918.29 µg/m^3 to 2,633.00 µg/m^3, which comply to the MAAQS 2013 (Standard [2020]) prescribed limit of 10,000 µg/m^3.

The iso-contour 1-hour averaging time, 8-hours averaging time and annual average is as shown Figure 12, Figure 13 and Figure 14 respectively.

Hydrogen Sulphide (H_2S)

The highest predicted 8-hours averaging time, 24-hours averaging time and annual average MAICs for H_2S were at 1.01 µg/m^3, 0.44 µg/m^3 and 0.032 µg/m^3 respectively, while the predicted MAICs for 8-hours averaging time, 24-

hours averaging time and annual average were all less than 0.20 µg/m^3 at all identified ASRs. Due to the low baseline value (BL), the Ground Level Concentration (GLC) for 8-hours averaging time ranged from 0.02 µg/m^3 to 0.12 µg/m^3 at the identified ASRs. Currently, this pollutant is not prescribed in the MAAQS 2013.

The iso-contour for 8-hours averaging time, 24-hours averaging time and annual average is as shown Figure 15, Figure 16 and Figure 17 respectively.

Hydrogen Chloride (HCl)

The highest predicted 8-hours averaging time, 24-hours averaging time and annual average MAICs for HCl was at 2.02 µg/m^3, 0.83 µg/m^3 and 0.054 µg/m^3 respectively, while the predicted MAICs for 8-hours averaging time, 24-hours averaging time and annual average were less than 0.2 µg/m^3, 0.12 µg/m^3 and 0.02 µg/m^3 respectively at all identified ASRs. Currently, this pollutant is not prescribed in the MAAQS 2013.

The iso-contour for 8-hours averaging time, 24-hours averaging time and annual average is as shown Figure 18, Figure 19 and Figure 20 respectively.

Carrying Capacity

For the Project, in order to assess the Project contribution to the existing airshed, the 25% threshold approach was adopted. The statement as per the International Finance Corporation (IFC) guidelines entitled "Environmental, Health, and Safety Guidelines: General EHS Guidelines: Environmental Air Emissions and Ambient Air Quality (2007)" is reproduced as follows:

- Emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards. As a general rule, this Guideline suggests 25% percent of the applicable air quality standards to allow additional, future sustainable development in the same airshed.

Based on the 25% threshold, the calculated equivalent ambient concentration for the modelled air pollutant as per the Malaysian Ambient Air Quality Standards 2013 (MAAQS 2013) is shown as shown below:

Calculated 25% Threshold for Identified Air Pollutants

Pollutant	Average Time	Unit	Standard (2020)	Calculated 25% Threshold
Particulate matter with size less than 10 micron (PM_{10})	Annual	µg/m^3	40	10
	24-hours	µg/m^3	100	25
Sulphur dioxide (SO_2)	1 Hour	µg/m^3	250	62.5
	24 Hours	µg/m^3	80	20
Carbon monoxide (CO)	1 Hour	mg/m^3	30	7.5
	8 Hours	mg/m^3	10	2.5
Nitrogen dioxide (NO_2)	1 Hour	µg/m^3	280	70
	24 Hours	µg/m^3	70	17.5

It is noted that in the Air Quality Assessment, the Nitrogen Dioxide (NO_2) was conservatively assumed to be 100% of NOx (Nitrogen Oxides) i.e. 100% NOx as NO_2 (Tier 1). Hence, further refinement was carried in accordance to the following conservative assumption as tabulated in the following table:

Averaging Time	% of NO_2	Reference
1-hour (In-stack)	10	Conversion ratios for NOx and NO_2 as recommended by UK Environment Agency
24-hour (Short-term)	35	

Note: The NOx modelled was for combustion processes for this study

Table 8 and Table 9 show the summary of compliance to the calculated 25% threshold for the identified air pollutants.

Findings

As shown in the tables, all maximum average incremental concentrations at the identified Air Sensitive Receptors (ASRs) namely ASR1: Open Space Near Kg. Lepau, ASR2: Sebana Cove Resort, ASR3: Sebana Golf Resort, ASR4: Bukit Pelali, ASR5: Open Space Near Kg. Bukit Gelugor and ASR6: Open Space Near Lake View for the prescribed averaging time were in compliance with each calculated 25% threshold.

Conclusion

It can be concluded that the emission from the Project respected the recommended 25% threshold requirement as per the IFC guidelines.

Table 7: Predicted MAICs for Identified Criteria Air Pollutants (in µg/m³) during Normal Operation

Parameter	Averaging Time	Figure	Average Baseline Level (µg/m³)	Concentration (µg/m³)												Standard 2020 (µg/m³)
				Highest Predicted MAIC	ASR1 Open Space Near Kg. Lepau		ASR2 Sebana Cove Resort		ASR3 Sebana Golf Resort		ASR4 Bukit Pelali		ASR5 Open Space Near Kg. Bukit Gelugor		ASR6 Open Space Near Lake View		
					Predicted MAIC	GLC	Predicted MAIC	GLC	Predicted MAIC	GLC	Predicted MAIC	GLC	Predicted MAIC	GLC	Predicted MAIC	GLC	
PM_{10}	24-hour	4	ASR1= 65.5 ASR2= 41.0 ASR3= 60.5 ASR4= 23.0 ASR5= 48.5 ASR6= 41.0	2.92 (Outside the PIP; Within the PIC)	0.56	66.06	0.68	41.68	1.08	61.58	0.31	23.31	0.38	48.88	0.55	41.55	100
	Annual	5	-	0.47 (Outside the PIP)	0.024	0.024	0.061	0.061	0.138	0.138	0.019	0.019	0.012	0.012	0.010	0.010	40
$PM_{2.5}$	24-hour	4	ASR1= 34.3 ASR2= 30.0 ASR3= 25.7 ASR4= 17.7 ASR5= 34.0 ASR6= 22.7	2.92 (Outside the PIP; Within the PIC)	0.56	34.86	0.68	30.68	1.08	26.78	0.31	18.01	0.38	34.38	0.55	23.25	35
	Annual	5	-	0.47 (Outside the PIP)	0.024	0.024	0.061	0.061	0.138	0.138	0.019	0.019	0.012	0.012	0.010	0.010	15
SO_2	1-hour	6	-	235.47 (Outside the PIP)	12.11	12.11	13.81	13.81	15.93	15.93	12.75	12.75	11.88	11.88	14.61	14.61	250
	24-hour	7	ASR1= <5 ASR2= <5 ASR3= <5 ASR4= <5 ASR5= <5 ASR6= <5	23.32 (Outside the PIP)	1.11	1.11	2.64	2.64	3.29	3.29	0.69	0.69	1.17	1.17	1.36	1.36	80
	Annual	8	-	1.84 (Within the PIP)	0.048	0.048	0.157	0.157	0.304	0.304	0.043	0.043	0.025	0.025	0.023	0.023	-

Parameter	Averaging Time	Figure	Average Baseline Level (µg/m³)	Concentration (µg/m³)												Standard 2020 (µg/m³)
				Highest Predicted MAIC	ASR1 Open Space Near Kg. Lepau		ASR2 Sebana Cove Resort		ASR3 Sebana Golf Resort		ASR4 Bukit Pelali		ASR5 Open Space Near Kg. Bukit Gelugor		ASR6 Open Space Near Lake View	
					Predicted MAIC	GLC	Predicted MAIC	GLC	Predicted MAIC	GLC	Predicted MAIC	GLC	Predicted MAIC	GLC	Predicted MAIC	GLC
NO_X as 100% NO_2	1-hour	9	-	359.34 (Outside the PIP)	33.84	33.84	37.13	37.13	40.56	40.56	42.78	42.78	35.23	35.23	36.52	36.52	280
	24-hour	10	ASR1= 4.5 ASR2= <5 ASR3= 5.0 ASR4= 4.0 ASR5= <5 ASR6= <5	42.26 (Outside the PIP, Within the PIC)	6.20	10.70	8.14	8.14	10.96	15.96	3.22	7.22	4.16	4.16	6.01	6.01	70
	Annual	11	-	5.95 (Within the PIP)	0.262	0.262	0.705	0.705	1.203	1.203	0.188	0.188	0.120	0.120	0.104	0.104	-
CO	1-hour	12	-	1,118.97 (Outside the PIP; Near ASR 4)	179.43	179.43	171.65	171.65	153.38	153.38	217.69	217.69	180.03	180.03	131.14	131.14	30,000
	8-hour	13	ASR1= 1,250 ASR2= 950 ASR3= 800 ASR4= 1,550 ASR5= 2,600 ASR6= 2,600	323.12 (Within the PIP)	47.94	1,297.94	70.47	1,020.47	118.29	918.29	41.51	1,591.51	27.95	2,627.95	33.00	2,633.00	10,000
	Annual	14	-	25.52 (Within the PIP)	1.31	1.31	3.09	3.09	8.17	8.17	1.09	1.09	0.64	0.64	0.55	0.55	-

Parameter	Averaging Time	Figure	Average Baseline Level (µg/m³)	Concentration (µg/m³)												Standard 2020 (µg/m³)
				Highest Predicted MAIC	ASR1 Open Space Near Kg. Lepau		ASR2 Sebana Cove Resort		ASR3 Sebana Golf Resort		ASR4 Bukit Pelali		ASR5 Open Space Near Kg. Bukit Gelugor		ASR6 Open Space Near Lake View	
					Predicted MAIC	GLC	Predicted MAIC	GLC	Predicted MAIC	GLC	Predicted MAIC	GLC	Predicted MAIC	GLC	Predicted MAIC	GLC	
H_2S	8-hour	15	ASR1= <10 ASR2= <10 ASR3= <10 ASR4= <10 ASR5= <10 ASR6= <10	1.01 (Outside the PIP)	0.02	0.02	0.08	0.08	0.12	0.12	0.04	0.04	0.04	0.04	0.03	0.03	-
	24-hour	16	-	0.44 (Outside PIP)	0.015	0.015	0.035	0.035	0.057	0.057	0.013	0.013	0.018	0.018	0.021	0.021	7 (Ontario)
	Annual	17	-	0.0323 (Within the PIP)	0.0005	0.0005	0.0019	0.0019	0.0053	0.0053	0.0007	0.0007	0.0004	0.0004	0.0003	0.0003	-
HCl	8-hour	18	-	2.02 (Outside the PIP, Near ASR4)	0.10	0.10	0.16	0.16	0.16	0.16	0.12	0.12	0.11	0.11	0.09	0.09	-
	24-hour	19	Not monitored	0.83 (Outside PIP)	0.047	0.047	0.065	0.065	0.109	0.109	0.042	0.042	0.041	0.041	0.050	0.050	20 (Ontario)
	Annual	20	Not monitored	0.0540 (Within the PIP)	0.0018	0.0018	0.0046	0.0046	0.0120	0.0120	0.0015	0.0015	0.0010	0.0010	0.0008	0.0008	-

Note: PM is conservatively assumed as 100% PM10 and PM2.5
Ground Level Concentration (GLC) = Baseline Level (BL) + Maximum Average Incremental Concentration (MAIC)
Average Baseline Levels were based on the Ambient Air Quality Monitoring Results carried out on April, May, June and July 2019
For calculation of average, values of Less than the Minimum Detectable Limit or not detected was assumed to be null
PIP = Pengerang Industrial Park
PIC = Pengerang Integrated Complex (Rapid)
Ontario = Ontario's Ambient Air Quality Criteria (April 2012)

Table 8: Predicted MAICs for Identified Criteria Air Pollutants (in µg/m³) during Normal Operation in Compliance of 25% Threshold

No.	Scenario	Identified Air Sensitive Receptor	Maximum Incremental (µg/m³)	Air Sensitive Receptor Incremental (µg/m³)	Compliance with 25% Threshold
1	Pollutant: PM10 24-hours Average Limit: 100 mg/m3 (MAAQS 2013 [Standard 2020]) **25% Threshold: 25 µg/m³**	ASR1: Open Space Near Kg. Lepau	2.92 (Outside PIP; Within PIC)	0.560	**YES**
		ASR2: Sebana Cove Resort		0.680	**YES**
		ASR3: Sebana Golf Resort		1.080	**YES**
		ASR4: Bukit Pelali		0.310	**YES**
		ASR5: Open Space Near Kg. Bukit Gelugor		0.380	**YES**
		ASR6: Open Space Near Lake View		0.550	**YES**
2	Pollutant: PM10 Annual Average Limit: 40 mg/m3 (MAAQS 2013 [Standard 2020]) **25% Threshold: 10 µg/m³**	ASR1: Open Space Near Kg. Lepau	0.47 (Outside PIP)	0.024	**YES**
		ASR2: Sebana Cove Resort		0.061	**YES**
		ASR3: Sebana Golf Resort		0.138	**YES**
		ASR4: Bukit Pelali		0.019	**YES**
		ASR5: Open Space Near Kg. Bukit Gelugor		0.012	**YES**
		ASR6: Open Space Near Lake View		0.010	**YES**
3	Pollutant: PM2.5 24-hours Average Limit: 35 mg/m3 (MAAQS 2013 [Standard 2020]) **25% Threshold: 8.75 µg/m³**	ASR1: Open Space Near Kg. Lepau	2.92 (Outside PIP; Within PIC)	0.560	**YES**
		ASR2: Sebana Cove Resort		0.680	**YES**
		ASR3: Sebana Golf Resort		1.080	**YES**
		ASR4: Bukit Pelali		0.310	**YES**
		ASR5: Open Space Near Kg. Bukit Gelugor		0.380	**YES**
		ASR6: Open Space Near Lake View		0.550	**YES**
4	Pollutant: PM2.5 Annual Average Limit: 15 mg/m3 (MAAQS 2013 [Standard 2020]) **25% Threshold: 3.75 µg/m³**	ASR1: Open Space Near Kg. Lepau	0.47 (Outside PIP)	0.024	**YES**
		ASR2: Sebana Cove Resort		0.061	**YES**
		ASR3: Sebana Golf Resort		0.138	**YES**
		ASR4: Bukit Pelali		0.019	**YES**
		ASR5: Open Space Near Kg. Bukit Gelugor		0.012	**YES**
		ASR6: Open Space Near Lake View		0.010	**YES**

No.	Scenario	Identified Air Sensitive Receptor	Maximum Incremental (µg/m³)	Air Sensitive Receptor Incremental (µg/m³)	Compliance with 25% Threshold
5	Pollutant: CO 1-hour Average Limit: 30,000 mg/m3 (MAAQS 2013 [Standard 2020]) **25% Threshold: 7,500 µg/m³**	ASR1: Open Space Near Kg. Lepau	1,118.97 (Outside PIP; Near ASR 4)	179.430	**YES**
		ASR2: Sebana Cove Resort		171.650	**YES**
		ASR3: Sebana Golf Resort		153.380	**YES**
		ASR4: Bukit Pelali		217.690	**YES**
		ASR5: Open Space Near Kg. Bukit Gelugor		180.030	**YES**
		ASR6: Open Space Near Lake View		131.140	**YES**
6	Pollutant: CO 8-hours Average Limit: 10,000 mg/m3 (MAAQS 2013 [Standard 2020]) **25% Threshold: 2,500 µg/m³**	ASR1: Open Space Near Kg. Lepau	323.12 (Within PIP)	47.940	**YES**
		ASR2: Sebana Cove Resort		70.470	**YES**
		ASR3: Sebana Golf Resort		118.290	**YES**
		ASR4: Bukit Pelali		41.510	**YES**
		ASR5: Open Space Near Kg. Bukit Gelugor		27.950	**YES**
		ASR6: Open Space Near Lake View		33.000	**YES**
7	Pollutant: SO2 1-hour Average Limit: 250 mg/m3 (MAAQS 2013 [Standard 2020]) **25% Threshold: 62.5 µg/m³**	ASR1: Open Space Near Kg. Lepau	235.47 (Outside PIP)	12.110	**YES**
		ASR2: Sebana Cove Resort		13.810	**YES**
		ASR3: Sebana Golf Resort		15.930	**YES**
		ASR4: Bukit Pelali		12.750	**YES**
		ASR5: Open Space Near Kg. Bukit Gelugor		11.880	**YES**
		ASR6: Open Space Near Lake View		14.610	**YES**
8	Pollutant: SO2 24-hours Average Limit: 80 mg/m3 (MAAQS 2013 [Standard 2020]) **25% Threshold: 20 µg/m³**	ASR1: Open Space Near Kg. Lepau	23.32 (Outside PIP)	1.110	**YES**
		ASR2: Sebana Cove Resort		2.640	**YES**
		ASR3: Sebana Golf Resort		3.290	**YES**
		ASR4: Bukit Pelali		0.690	**YES**
		ASR5: Open Space Near Kg. Bukit Gelugor		1.170	**YES**
		ASR6: Open Space Near Lake View		1.360	**YES**

Table 9: Predicted MAICs for NO_2 (in µg/m³) during Normal Operation in Compliance of 25% Threshold

No.	Scenario	Identified Air Sensitive Receptor	Maximum Incremental (µg/m³)	Air Sensitive Receptor Incremental (µg/m³)- NOx as 100% NO2	Air Sensitive Receptor Incremental (µg/m³)- NOx as 10% NO2	Compliance with 25% Threshold	Air Sensitive Receptor Incremental (µg/m³)- NOx as 35% NO2	Compliance with 25% Threshold
1	1-hour Average Limit: 280 µg/m3 (MAAQS 2013 [Standard 2020]) **25% Threshold: 70 µg/m³**	ASR1: Open Space Near Kg. Lepau	359.34 35.93 (10%) (Outside PIP)	33.84	3.38	YES		
		ASR2: Sebana Cove Resort		37.13	3.71	YES		
		ASR3: Sebana Golf Resort		40.56	4.06	YES		
		ASR4: Open Space within Bukit Pelali		42.78	4.28	YES		
		ASR5: Open Space Near Kg. Bukit Gelugor		35.23	3.52	YES		
		ASR6: Open Space Near Lake View		36.52	3.65	YES		
2	24-hours Average Limit: 70 µg/m3 (MAAQS 2013 [Standard 2020]) **25% Threshold: 17.5 µg/m³**	ASR1: Open Space Near Kg. Lepau	42.26 14.79 (35%) (Outside PIP, Within PIC)	6.20			2.17	YES
		ASR2: Sebana Cove Resort		8.14			2.85	YES
		ASR3: Sebana Golf Resort		10.96			3.84	YES
		ASR4: Open Space within Bukit Pelali		3.22			1.13	YES
		ASR5: Open Space Near Kg. Bukit Gelugor		4.16			1.46	YES
		ASR6: Open Space Near Lake View		6.01			2.10	YES

Figure 3: Windrose for the Study Area based on 2015-2017 Meteorological Data

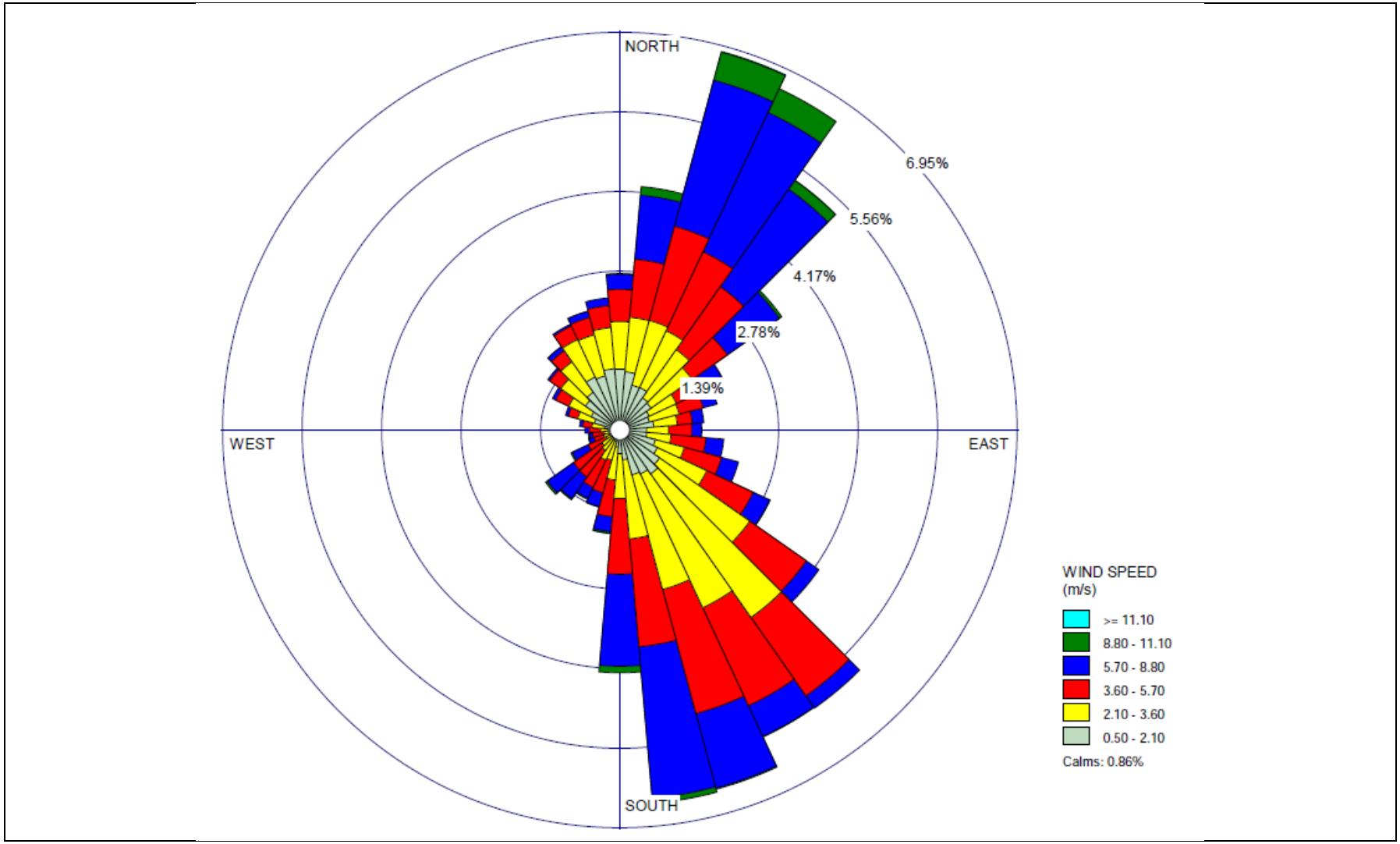


Figure 4: Predicted Maximum 24-hours Average Incremental Concentration of PM_{10}/ $PM_{2.5}$ during Normal Operation

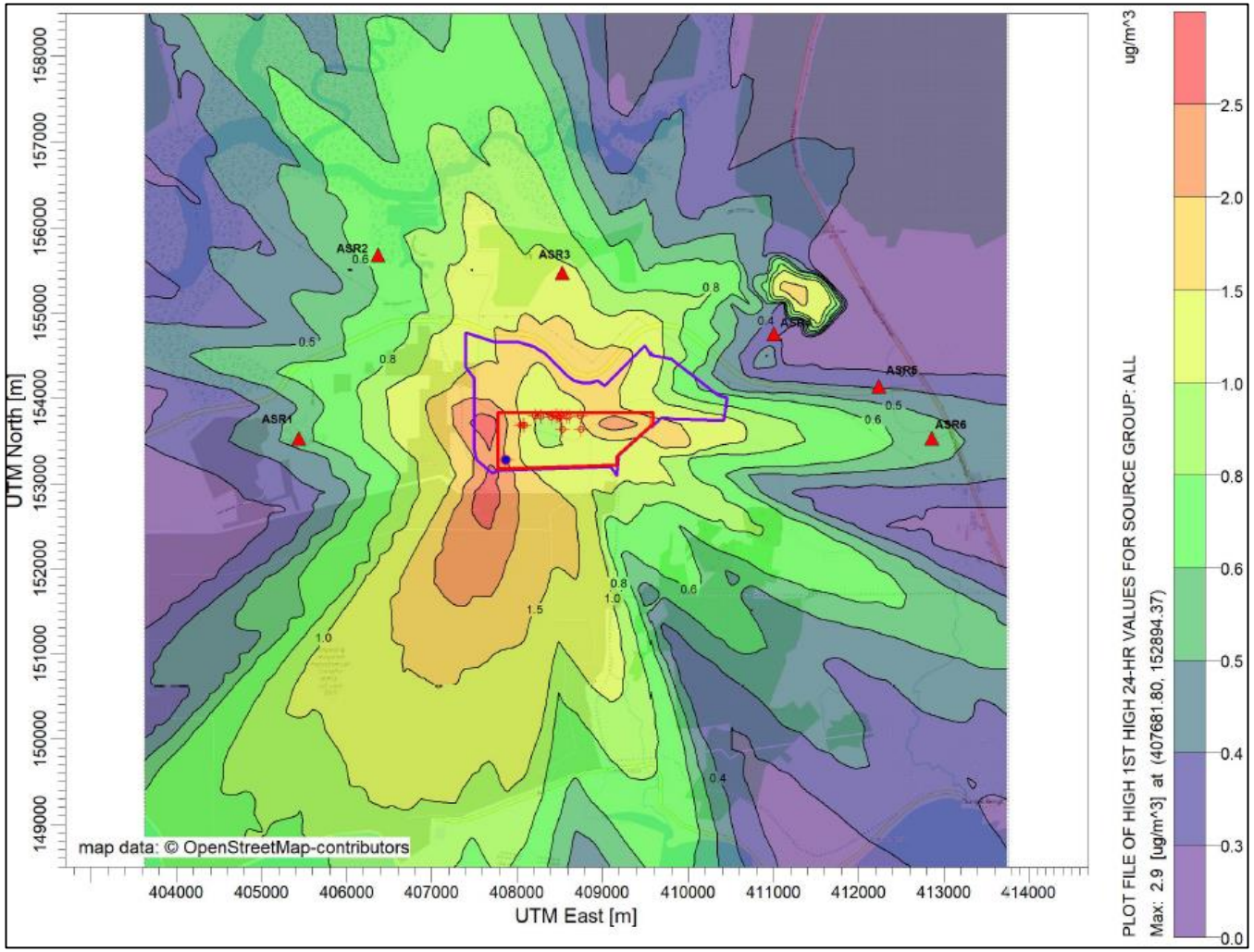


Figure 5: Predicted Maximum Annual Average Incremental Concentration of PM_{10}/ $PM_{2.5}$ during Normal Operation

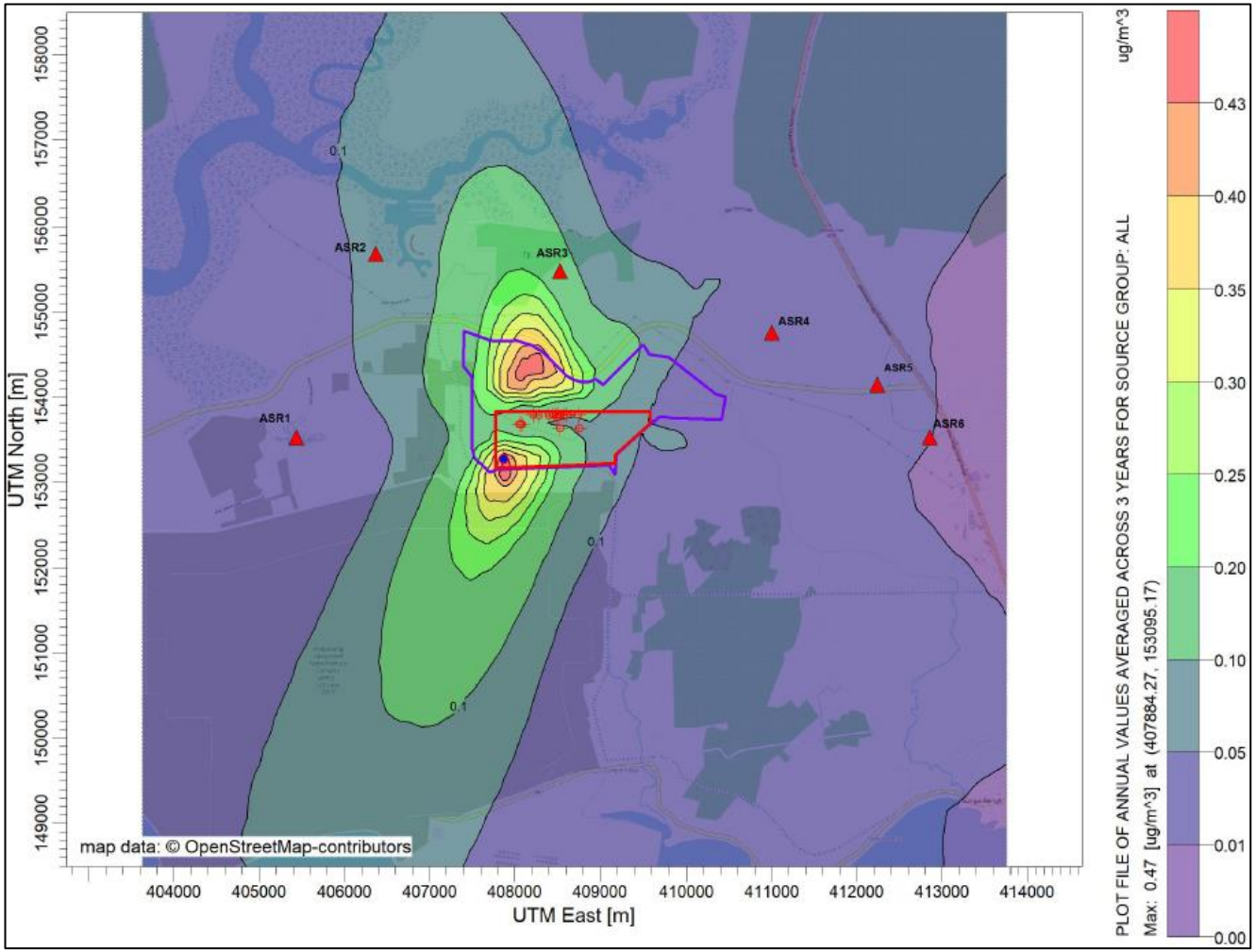


Figure 6: Predicted Maximum 1-hour Average Incremental Concentration of SO_2 during Normal Operation

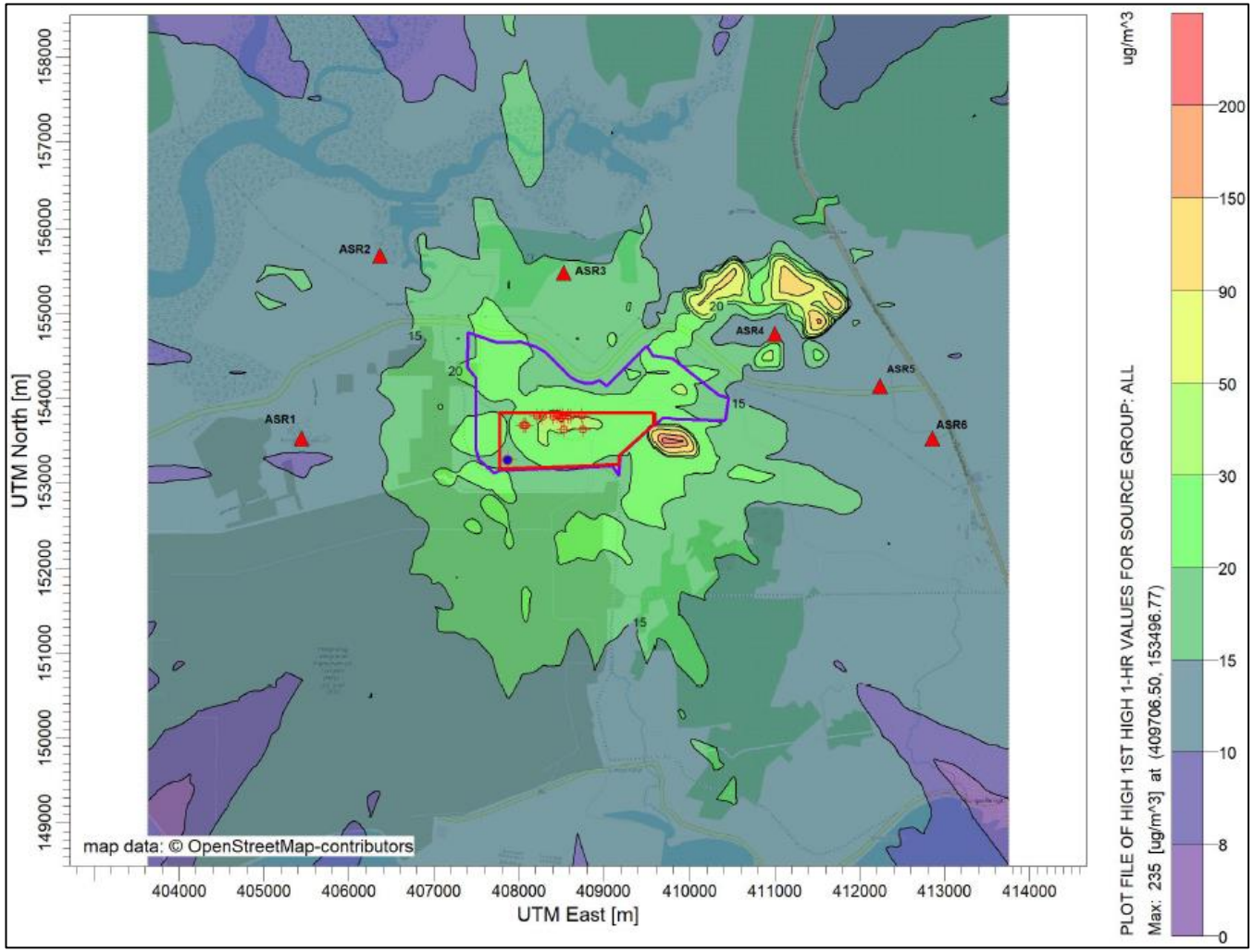


Figure 7: Predicted Maximum 24-hours Average Incremental Concentration of SO_2 during Normal Operation

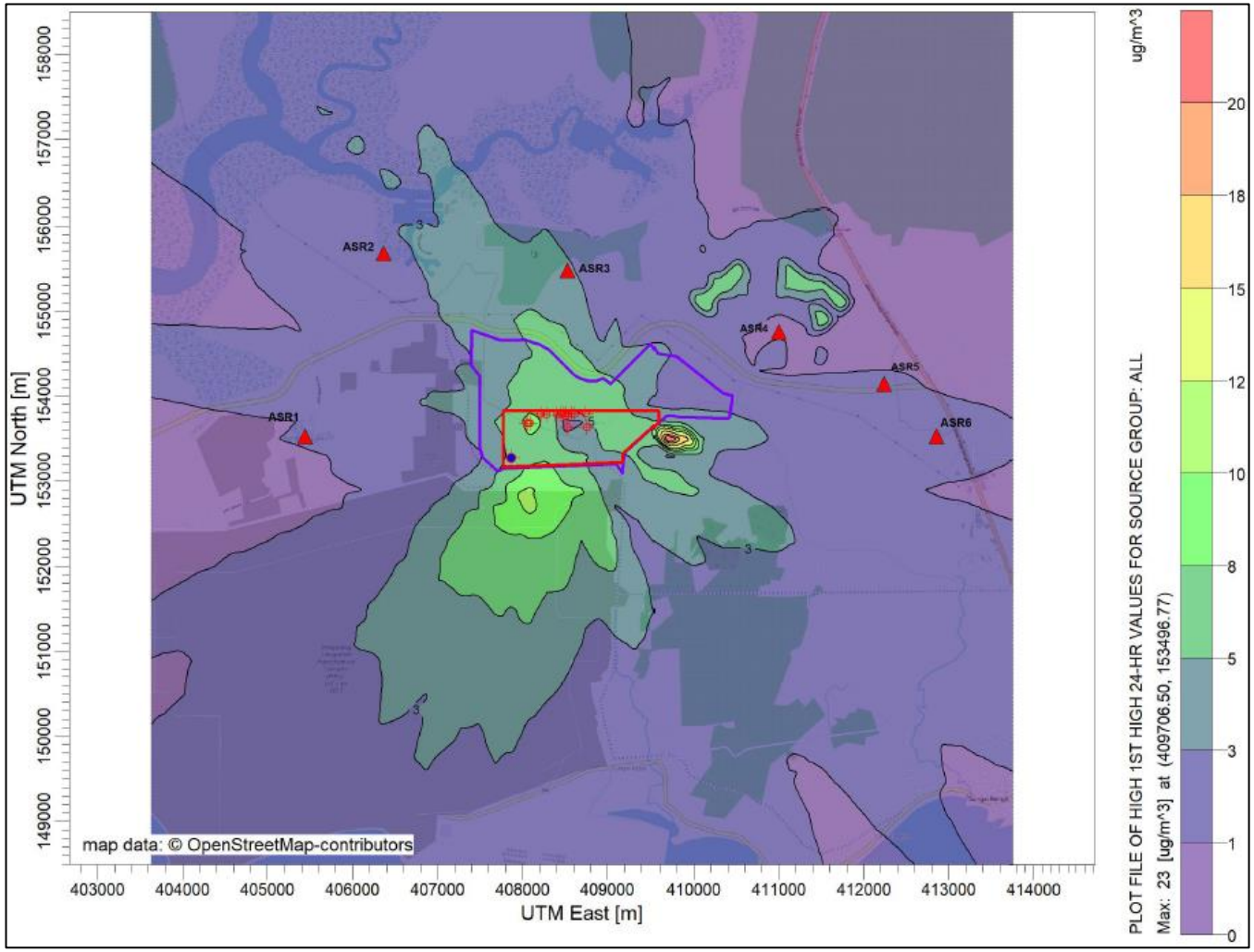


Figure 8: Predicted Maximum Annual Average Incremental Concentration of SO_2 during Normal Operation

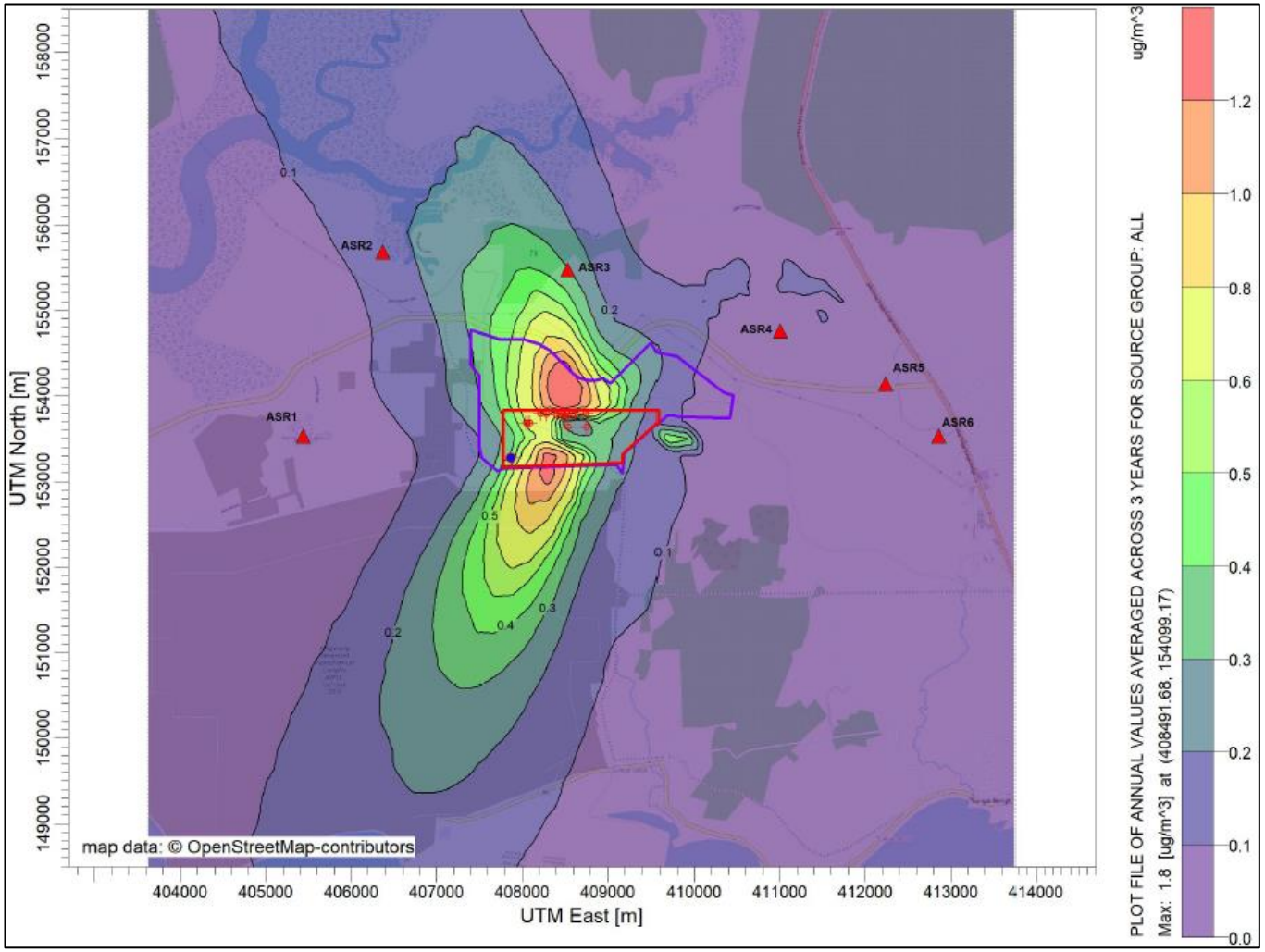


Figure 9: Predicted Maximum 1-hour Average Incremental Concentration of NO_2 during Normal Operation

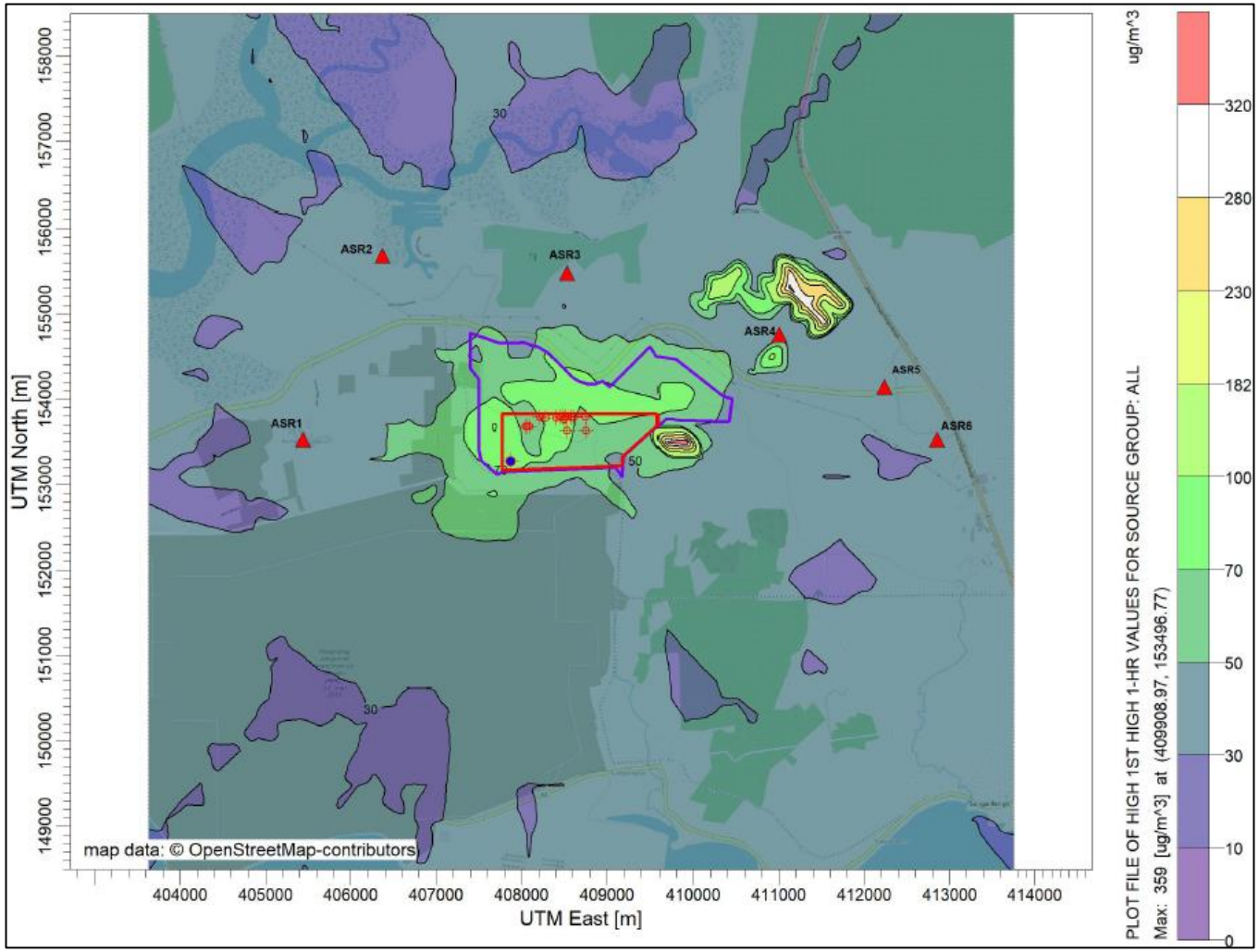


Figure 10: Predicted Maximum 24-hours Average Incremental Concentration of NO_2 during Normal Operation

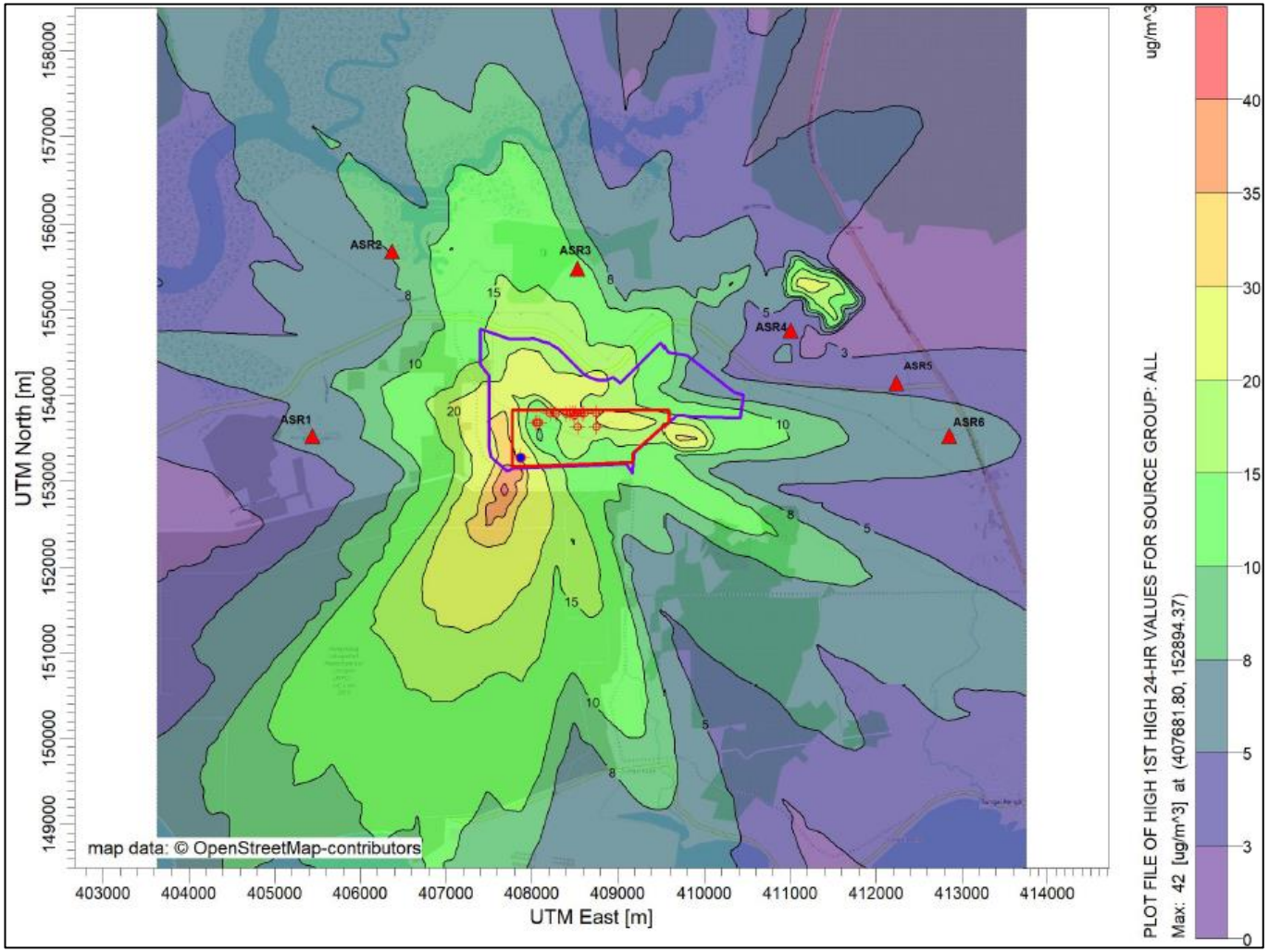


Figure 11: Predicted Maximum Annual Average Incremental Concentration of NO_2 during Normal Operation

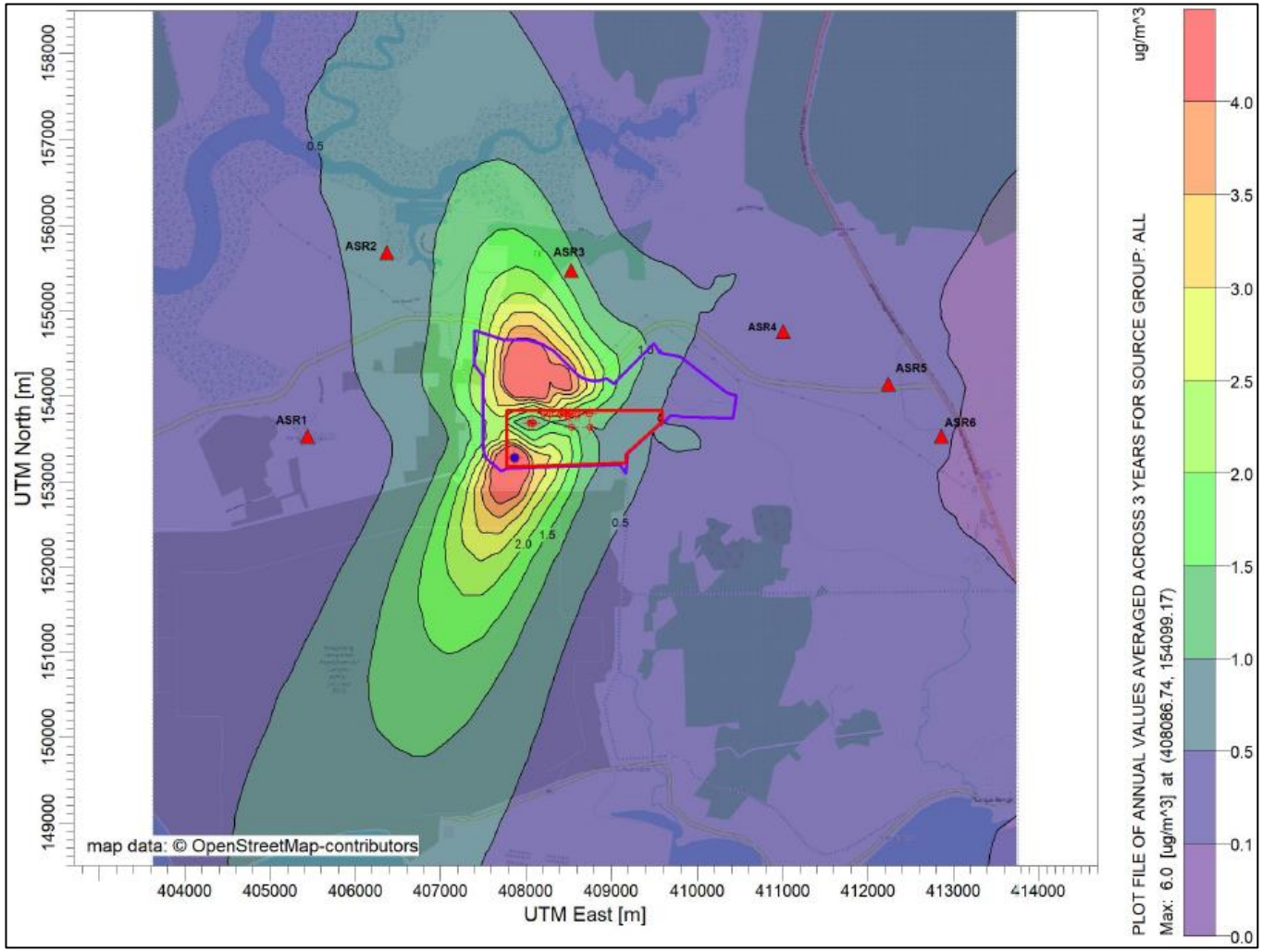


Figure 12: Predicted Maximum 1-hour Average Incremental Concentration of CO during Normal Operation

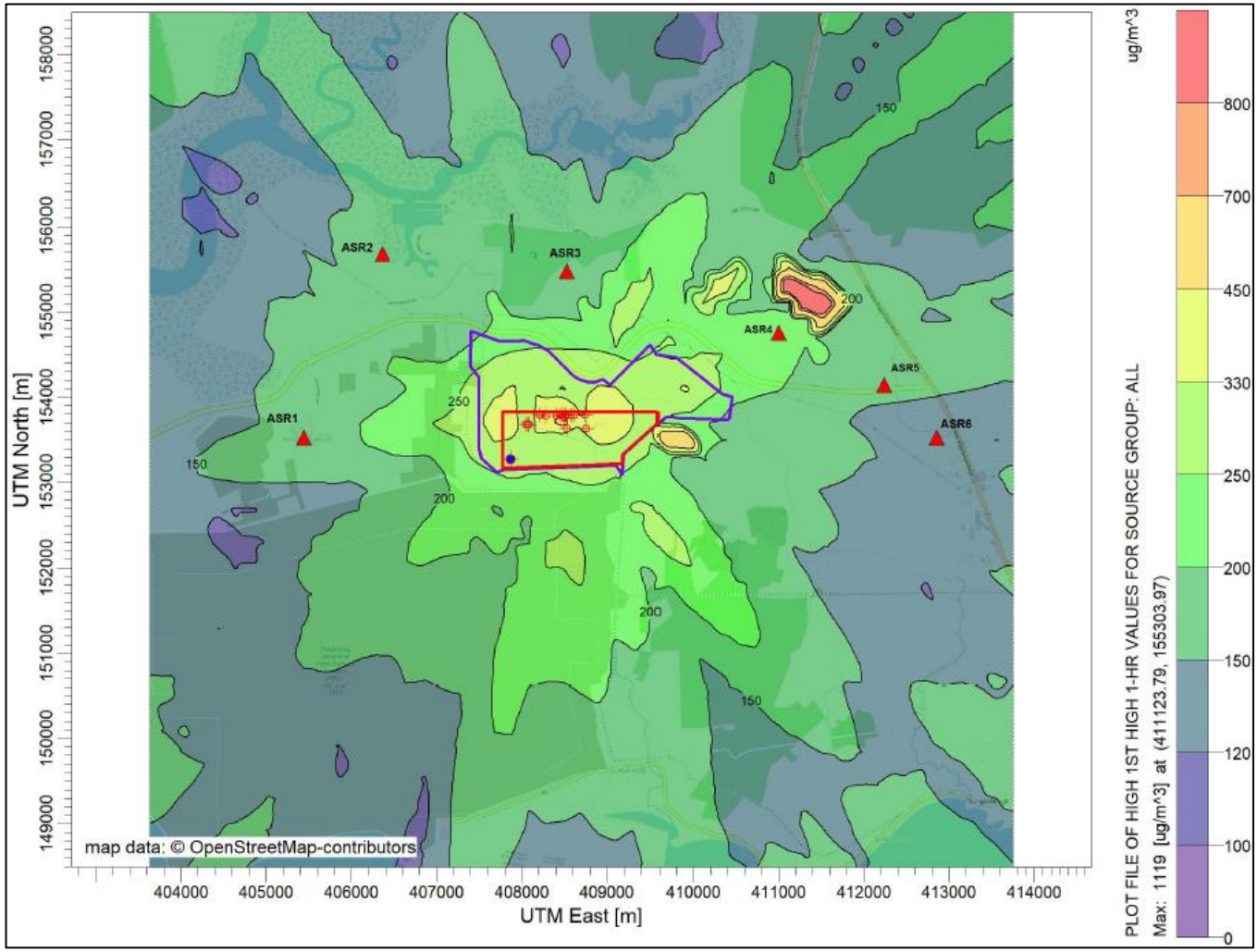


Figure 13: Predicted Maximum 8-hours Average Incremental Concentration of CO during Normal Operation

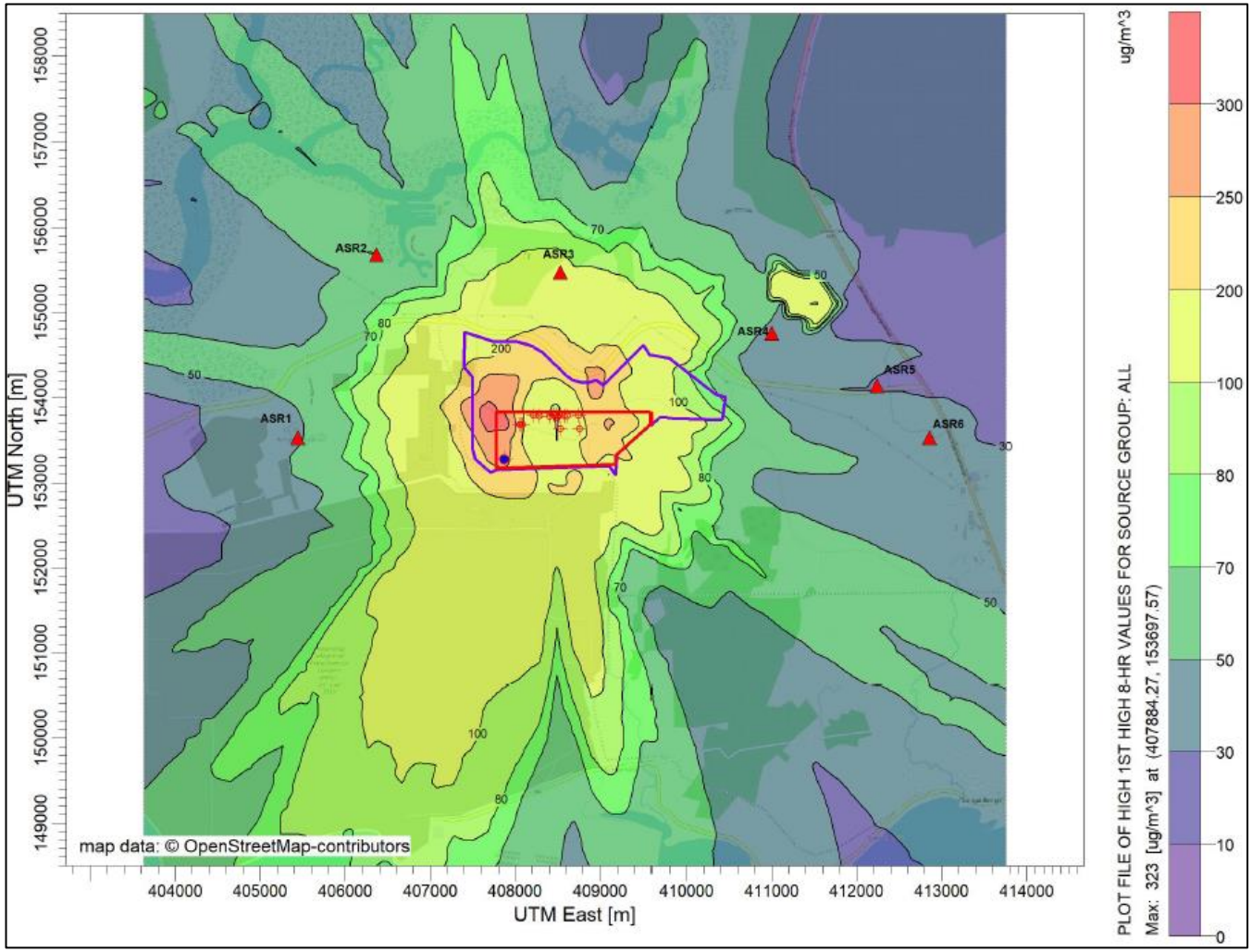


Figure 14: Predicted Maximum Annual Average Incremental Concentration of CO during Normal Operation

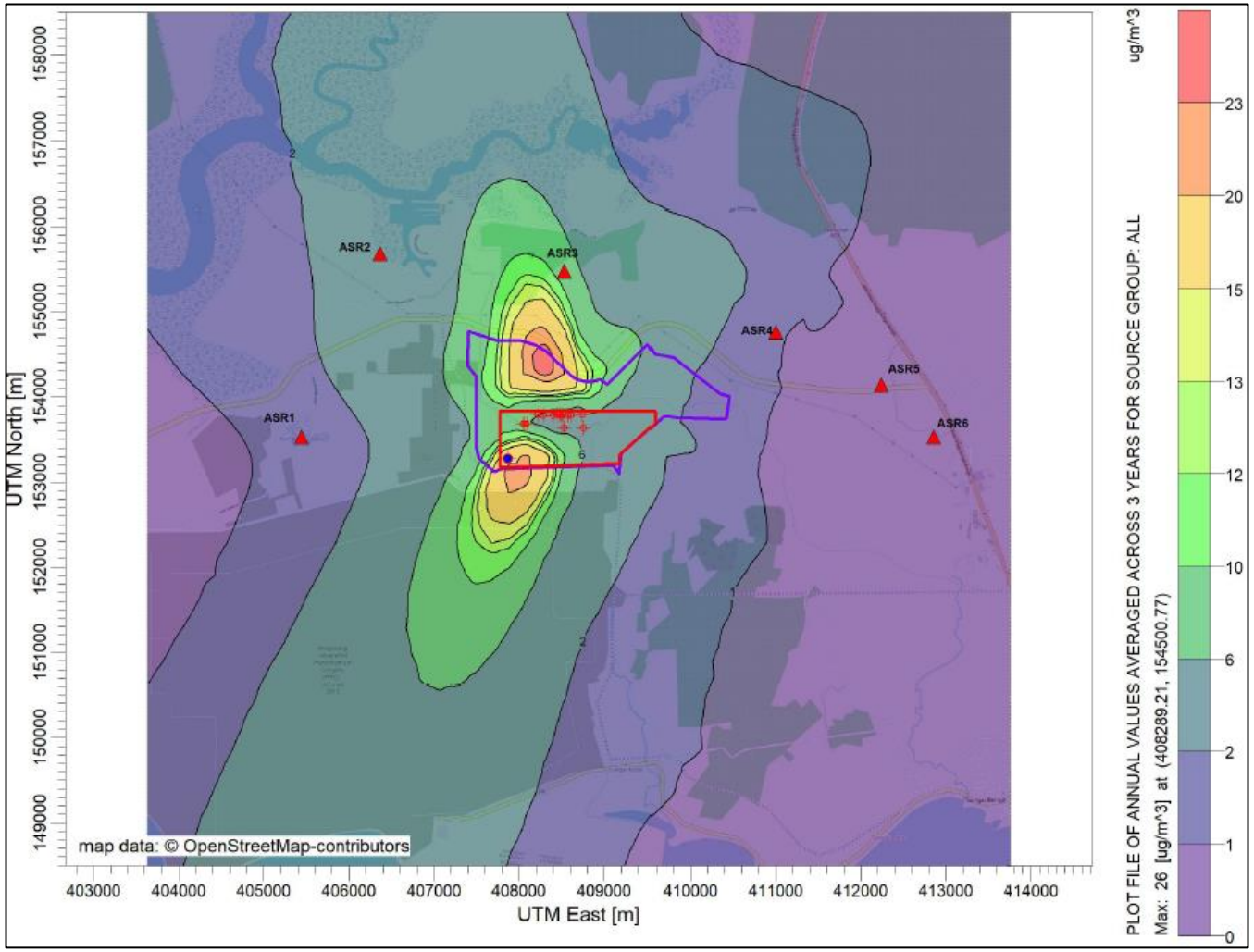


Figure 15: Predicted Maximum 8-hours Average Incremental Concentration of H_2S during Normal Operation

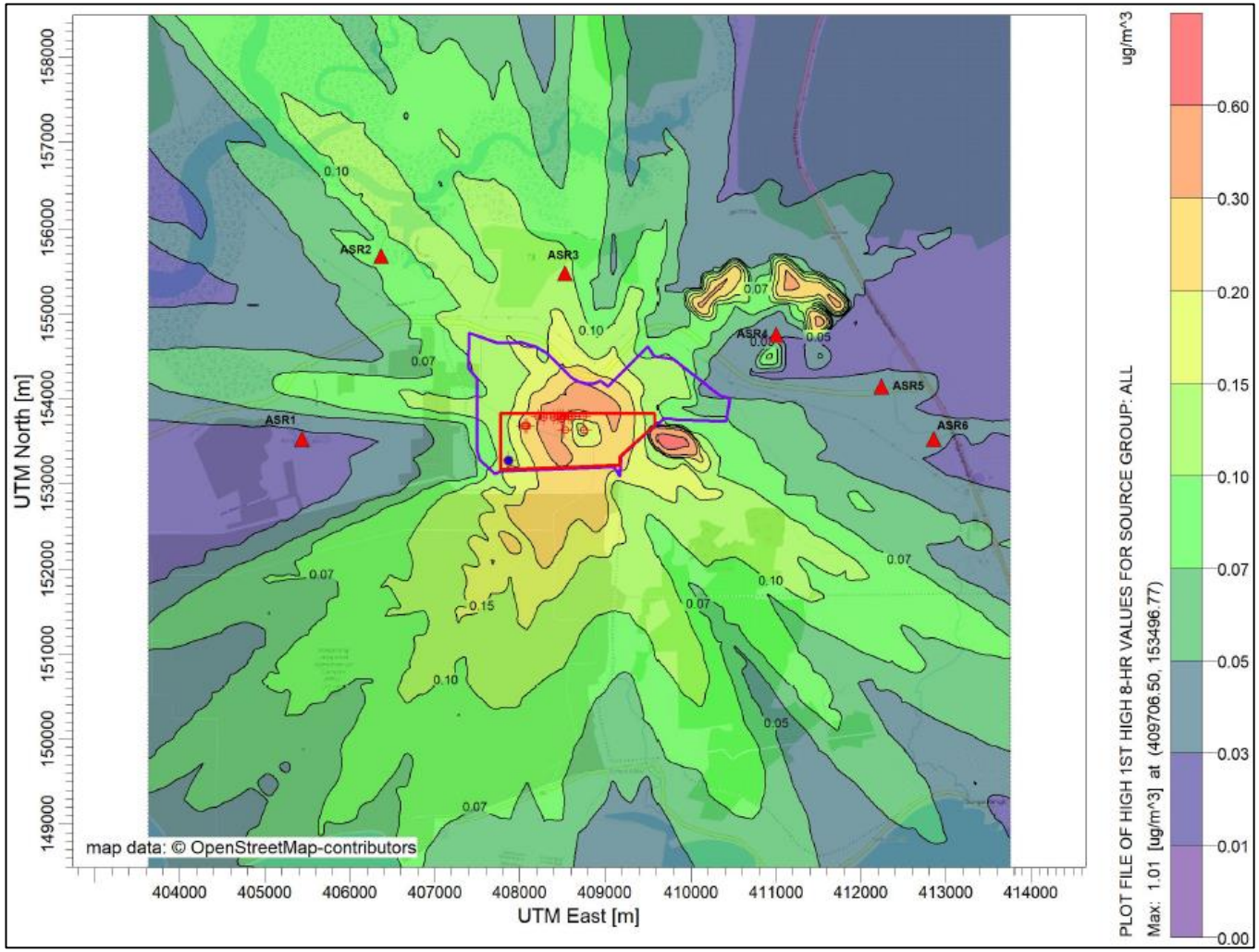


Figure 16: Predicted Maximum 24-hours Average Incremental Concentration of H_2S during Normal Operation

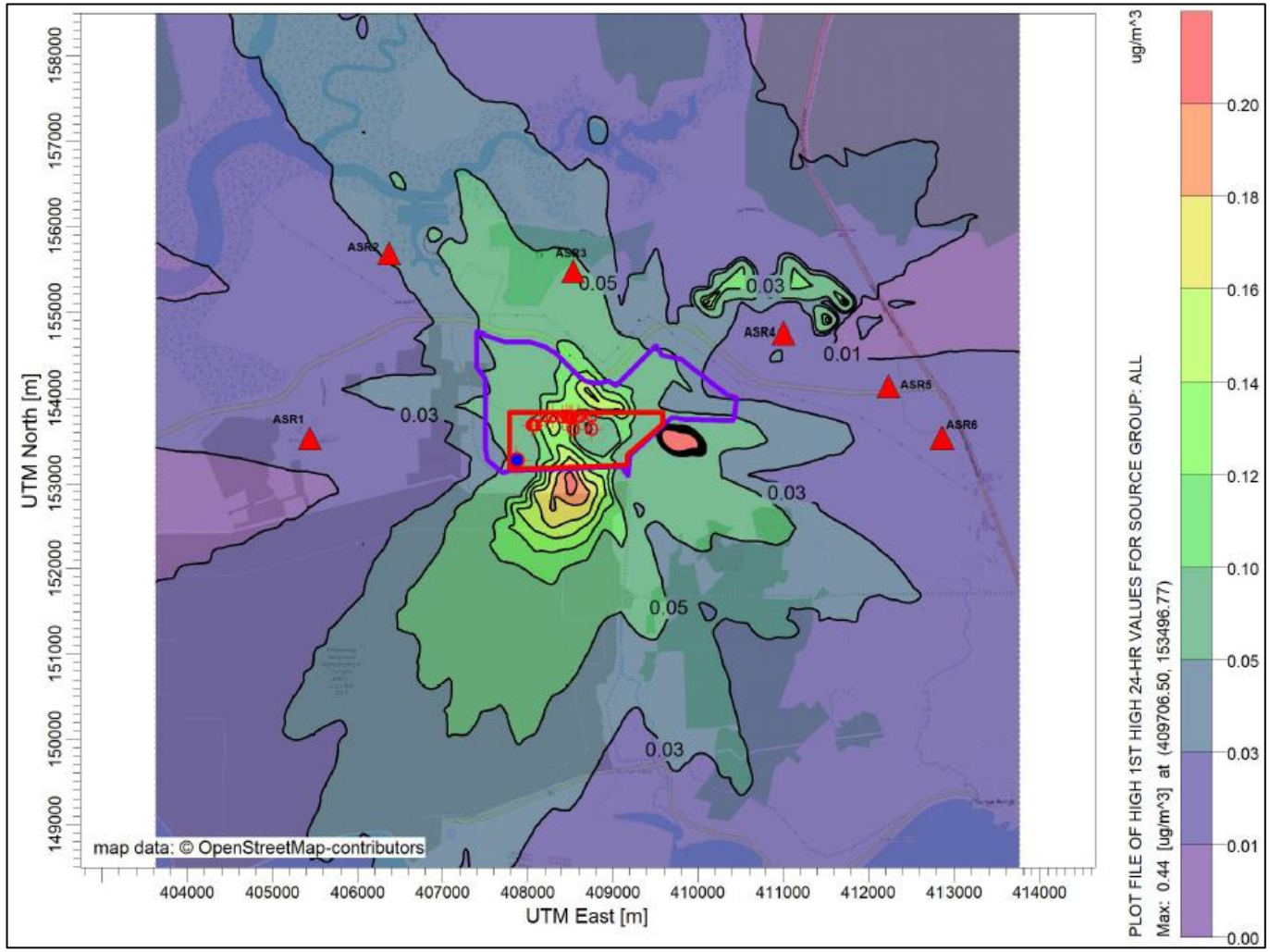


Figure 17: Predicted Maximum Annual Average Incremental Concentration of H_2S during Normal Operation

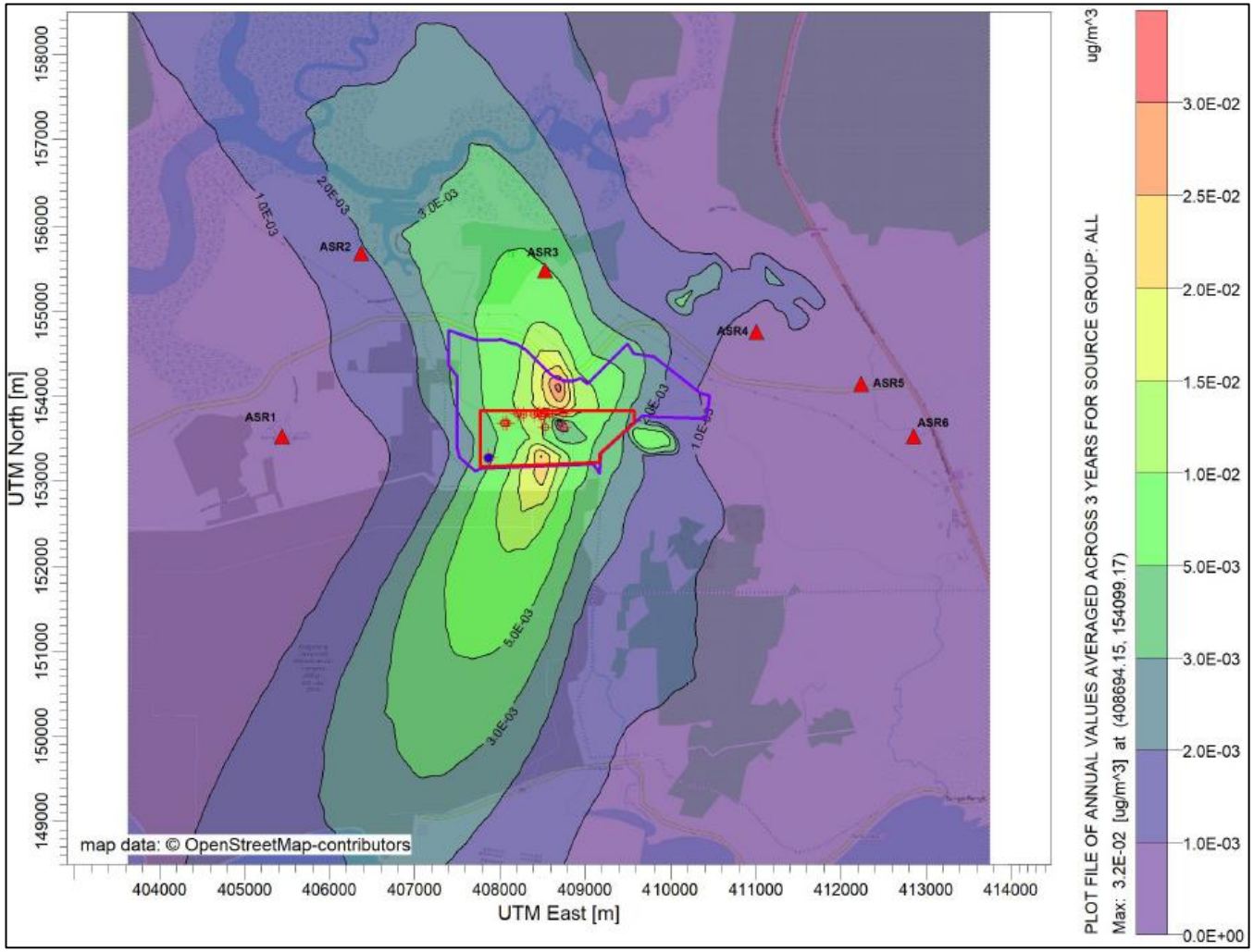


Figure 18: Predicted Maximum 8-hours Average Incremental Concentration of HCl during Normal Operation

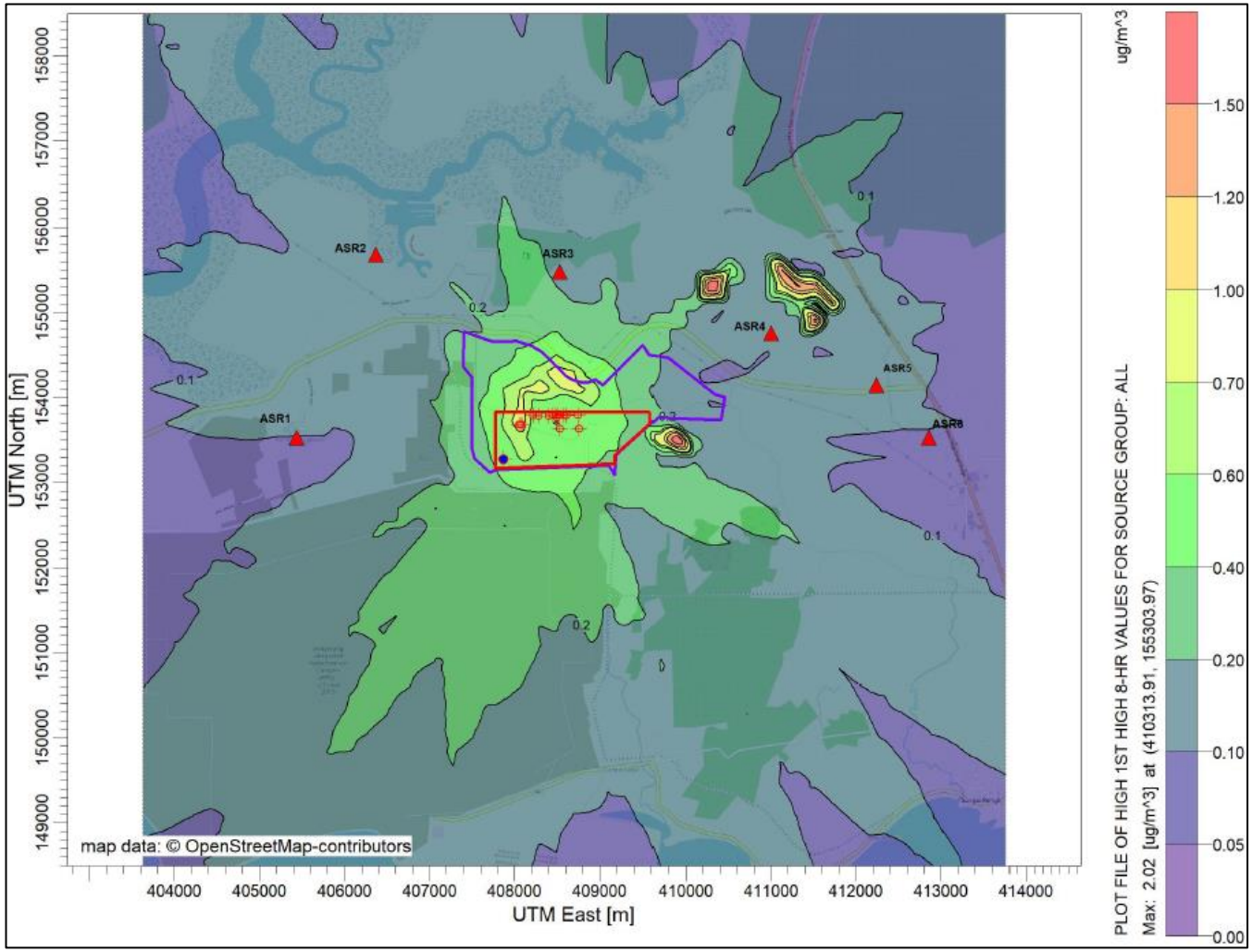


Figure 19: Predicted Maximum 24-hours Average Incremental Concentration of HCl during Normal Operation

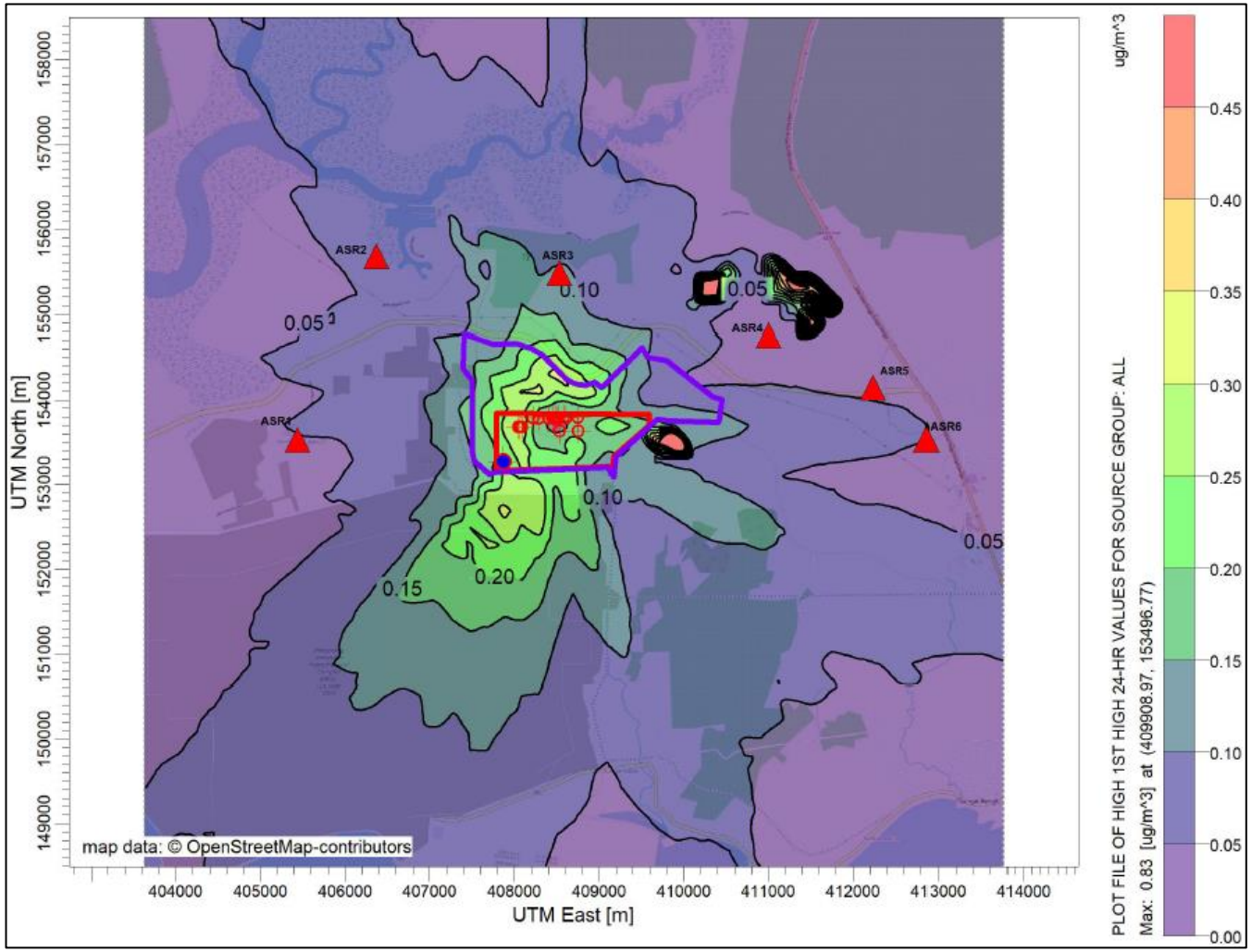
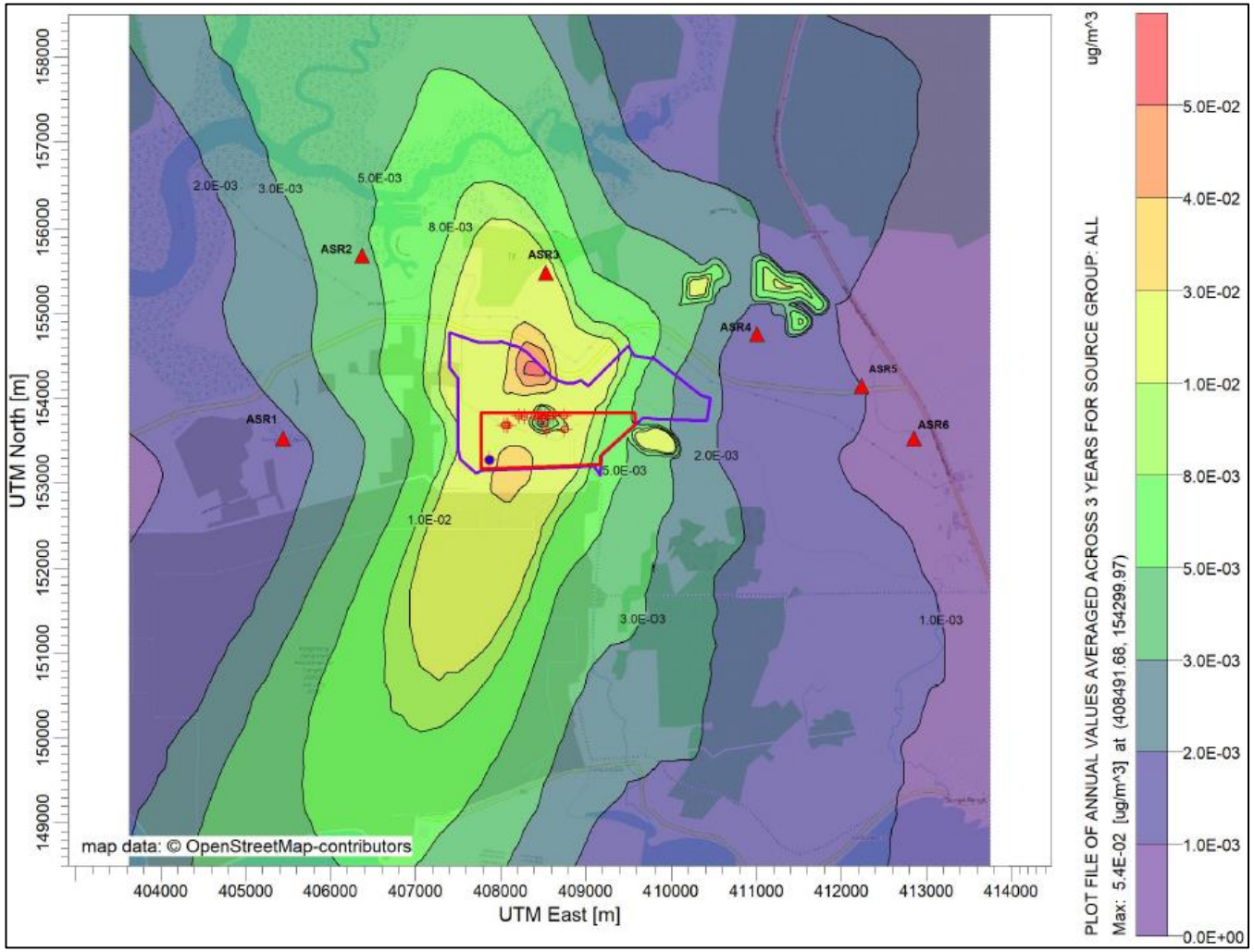


Figure 20: Predicted Maximum Annual Average Incremental Concentration of HCl during Normal Operation



B. Abnormal Situation

For the ambient air criteria during abnormal situation, the Acute Exposure Guidelines Level values for Sulphur Dioxide (SO_2) and Hydrogen Sulphide (H_2S) as shown in Table 10 were adopted. The maximum 1-hour averaging time incremental concentration iso-contour for SO_2 and H_2S is as shown in Figure 24 and Figure 25 respectively.

Sulphur Dioxide (SO_2)

The highest predicted MAICs of SO_2 for 1-hour averaging time during abnormal situation was at 7,543.9 µg/m^3 occurring within Pengerang Integrated Complex (RAPID).

The predicted MAICs at the identified ASRs ranged from 502.2 µg/m^3 to 1,649.1 µg/m^3, with all ASRs were below the adopted AEGL-2 (Disabling) of 1,950 µg/m^3.

Further analysis of the 3-years of modelling period indicates that the percentile for compliance with AEGL-2 for the overall Sebana Cove Resort development was 99.98% i.e. 0.02% (5 hours out of 26,304 modelling hours) of exceedance to AEGL-2.

Additional simulation was carried out for the nearest proposed 5-storey flat (as illustrated in Figure 21) within the Sebana Cove mixed development which indicates that the predicted MAICs at different levels will be elevated ranging about 2,242 µg/m^3 to 2,247 µg/m^3 and exceeded the AEGL-2. However, at 99.98%, the predicted MAICs at different levels were within the AEGL-2 ranging about 571 µg/m^3 to 600 µg/m^3. The result of this simulation is as shown in Table 12 and shown in Figure 22.

Hydrogen Sulphide (H_2S)

The highest predicted MAICs of H_2S for 1-hour averaging time during abnormal situation was at 419.6 µg/m^3.

The predicted MAICs at the identified ASRs ranged from 27.9 µg/m^3 to 91.7 µg/m^3 with all ASRs were below the adopted AEGL-1 (Non-disabling) of 710 µg/m^3.

Additional simulation was carried out for the nearest proposed 5-storey flat within the Sebana Cove mixed development which indicates that the predicted MAICs at different levels will within AEGL-1. The result of this simulation is as shown in Table 12 and shown in Figure 23.

2.2.3 Findings

Based on the findings of the simulations, during normal operation, the calculated GLCs for identified criteria air pollutants were with the prescribed limits of MAAQS 2013 (Standard [2020]). While, during abnormal situation (short-term exposure), as anticipated the contribution of H_2S to the surrounding environment was within the AEGL-1 (Non-disabling) as intended by installation of Flare System as one of air pollution control system except for the contribution of converted SO_2 as earlier highlighted in this Air Quality Modelling exercise. The predicted SO_2 during worst-case scenario was within AEGL-2 at the identified air sensitive receptors. Nevertheless, the frequency of this maximum conservative SO_2 load due to flaring would be very unlikely during the Project Operation based on the industrial practices.

Table 10: Acute Exposure Guidelines Level (AEGL) Values for NO_2 and H_2S

	10-minutes	30-minutes	1-hour	4-hours	8-hours	End Point
Sulphur Dioxide (SO_2)						
AEGL-1 (Non-disabling)	0.20 ppm (0.52 mg/m^3)	0.20 ppm (0.52 mg/m^3)	0.20 ppm (0.52 mg/m^3)	0.20 ppm (0.52 mg/m^3)	0.20 ppm (0.52 mg/m^3)	NOEL for bronchoconstriction in exercising asthmatics
AEGL-2 (Disabling)	0.75 ppm (1.95 mg/m^3)	0.75 ppm (1.95 mg/m^3)	0.75 ppm (1.95 mg/m^3)	0.75 ppm (1. mg/m^3)	0.75 ppm (1.95 mg/m^3)	Moderate bronchoconstriction in exercising asthmatics
AEGL-3 (Lethality)	30 ppm (78 mg/m^3)	30 ppm (78 mg/m^3)	30 ppm (78 mg/m^3)	30 ppm (78 mg/m^3)	30 ppm (78 mg/m^3)	Calculated BMCLC05 in the rat after a 4-hour exposure
Hydrogen Sulphide (H_2S)						
AEGL-1 (Non-disabling)	0.75 ppm (1.05 mg/m^3)	0.60 ppm (0.84 mg/m^3)	0.51 ppm (0.71 mg/m^3)	0.36 ppm (0.50 mg/m^3)	0.33 ppm (0.46 mg/m^3)	Headache in humans with asthma
AEGL-2 (Disabling)	41 ppm (59 mg/m^3)	32 ppm (45 mg/m^3)	27 ppm (39 mg/m^3)	20 ppm (28 mg/m^3)	17 ppm (24 mg/m^3)	Perivascular edema in rats
AEGL-3 (Lethality)	76 ppm (106 mg/m^3)	59 ppm (85 mg/m^3)	50 ppm (71 mg/m^3)	37 ppm (52 mg/m^3)	31 ppm (44 mg/m^3)	Highest concentration causing no mortality in the rat after a 1-h exposure

Source: National Academy of Science, United States of America (2010). Acute Exposure Guideline Levels for Selected Airborne Chemicals: Volume 8 and Volume 11.

Note: AEGL-1 is the airborne concentration of a substance above which is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptimatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure;

AEGL-2 is the airborne concentration of a susbtance above which is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape; and

AEGL-3 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening adverse health effects or death.

Table 11: Predicted MAICs for Identified Pollutants (in µg/m³) during Abnormal Situation

Para-meter	Averaging Time	Figure	Baseline Level (µg/m³)	Percentile (%)	Concentration (µg/m³)							AEGL-1 (Non-disabling)	AEGL-2 (Disabling)	AEGL-3 (Lethal)
					Highest Predicted MAIC	ASR 1: Open Space Near Kg. Lepau	ASR 2: Sebana Cove Resort	ASR 3: Sebana Golf Resort	ASR 4: Bukit Pelali	ASR 5: Open Space near Kg. Bukit Gelugor	ASR 6: Open Space near Lake View			
SO_2	1-hour	24	ASR1 = <5 ASR2 = <5 ASR3 = <5 ASR4 = <5 ASR5 = <5 ASR6 = <5 (24-hours averaging time)	100	7,543.9 (Outside PIP, Within PIC)	1,649.1	1,279.3	790.8	502.2	893.0	559.6	520 µg/m³ (0.20 ppm)	1,950 µg/m³ (0.75 ppm)	78,000 µg/m³ (30 ppm)
				99.98	2,449.1 (Outside PIP, Within PIC)	748.2	697.9	506.3	308.6	466.9	274.0			
H_2S	1-hour	25	ASR1= 27.1 ASR2= 22.9 ASR3= 27.1 ASR4= 20.8 ASR5= 22.9 ASR6= 22.9 (8-hours averaging time)	100	419.6 (Outside PIP, Within PIC)	91.7	71.2	44.0	27.9	49.7	31.1	710 µg/m³ (0.51ppm)	39,000 µg/m³ (27 ppm)	71,000 µg/m³ (50 ppm)

Note: PIP = Pengerang Industry Park
PIC = Pengerang Integrated Complex (Rapid)
AEGL = Acute Exposure Guidelines Level
AEGL-1 is the airborne concentration of a substance above which is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure;
AEGL-2 is the airborne concentration of a substance above which is predicted that the general population, including susceptible individuals, could experience irreversible or

other serious, long-lasting adverse health effects or an impaired ability to escape; and
AEGL-3 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life threatening adverse health effects or death.

Figure 21: 3D View of the Proposed *Rumah Pangsa (Package A)* at Sebana Cove Mixed Development

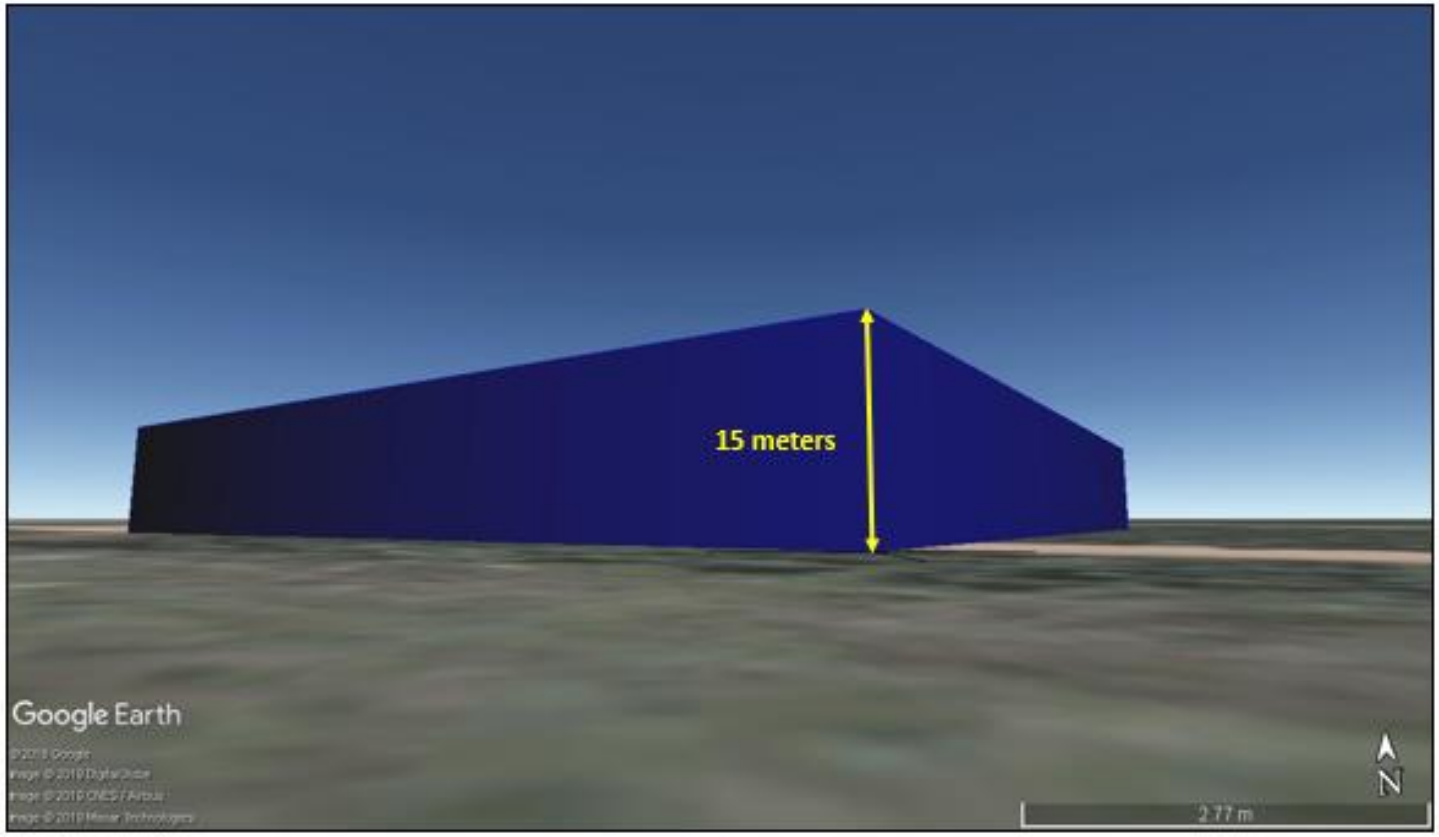
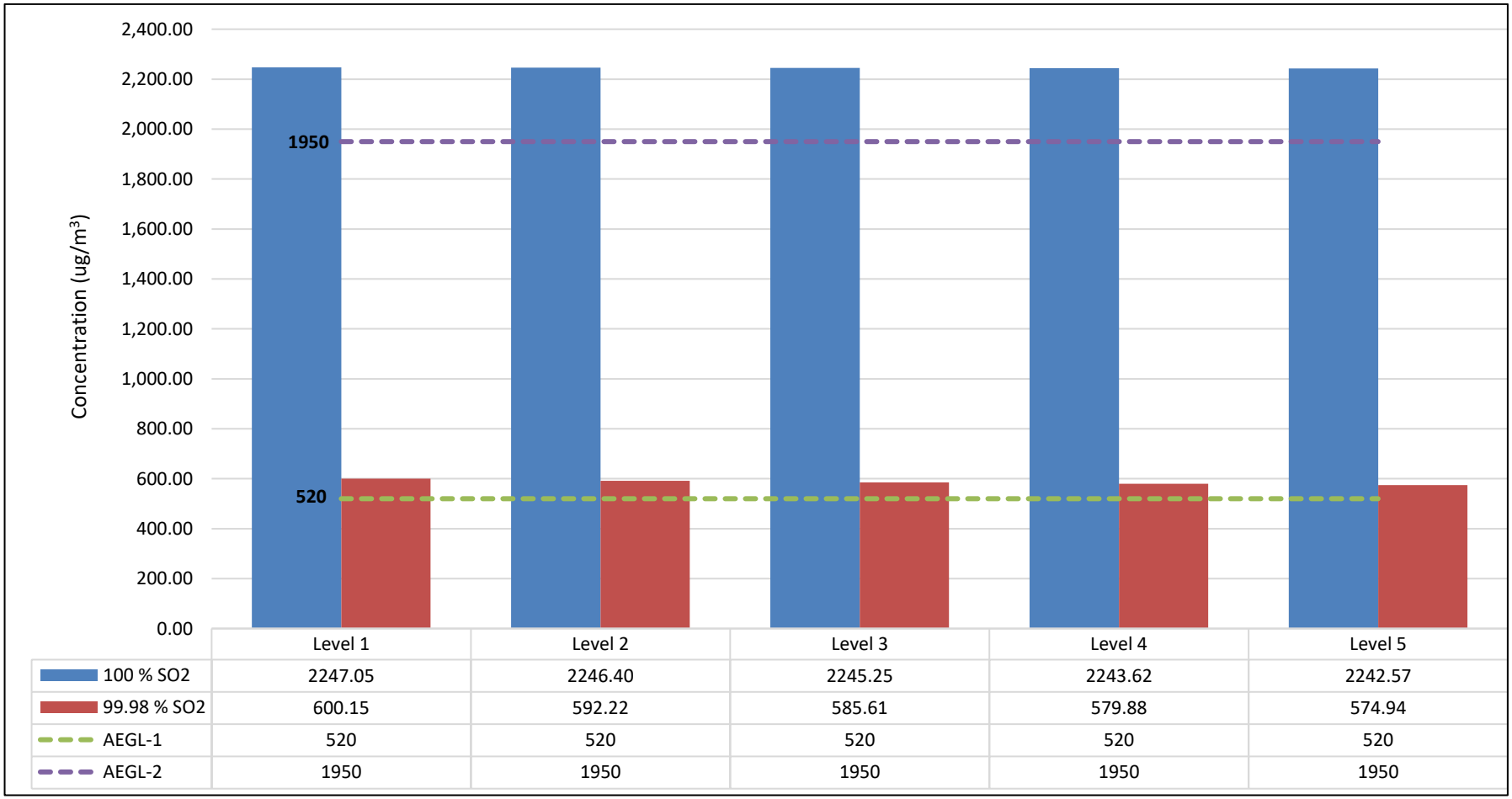


Table 12: Predicted MAICs for Identified Pollutants (in µg/m³) at Individual Level of Flagpole Receptors during Abnormal Situation

Parameter	Averaging Time	Baseline Level (µg/m3)	Percentile (%)	Concentration (µg/m3)					AEGL-1 (Non-disabling)	AEGL-2 (Disabling)	AEGL-3 (Lethal)
				Level 1 (1.5 m)	Level 2 (4.5 m)	Level 3 (7.5 m)	Level 4 (10.5 m)	Level 5 (13.5 m)			
SO_2	1 hour	ASR1 = <5 ASR2 = <5 ASR3 = <5 ASR4 = <5 ASR5 = <5 ASR6 = <5 (24-hours averaging time)	100	2,247.05	2,246.40	2,245.25	2,243.62	2,242.57	520 µg/m³ (0.20 ppm)	1,950 µg/m³ (0.75 ppm)	78,000 µg/m³ (30 ppm)
			99.98	600.15	592.22	585.61	579.88	574.94			
H_2S		ASR1= 27.1 ASR2= 22.9 ASR3= 27.1 ASR4= 20.8 ASR5= 22.9 ASR6= 22.9 (8-hours averaging time)	100	124.99	124.95	124.89	124.80	124.74	710 µg/m³ (0.51ppm)	39,000 µg/m3 (27 ppm)	71,000 µg/m³ (50 ppm)

Note: Each floor is assumed to be 3 m in height and the breathing zone is about 1.5 m from each floors

Figure 22: Predicted 1-hour Maximum Average Incremental Concentrations for SO_2 at Individual Level of Flagpole Receptors during Abnormal Operation (in µg/m³)



	Level 1	Level 2	Level 3	Level 4	Level 5
100 % SO2	2247.05	2246.40	2245.25	2243.62	2242.57
99.98 % SO2	600.15	592.22	585.61	579.88	574.94
AEGL-1	520	520	520	520	520
AEGL-2	1950	1950	1950	1950	1950

Figure 23: Predicted 1-hour Maximum Average Incremental Concentrations for H_2S at Individual Level of Flagpole Receptors during Abnormal Operation (in µg/m³)

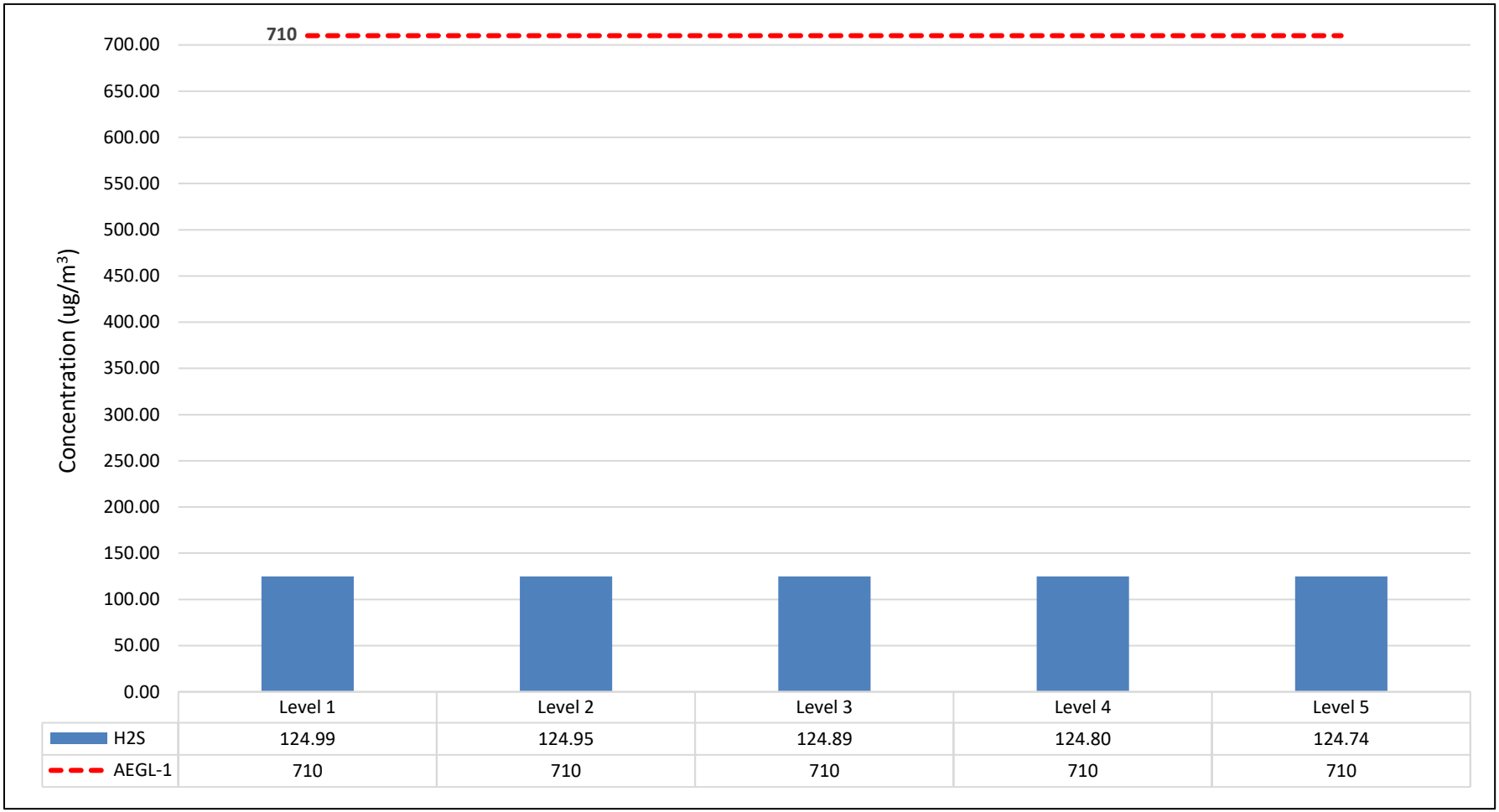
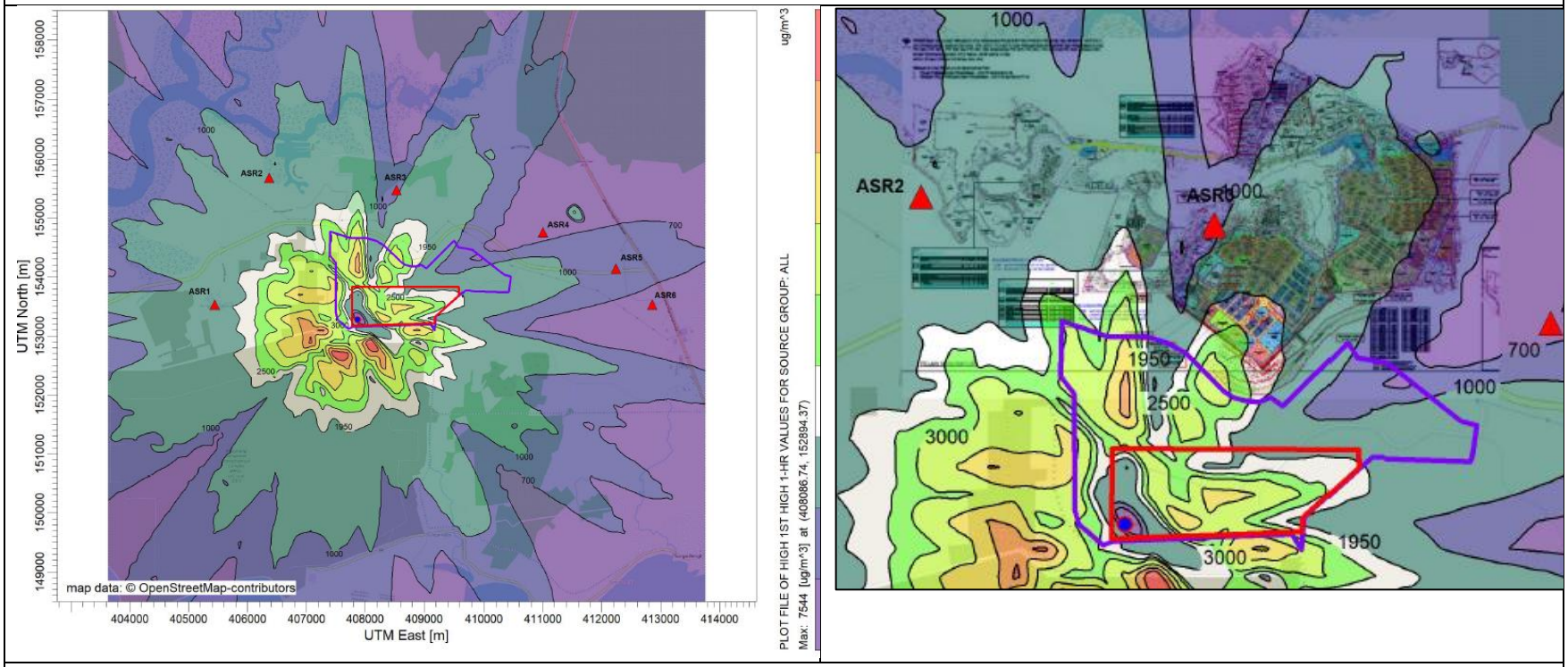


Figure 24: Predicted Maximum 1-hour Average Incremental Concentration of SO_2 during Abnormal Situation

100% Percentile



99.98% Percentile

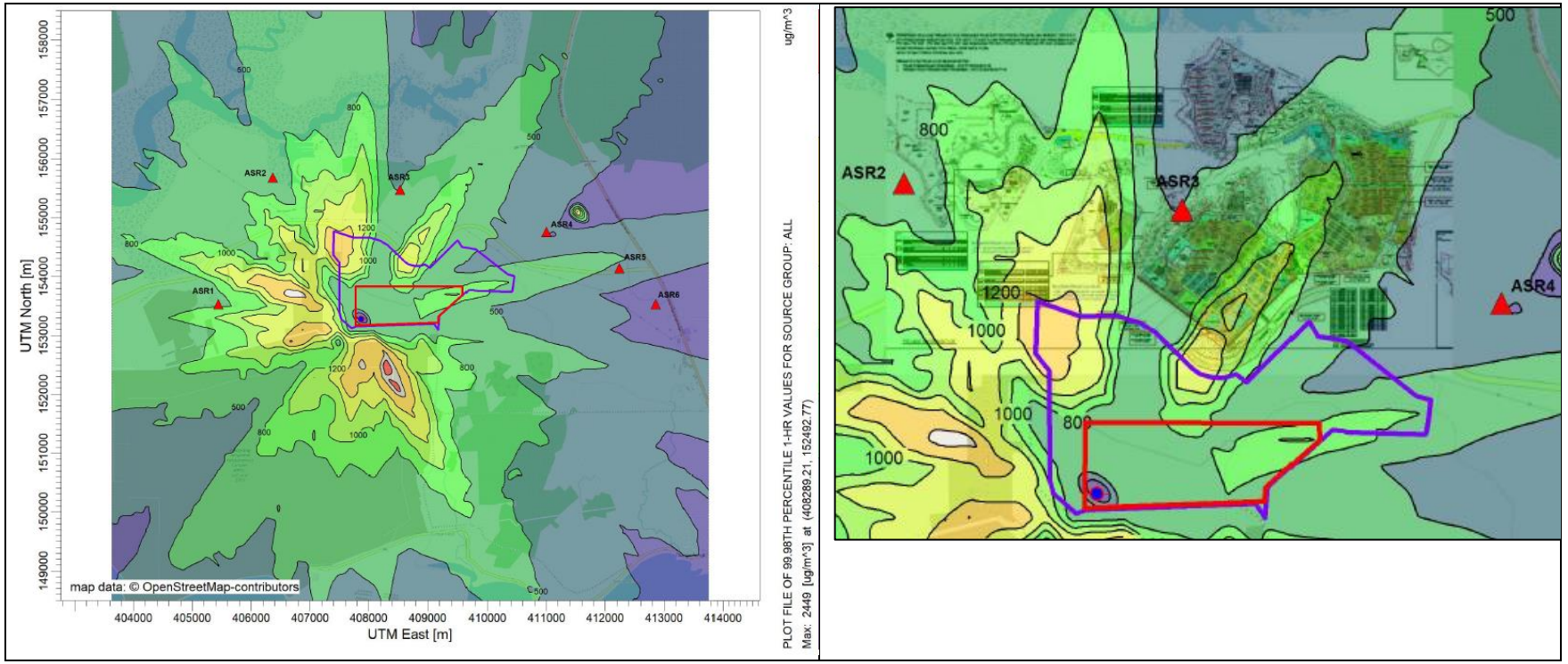
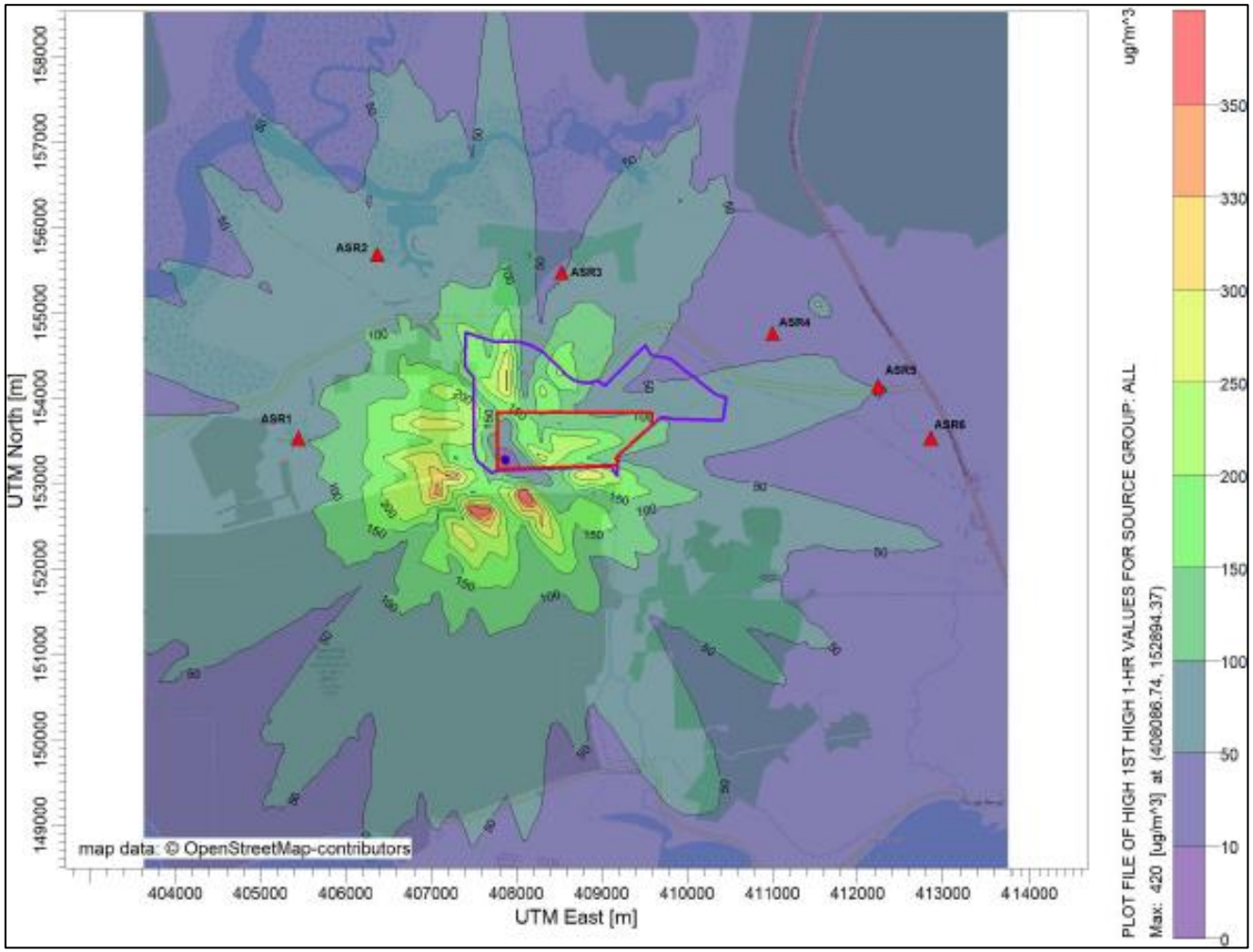

UTM North [m]
UTM East [m]
ug/m^3
PLOT FILE OF 99.98TH PERCENTILE 1-HR VALUES FOR SOURCE GROUP: ALL
Max: 2449 [ug/m^3] at (408289.21, 152492.77)
map data: © OpenStreetMap-contributors
ASR1
ASR2
ASR3
ASR4
ASR5
ASR6
500
800
1000
1200

Figure 25: Predicted Maximum 1-hour Average Incremental Concentration of H_2S during Abnormal Situation



3. MITIGATION MEASURES

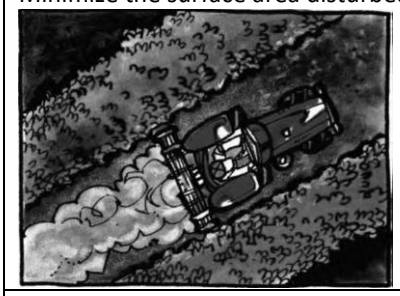
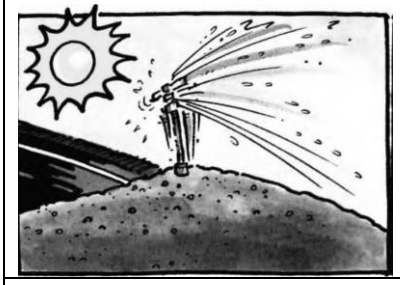
3.1 During Construction Period

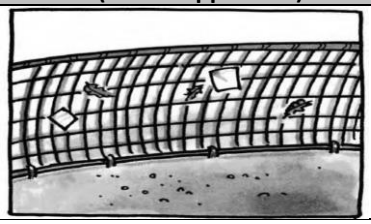
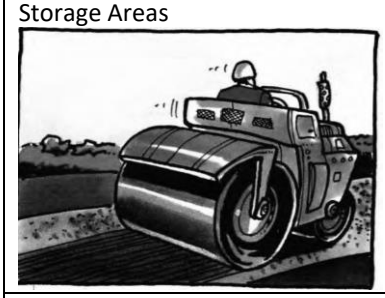
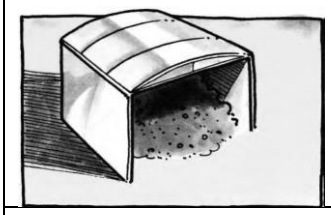
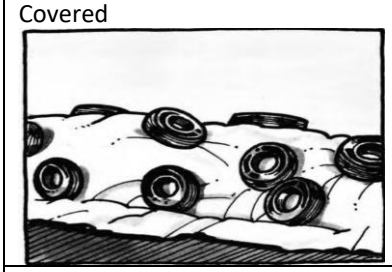
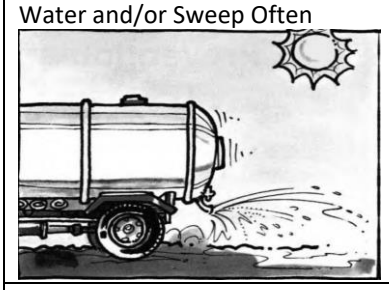
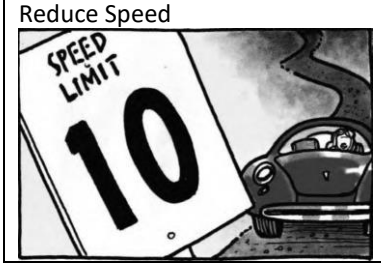
The industrial park developer will hand over the Project Site at the required platform. Hence, for the Project, no major earthwork will be carried out within the Project Site. Nevertheless, in order to minimize the fugitive dust generation during the construction period, where applicable, the following mitigating measures can be adopted by the Project Proponent:

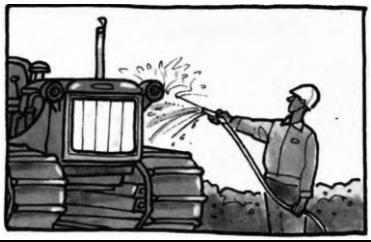
- Fenced construction area to reduce wind-blown dust dispersion and dust clouds;
- The heights from which materials are dropped should be reduced to a practical minimum height to control fugitive dust emissions arising during material handling;
- Ensure construction access or haulage route are kept damp by water browser or equivalent measures on regular basis during the whole construction period. As a rule of thumb, water spraying should be conducted at least every 2 hours during hot and dry conditions when evaporation of water is greatest (Hong Kong Construction Association, 2013). More frequent water spraying should be conducted as when necessary;
- All dusty materials should be sprayed with water prior to any loading, unloading or transfer operation so as to maintain the dusty materials wet;
- The load carried by the vehicle off-site should be covered by clean impervious sheeting to ensure that the dusty materials do not leak from the vehicle;
- Wash trough for wheel washing to be constructed at the entrance of each access road. All construction vehicles shall have their wheels washed before leaving or entering the site onto a public road;
- Areas cleared for open spaces shall be turfed as soon as possible;
- All vehicle within the Project Site to adhere to the speed limit of 25 km/hr;
- All stockpile construction material that could generate fugitive dust during high wind speed such as fine sand and aggregate to be covered when not in used or during high wind speed;
- Fuel-efficient and well-maintained haulage trucks will be used to minimize exhaust emissions. Smoke belching vehicles and equipment shall not be allowed and shall be removed from the Project Site;
- Undertake immediate repairs of any malfunctioning construction vehicles and equipment;
- Idling of engines shall be discouraged;
- To maintain good housekeeping at the Project area, a good housekeeping checklist for managing construction dust can be developed by the Project Proponent as part of its periodic internal environmental auditing for the Project;
- Installation and operation of portable generator set or other fuel burning equipment should comply with the requirements of the *Environmental Quality (Clean Air) Regulations 2014 (CAR 2014)*;
- No open burning of material should be carried out at all times and this activity is strictly prohibited under the *Environmental Quality (Prescribed Activity) (Open Burning) Order 2003*; and

- Where applicable, Project Proponent to adopt Best Management Practices (BMPs) for control of fugitive dust during construction activity as suggested in Table 13.

Table 13: Best Management Practices (BMPs) for Control of Fugitive Dust during Construction Activity

Best Management Practice (where applicable)	Description
Minimize the surface area disturbed 	The less ground disturb, the less dust will rise in every works and less clean up works needed.
Limit dusty work on windy days 	Land clearing activity shall be on hold and stockpiles shall be covered.
Apply dust suppression measures when needed 	Even if the regular schedule is thrown off. It may be a one-time occurrence, or the schedule may need adjusting to more frequent application intervals.
Clean Up Those Dusty Spills Immediately 	Don't wait for the next scheduled housekeeping - the mess will just get bigger and will take longer.
Grow Vegetative Ground Cover 	Growing grasses or legumes is the most effective, easiest and most economical control because these plants provide a dense, complete cover. Even when the vegetation dries up, the roots will help hold the soil in place.
Use Wind Erosion Controls	Plant bushes or trees, erect wood or rock walls or earthen banks as permanent wind-breaks, or install porous wind fences as more temporary

Best Management Practice (where applicable)	Description
	measures. Using controls with 50% porosity is ideal; the reduced wind velocity provided allows larger particles to settle to the ground.
Pave Haul Roads and Storage Areas 	Heavy vehicles pulverize the surface material and create a constant source of dust. If wholesale paving is too costly, pave just the entrance and exit to minimize carryout, and gravel the remainder to reduce the amount of surface silt.
Enclose Storage, Handling Areas 	If dusty materials are frequently loaded and unloaded. Storage silos, 3-sided bunkers and open-ended buildings are some enclosures used. If handling is less frequent, wind fencing can be used. Conveyor loading may require enclosure or the use of water spray bars both above and below the belt surface to reduce emissions.
Keep Storage Piles Covered 	Piles should be covered with a physical cover or with a dust suppressant spray. Limit the working face of the pile to the downwind side. Most emissions come from loading the pile, load out from the pile, and truck and loader traffic in the immediate area, if the pile is batch loaded. Keep the drop height low to reduce dust, and keep the ground at the base of the pile clear of spills.
Water and/or Sweep Often 	Ensure that vehicle traffic is not picking up dust for wind action and carryout. Fewer treatments are necessary in cool, wet weather. "Reasonable dust control measures" are required by some local fugitive dust rules, as are an adequate water supply and keeping dust control equipment in good working order.
Reduce Speed 	Speed Limits on unpaved surfaces to 10 or 15 miles per hour (~15 or ~25 km per hour) for well-travelled areas and heavy vehicles, never to exceed 25 mph (~40 kmph) for any vehicle on any unpaved surface.

Best Management Practice (where applicable)	Description
Minimize Trips 	Minimize trips by carpooling and grouping jobs and errands. Keep exposed areas adjacent to roads undisturbed by posting, fencing, installing gates or otherwise limiting access to vehicle traffic.
Prevent Transport of Dusty Material Offsite 	Rinsing vehicles before they leave the property and tightly covering loaded trucks.

Source: Modified and adapted from California Environmental Protection Agency (2007)

In addition to the above BMPs, the Project Proponent shall also refer to the DOE Malaysia issued guidance document for mitigation of fugitive emission under the *Environmental Quality (Clean Air) Regulations 2014.* The guidance document is entitled "Guidance Document on Fugitive Emission Control".

3.2 During Construction Period

Mitigating measures that should be adopted by the Project Proponent for the Project are as follows:

- The design of all proposed stacks, flare and air pollution control systems should be guided by the Guidance Document on Fuel Burning Equipments and Air Pollution Control Systems issued by DOE Malaysia under the *Environmental Quality (Clean Air) Regulations 2014*.
- The emission concentrations for the prescribed pollutants shall comply with *Environmental Quality (Clean Air) Regulations, 2014* as per the following:
    - Third Schedule [Regulation 13]: Limit Values and Technical Standards (By Activity or Industry): E. Oil and Gas Industries: Refineries (All Sizes): Natural Gas Processing and Storage and Handling of Petroleum Products; and
    - Third Schedule [Regulation 13]: Limit Values and Technical Standards (By Activity or Industry): A. Heat and Power Generation: 1. Boilers under Gaseous Fuels.
- Prior to any installation of fuel burning equipment and air pollution control system, written notification as required under Regulations 5 the above said regulations shall be carried out by submission to the state DOE as per the following:
    - AS/PUB/N-CHIMNEY form: Written Notification on Installation of Exhaust/Vent;
    - AS/PUB/N-APB form: Written Notification on Air Emission Sources (Fuel Burning Equipment);
    - AS/PUB/N-SCRUBBER form: Written Notification on Air Emission Sources (Air Pollution Control System (Scrubber)); and/or

- Other relevant forms issued by DOE Malaysia.

Upon completion of the installation of the equipment, a written declaration shall be submitted to state DOE under Regulation 7(5).

- Installation of Continuous Emission Monitoring System (CEMS) shall be guided by the following guidelines:
  - Volume I- Guideline for the Installation and Maintenance of Continuous Emission Monitoring Systems (CEMS) for Industrial Premises/Facilities; and
  - Volume II-Guideline for the Continuous Emission Monitoring Systems-Data Interface Systems (CEMS-DIS) for Industrial Premises/Facilities.
- Leakage Detection And Repair (LDAR) programme shall be implemented in the facility as required under the Environmental Quality (Clean Air) Regulations 2014 as prescribed in Note 6 of the Third Schedule [Regulation 13]: Limit Values and Technical Standards (By Activity or Industry): E. Oil and Gas Industries: Refineries (All Sizes); Natural Gas Processing and Storage; and Handling of Petroleum Products of the said regulations. Note 6 is read as "For compliance check a "Leakage Detection and Repair Programme" shall be implemented as outlined in the Guidance Document on Leak Detection and Repair in a manner as specified and approved by the Director General.
- The fugitive emissions of volatile organic substances within the facility shall be minimized according to the Best Available Techniques Guidance Document on Storage and Handling of Petroleum Products issued by DOE Malaysia under the CAR 2014
- As prescribed in Second Schedule [Regulation 13]: Limit Values and Technical Standards (General): (III) Control of fugitive emissions of the Environmental Quality (Clean Air) Regulations 2014, the control of fugitive emissions of non-methane volatile organic compound (NMVOC) shall be minimized in accordance to the Guidance Document on Fugitive Emission Control.
- All internal roads used for the movement of vehicular movements should be paved with suitable material to suppress or minimize dust generation along the roads.

In addition, the Project Proponent will design the Plant in accordance to the World Bank Group's guidelines entitled "Environmental, Health and Safety Guidelines for Petroleum Refining (November 17, 2016)".

Based on the result of the impact assessment of SO_2 to the surrounding air sensitive receptor during abnormal situation i.e. with flaring, attention shall be given to the design of the proposed flare. The following pollution prevention and control measures as recommended in the World Bank Group's guidelines, where appropriate, should be considered for gas flaring:

- Implementing source gas reduction measures to the maximum extent possible;
- Using efficient flare tips (i.e., optimal released gas sonic velocity, in order to avoid malfunctioning of the flare due to its flame off), and optimization of the size and number of burner nozzles (not less than three, which will ensure—acting as pilot burners, positioned 120° from each other—the continuity of flaring);
- Maximizing flare combustion efficiency by controlling and optimizing flare fuel/air/steam flow rates to ensure the correct ratio of assist stream to flare stream;
- Minimizing flaring from purges and pilots, without compromising safety, through measures including the installation of purge gas reduction devices, flare gas recovery units (mainly for continuous or predictable

releases), an upstream knock-out drum (vapour–liquid separator used to avoid entrainment of liquid to the flare stack), soft-seat valve technology (where appropriate), conservation pilots, the use of inert purge gas, and the diversion of flows into the refinery fuel gas distribution network;

- Minimizing the risk of pilot blow-out by ensuring sufficient exit tip velocity and providing wind guards;
- Using a reliable pilot auto-ignition system;
- Installing high-integrity instrument pressure protection systems, where appropriate, to reduce over-pressure events and avoid or reduce flaring situations;
- Minimizing liquid carry-over and entrainment in the gas flare stream with a suitable liquid separation system;
- Minimizing flame lift (flash off) and flame lick (flash back);
- Operating flares to control odour and visible smoke emissions using suitable optical instruments, such as flame detectors, which act on the steam injection in case of black smoke at tip;
- Locating flares at a safe distance from local communities and the workforce, including workers' accommodation units;
- Implementing burner maintenance planning and replacement programs to ensure continuous maximum flare efficiency;
- Metering flare gas on a monthly basis in the interest of pollution evaluation, mainly in terms of CO_2 and SO_2, as well as of released heat (which is an indirect estimation of the greenhouse gas (GHG) emissions);
- Avoiding over-steaming, as too much steam in a flare will reduce flare performance;
- Avoiding a wake-dominated flame. A strong crosswind at high velocity can have a powerful effect on the flare's flame dimensions and shape, causing the flame to be wake-dominated (i.e., the flame is bent over on the downwind side of a flare and imbedded in the wake of the flare tip), reducing flare performance and potentially damaging the flare tip; and
- Avoiding flame lift-off, a condition in which a flame separates from the tip of the flare and there is space between the flare tip and the bottom of the flame due to excessive air induction as a result of the flare gas and center steam exit velocities. This type of flame can reduce flare performance and can progress to a condition where the flame becomes completely extinguished.

APPENDIX D

E S Laboratories (M) Sdn. Bhd. (251842-A)

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Certificate of Analysis

Registration No. : L-KL-JQ1904NES - 0243
Company : EnviroSolutions & Consulting Sdn. Bhd.
Project : Pengerang, Johor
Sampling Date : 10th to 12th April 2019
Receiving Date : 15th April 2019
Reporting Date : 16th April 2019
Sample Marking :
1. A1 : At an open space within Sebana Golf Resort [N 01° 32' 1.09" E 103° 31' 0.03"]
2. A2 : At an open space within Kampung Lepau [N 01° 31' 54.66" E 103° 31' 1.50"]
3. A3 : At an open space southern boundary of PEC [N 01° 32' 14.4" E 103° 30' 43.5"]
4. A4 : At an open space within Bukit Pelali [N 01° 31' 26.04" E 103° 30' 55.63"]

Result(s) of analysis:-

Parameters	Results				Malaysian Ambient Air Quality Standard	Method Used
	A1	A2	A3	A4		
Particulate Matter 10µm (PM10) (ug/m³)	78	93	56	14	120 µg/m³ (24 hours averaging time)	In-House method(ESL/F/A-06) based on manufacturer's measurement procedures (Minivol™ TAS)
Particulate Matter 2.5µm (PM2.5) (ug/m³)	23	66	43	8	50 µg/m³ (24 hours averaging time)	
Carbon Monoxide as CO (mg/m³)	0.8	1.4	0.8	0.8	10 mg/m³ (8 hours averaging time)	ASTM D4599-14
Sulphur Dioxide as SO_2 (ug/m³)	<5	<5	<5	<5	90 µg/m³ (24 hours averaging time)	ASTM D 2914, 1993
Nitrogen Dioxide as NO_2 (ug/m³)	10	9	<5	8	75 µg/m³ (24 hour averaging time)	ASTM D 1607, 1991

.....
Ong Poh Cheng
MMIC MI429/2600/1995
(Lab Manager)

Note:
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2. *ASTM means Annual Book of ASTM Standards by American Society for Testing and Materials.*
3. *Malaysian Ambient Air Quality Standard means parameters limits stipulated in the Malaysian Ambient Air Quality Standard by Department of Environment (DOE)*
4. *"<" means less than the minimum detectable limit or "not detected".*

Attention **Ms. Chuah Li Mor**
Address **EnviroSolutions & Consulting Sdn. Bhd.**
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Damansara Utama,
47400 Petaling Jaya,
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Certificate of Analysis

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Company : EnviroSolutions & Consulting Sdn. Bhd.
Project : Pengerang, Johor
Sampling Date : 10th to 12th April 2019
Receiving Date : 15th April 2019
Reporting Date : 16th April 2019
Sample Marking :
5. A1 : At an open space Northwest of the Project boundary [N 01° 32' 1.09" E 103° 31' 0.03"]
6. A2 : At an open space Southeast of the Project boundary [N 01° 31' 54.66" E 103° 31' 1.50"]
7. A3 : At an open space nearest house at Kg. Ayer Putih [N 01° 32' 14.4" E 103° 30' 43.5"]
8. A4 : At an open space nearest house at Taman Desa Damai [N 01° 31' 26.04" E 103° 30' 55.63"]

Result(s) of analysis:-

Parameters	Results				Malaysian Ambient Air Quality Standard	Method Used
	A5	A6	A7	A8		
Particulate Matter 10µm (PM10) (ug/m³)	32	40	41	51	120 µg/m³ (24 hours averaging time)	In-House method(ESL/F/A-06) based on manufacturer's measurement procedures (Minivol™ TAS)
Particulate Matter 2.5µm (PM2.5) (ug/m³)	27	18	39	6	50 µg/m³ (24 hours averaging time)	
Carbon Monoxide as CO (mg/m³)	2.6	2.3	1.1	1.1	10 mg/m³ (8 hours averaging time)	ASTM D4599-14
Sulphur Dioxide as SO_2 (ug/m³)	<5	<5	<5	<5	90 µg/m³ (24 hours averaging time)	ASTM D 2914, 1993
Nitrogen Dioxide as NO_2 (ug/m³)	<5	<5	<5	<5	75 µg/m³ (24 hour averaging time)	ASTM D 1607, 1991

.....
Ong Poh Cheng
MMIC M1429/2600/1995
(Lab Manager)

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STANDARDS MALAYSIA ACCREDITED LABORATORY
MS ISO/IEC 17025 TESTING
SAMM NO. 076

Certificate of Analysis

Registration No. : L-KL-JQ1904NES - 0583
Company : EnviroSolutions & Consulting Sdn. Bhd.
Project : Pengerang, Johor
Sampling Date : 29th April to 1st May 2019
Receiving Date : 2nd May 2019
Reporting Date : 14th May 2019
Sample Marking :
1. A1 : At an open space within Sebana Golf Resort [N 01° 32' 1.09" E 103° 31' 0.03"]
2. A2 : At an open space within Kampung Lepau [N 01° 31' 54.66" E 103° 31' 1.50"]
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4. A4 : At an open space within Bukit Pelali [N 01° 31' 26.04" E 103° 30' 55.63"]

Result(s) of analysis:-

Parameters	Results				Malaysian Ambient Air Quality Standard	Method Used
	A1	A2	A3	A4		
Particulate Matter 10µm (PM10) (ug/m³)	43	38	62	32	120 µg/m³ (24 hours averaging time)	In-House method(ESL/F/A-06) based on manufacturer's measurement procedures (Minivol™ TAS)
Particulate Matter 2.5µm (PM2.5) (ug/m³)	29	21	29	19	50 µg/m³ (24 hours averaging time)	
Carbon Monoxide as CO (mg/m³)	0.8	1.1	1.4	2.3	10 mg/m³ (8 hours averaging time)	ASTM D4599-14
Sulphur Dioxide as SO_2 (ug/m³)	<5	<5	<5	<5	90 µg/m³ (24 hours averaging time)	ASTM D 2914, 1993
Nitrogen Dioxide as NO_2 (ug/m³)	<5	<5	<5	<5	75 µg/m³ (24 hour averaging time)	ASTM D 1607, 1991

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Ong Poh Cheng
MMIC M1429/2600/1995
(Lab Manager)

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8. A4 : At an open space nearest house at Taman Desa Damai [N 01° 31' 26.04" E 103° 30' 55.63"]

Result(s) of analysis:-

Parameters	Results				Malaysian Ambient Air Quality Standard	Method Used
	A5	A6	A7	A8		
Particulate Matter 10µm (PM10) (ug/m³)	65	42	41	48	120 µg/m³ (24 hours averaging time)	In-House method(ESL/F/A-06) based on manufacturer's measurement procedures (Minivol™ TAS)
Particulate Matter 2.5µm (PM2.5) (ug/m³)	37	24	20	18	50 µg/m³ (24 hours averaging time)	
Carbon Monoxide as CO (mg/m³)	2.6	2.9	0.8	1.1	10 mg/m³ (8 hours averaging time)	ASTM D4599-14
Sulphur Dioxide as SO_2 (ug/m³)	<5	<5	<5	<5	90 µg/m³ (24 hours averaging time)	ASTM D 2914, 1993
Nitrogen Dioxide as NO_2 (ug/m³)	<5	<5	<5	<5	75 µg/m³ (24 hour averaging time)	ASTM D 1607, 1991

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MMIC M1429/2600/1995
(Lab Manager)

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Result(s) of analysis:-

Parameters	Results				Malaysian Ambient Air Quality Standard	Method Used
	A1	A2	A3	A4		
Particulate Matter 10µm (PM10) (ug/m³)	43	38	62	32	120 µg/m³ (24 hours averaging time)	In-House method(ESL/F/A-06) based on manufacturer's measurement procedures (Minivol™ TAS)
Particulate Matter 2.5µm (PM2.5) (ug/m³)	29	21	29	19	50 µg/m³ (24 hours averaging time)	
Carbon Monoxide as CO (mg/m³)	0.8	1.1	1.4	2.3	10 mg/m³ (8 hours averaging time)	ASTM D4599-14
Sulphur Dioxide as SO_2 (ug/m³)	<5	<5	<5	<5	90 µg/m³ (24 hours averaging time)	ASTM D 2914, 1993
Nitrogen Dioxide as NO_2 (ug/m³)	<5	<5	<5	<5	75 µg/m³ (24 hour averaging time)	ASTM D 1607, 1991

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Ong Poh Cheng
MMIC M1429/2600/1995
(Lab Manager)

Note:
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4. *"<" means less than the minimum detectable limit or "not detected".*

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STANDARDS MALAYSIA ACCREDITED LABORATORY
MS ISO/IEC 17025 TESTING SAMM NO. 076

Certificate of Analysis

Registration No. : L-KL-JQ1904NES - 0583
Company : EnviroSolutions & Consulting Sdn. Bhd.
Project : Pengerang, Johor
Sampling Date : 29th April to 1st May 2019
Receiving Date : 2nd May 2019
Reporting Date : 14th May 2019
Sample Marking :
5. A1 : At an open space Northwest of the Project boundary [N 01° 32' 1.09" E 103° 31' 0.03"]
6. A2 : At an open space Southeast of the Project boundary [N 01° 31' 54.66" E 103° 31' 1.50"]
7. A3 : At an open space nearest house at Kg. Ayer Putih [N 01° 32' 14.4" E 103° 30' 43.5"]
8. A4 : At an open space nearest house at Taman Desa Damai [N 01° 31' 26.04" E 103° 30' 55.63"]

Result(s) of analysis:-

Parameters	Results				Malaysian Ambient Air Quality Standard	Method Used
	A5	A6	A7	A8		
Particulate Matter 10µm (PM10) (ug/m³)	65	42	41	48	120 µg/m³ (24 hours averaging time)	In-House method(ESL/F/A-06) based on manufacturer's measurement procedures (Minivol™ TAS)
Particulate Matter 2.5µm (PM2.5) (ug/m³)	37	24	20	18	50 µg/m³ (24 hours averaging time)	
Carbon Monoxide as CO (mg/m³)	2.6	2.9	0.8	1.1	10 mg/m³ (8 hours averaging time)	ASTM D4599-14
Sulphur Dioxide as SO_2 (ug/m³)	<5	<5	<5	<5	90 µg/m³ (24 hours averaging time)	ASTM D 2914, 1993
Nitrogen Dioxide as NO_2 (ug/m³)	<5	<5	<5	<5	75 µg/m³ (24 hour averaging time)	ASTM D 1607, 1991

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Ong Poh Cheng
MMIC M1429/2600/1995
(Lab Manager)

Note:

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Certificate of Analysis

Registration No. : L-KL-JQ1906NES - 0309
Company : EnviroSolutions & Consulting Sdn. Bhd.
Project : Pengerang, Johor
Sampling Date : 20th June 2019
Receiving Date : 26th June 2019
Reporting Date : 28th June 2019
Sample Marking :
1. A1 : At an open space within Sebana Golf Resort [N 01° 32' 1.09" E 103° 31' 0.03"]
2. A2 : At an open space within Kampung Lepau [N 01° 31' 54.66" E 103° 31' 1.50"]
3. A3 : At an open space southern boundary of PEC [N 01° 32' 14.4" E 103° 30' 43.5"]
4. A4 : At an open space within Bukit Pelali [N 01° 31' 26.04" E 103° 30' 55.63"]

Result(s) of analysis:-

Parameters	Results				Malaysian Ambient Air Quality Standard	Method Used
	A1	A2	A3	A4		
Hydrogen Sulphide as H_2S ($\mu g/m^3$)	<10	<10	<10	<10	-	APHA 701, 1989

.....
Ong Poh Cheng
MMIC M1429/2600/1995
(Lab Manager)

Note:
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3. *"<" means less than the minimum detectable limit or "not detected".*

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Certificate of Analysis

Registration No. : L-KL-JQ1906NES - 0309
Company : EnviroSolutions & Consulting Sdn. Bhd.
Project : Pengerang, Johor
Sampling Date : 20th June 2019
Receiving Date : 26th June 2019
Reporting Date : 28th June 2019
Sample Marking :

5. A5 : At an open space Northwest of the Project boundary [N 01° 32' 1.09" E 103° 31' 0.03"]
6. A6 : At an open space Southeast of the Project boundary [N 01° 31' 54.66" E 103° 31' 1.50"]
7. A7 : At an open space nearest house at Kg. Ayer Putih [N 01° 32' 14.4" E 103° 30' 43.5"]
8. A8 : At an open space nearest house at Taman Desa Damai [N 01° 31' 26.04" E 103° 30' 55.63"]

Result(s) of analysis:-

Parameters	Results				Malaysian Ambient Air Quality Standard	Method Used
	A5	A6	A7	A8		
Hydrogen Sulphide as H_2S ($\mu g/m^3$)	<10	<10	<10	<10	-	APHA 701, 1989

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Ong Poh Cheng
MMIC M1429/2600/1995
(Lab Manager)

Note:

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E S Laboratories (M) Sdn. Bhd. (251842-A)

No. 18, Jalan Tago 11, Tago Industrial Park, Sri Damansara, 52200 Kuala Lumpur, Malaysia.
Tel: 03-62734940 Fax: 03-62722940 E-mail: general@esm.com.my Website: www.esm.com.my

STANDARDS MALAYSIA ACCREDITED LABORATORY
MS ISO/IEC 17025 TESTING
SAMM NO. 076

Certificate of Analysis

Registration No. : L-KL-JQ1907NES - 0335
Company : EnviroSolutions & Consulting Sdn. Bhd.
Project : Pengerang, Johor
Sampling Date : 15th to 17th July 2019
Receiving Date : 18th July 2019
Reporting Date : 19th July 2019
Sample Marking :
1. A1 : At an open space within Sebana Golf Resort [N 01° 24' 23.4" E 104° 10' 40"]
2. A2 : At an open space within Kampung Lepau [N 01° 23' 20" E 104° 09' 00"]
3. A3 : At an open space southern boundary of PEC [N 01° 23' 05" E 104° 10' 40"]
4. A4 : At an open space within Bukit Pelali [N 01° 24' 00" E 104° 12' 00"]

Result(s) of analysis:-

Parameters	Results				Malaysian Ambient Air Quality Standard	Method Used
	A1	A2	A3	A4		
Particulate Matter 2.5µm (PM2.5) (ug/m³)	25	16	37	26	50 µg/m³ (24 hours averaging time)	In-House method(ESL/F/A-06) based on manufacturer's measurement procedures (Minivol™ TAS)
*Hydrogen Sulphide as H_2S (µg/m³)	<10	<10	<10	<10	-	ISC 701, 1989

.....
Ong Poh Cheng
MMIC M 429/2600/1995
(Lab Manager)

Note:

1. *The results reported relate only to the item tested as per the details given in this COA.*
2. *ISC – Method of Air Sampling and Analysis by Intersociety Committee*
3. *Malaysian Ambient Air Quality Standard means parameters limits stipulated in the Malaysian Ambient Air Quality Standard by Department of Environment (DOE)*
4. *"<" means less than the minimum detectable limit or "not detected".*
5. *(*) means Not SAMM Accredited*

Attention : **Ms. Chuah Li Mor**
Address : **EnviroSolutions & Consulting Sdn. Bhd.**
65B Jalan SS21/60,
Damansara Utama,
47400 Petaling Jaya,
Selangor darul Ehsan.

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Tel: 03-62734940 Fax: 03-62722940 E-mail: general@esm.com.my Website: www.esm.com.my

STANDARDS MALAYSIA ACCREDITED LABORATORY
MS ISO/IEC 17025
TESTING
SAMM NO. 076

Certificate of Analysis

Registration No. : L-KL-JQ1907NES - 0335
Company : EnviroSolutions & Consulting Sdn. Bhd.
Project : Pengerang, Johor
Sampling Date : 15th to 18th July 2019
Receiving Date : 18th July 2019
Reporting Date : 19th July 2019
Sample Marking :
5. A5 : At an open space Northwest of the Project boundary [N 01° 23' 40" E 104° 12' 40"]
6. A6 : At an open space Southeast of the Project boundary [N 01° 23' 20" E 104° 13' 00"]
7. A7 : At an open space nearest house at Kg. Ayer Putih [N 01° 24' 30" E 104° 09' 30"]
8. A8 : At an open space nearest house at Taman Desa Damai [N 01° 23' 30" E 104° 10' 50"]

Result(s) of analysis:-

Parameters	Results				Malaysian Ambient Air Quality Standard	Method Used
	A5	A6	A7	A8		
Particulate Matter 2.5µm (PM2.5) (ug/m³)	38	26	31	33	50 µg/m³ (24 hours averaging time)	In-House method(ESL/F/A-06) based on manufacturer's measurement procedures (Minivol™ TAS)
*Hydrogen Sulphide as H_2S (µg/m³)	<10	<10	<10	<10	-	ISC 701, 1989

.....
Ong Poh Cheng
MMIC M1429/2600/1995
(Lab Manager)

Note:

1. *The results reported relate only to the item tested as per the details given in this COA.*
2. *ISC – Method of Air Sampling and Analysis by Intersociety Committee*
3. *Malaysian Ambient Air Quality Standard means parameters limits stipulated in the Malaysian Ambient Air Quality Standard by Department of Environment (DOE)*
4. *"<" means less than the minimum detectable limit or "not detected".*
5. *(*) means Not SAMM Accredited*

Attention : **Ms. Chuah Li Mor**
Address : **EnviroSolutions & Consulting Sdn. Bhd.**
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ALS TECHNICHEM (M) SDN BHD

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ALS Technichem

CERTIFICATE OF ANALYSIS

DATE : 18 October 2018

OUR REF. : JB1804215

COMPANY : ENVIROSOLUTIONS & CONSULTING SDN BHD.
No 65b, Jalan SS21/60,
Damandara Utama
47400 Petaling Jaya, Selangor
(Attn.: Ms Chuah Li Mor)

PROJECT : Environmental Impact Assessment (EIA) of the Pengerang Energy Complex, Johor for Chemone Holdings Pte Ltd

DATE RECEIVED: 8th October 2018

SAMPLING DATE: 24th September to 6th October 2018

ANALYSIS RESULTS
(As per sample)

MONITORING : Ambient Air Monitoring

Sampling Points	Sample ID	Sampling Date
A1	JB1804215	4 October 2018
A2		1 October 2018
A3		25 September 2018
A4		2 October 2018
A5		5 October 2018
A6		3 October 2018
A7		24 September 2018
A8		26 September 2018

Muhamad Farid Bin Mohammed Noh
Project Chemist
BSc. (Hons) Chem, MSc. (Environmental), MMIC
IKM No. : M/4344/7239/15

BRANCH & COLLECTION CENTRE:

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40150 Shah Alam, Selangor.
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(KK): Mezzanine Floor, No.3, Lot 5, Lorong Kilang (SLIE),
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CERTIFICATE OF ANALYSIS

DATE : 18 October 2018

OUR REF. : JB1804215

RESULTS
(As per sample)

Parameter	Duration	Unit	LOR*	Results			
				A1	A2	A3	A4
Particulate Matter (PM_{10})	24 hrs	µg/m³	1	278	139	125	97
Particulate Matter ($PM_{2.5}$)	24 hrs	µg/m³	1	139	97	83	83
Nitrogen Dioxide (NO_2)	1 hr	µg/m³	42	<42	<42	<42	<42
Sulfur Dioxide (SO_2)	1 hr	µg/m³	83	<83	<83	<83	<83
Carbon Monoxide (CO)	1 hr	mg/m³	0.1	<0.1	<0.1	<0.1	<0.1
Carbon Monoxide (CO)	8 hrs	mg/m³	0.1	<0.1	<0.1	<0.1	<0.1
Total Hydrocarbon	8 hrs	µg/m³	104	<104	<104	<104	<104
Volatile Organic Compound (VOCs)	8 hrs	mg/m³	-	ND	ND	ND	ND
Hydrogen Sulphide (H_2S)	8 hrs	µg/m³	2.1	27.1	27.1	25.0	20.8
Ammonia (NH_3)	8 hrs	mg/m³	0.01	<0.01	<0.01	<0.01	<0.01

Remarks:
ND – Not Detected
Methods of sampling;

1) PM_{10} and $PM_{2.5}$ - In-House Method QWI-CH/17-103 refer to NIOSH 0600 method
2) NO_2, SO_2 - In-House Method QWI-CH/17-36 refer to J.P. Lodge 704C and 407
3) CO - Portable Gas Analyzer by MRU Optima 7
4) Total Hydrocarbon – NIOSH1500
5) VOCs – Refer to Method EPA TO -17
6) H_2S – In-House Method QWI-CH/17-102 refer to NIOSH6013
7) NH_3 – In-House Method based on J.P. Lodge 401

Muhamad Farid Bin Mohammed Noh
Project Chemist
BSc. (Hons) Chem, MSc. (Environmental), MMIC
IKM No. : M/4344/7239/15

BRANCH & COLLECTION CENTRE:

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CERTIFICATE OF ANALYSIS

DATE : 18 October 2018

OUR REF. : JB1804215

RESULTS
(As per sample)

Parameter	Duration	Unit	LOR*	Results			
				A5	A6	A7	A8
Particulate Matter (PM_{10})	24 hrs	µg/m³	1	153	97	111	181
Particulate Matter ($PM_{2.5}$)	24 hrs	µg/m³	1	111	83	69	83
Nitrogen Dioxide (NO_2)	1 hr	µg/m³	42	42	42	<42	42
Sulfur Dioxide (SO_2)	1 hr	µg/m³	83	<83	<83	83	<83
Carbon Monoxide (CO)	1 hr	mg/m³	0.1	<0.1	<0.1	<0.1	<0.1
Carbon Monoxide (CO)	8 hrs	mg/m³	0.1	<0.1	<0.1	<0.1	<0.1
Total Hydrocarbon	8 hrs	µg/m³	104	<104	<104	<104	<104
Volatile Organic Compound (VOCs)	8 hrs	mg/m³	-	ND	ND	ND	ND
Hydrogen Sulphide (H_2S)	8 hrs	µg/m³	2.1	22.9	22.9	22.9	35.4
Ammonia (NH_3)	8 hrs	mg/m³	0.01	<0.01	<0.01	<0.01	<0.01

Remarks:
ND – Not Detected
Methods of sampling;

1) PM_{10} and $PM_{2.5}$ - In-House Method QWI-CH/17-103 refer to NIOSH 0600 method
2) NO_2, SO_2 - In-House Method QWI-CH/17-36 refer to J.P. Lodge 704C and 407
3) CO - Portable Gas Analyzer by MRU Optima 7
4) Total Hydrocarbon – NIOSH1500
5) VOCs – Refer to Method EPA TO -17
6) H_2S – In-House Method QWI-CH/17-102 refer to NIOSH6013
7) NH_3 – In-House Method based on J.P. Lodge 401

Muhamad Farid Bin Mohammed Noh
Project Chemist
BSc. (Hons) Chem, MSc. (Environmental), MMIC
IKM No. : M/4344/7239/15

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DATE : 18 October 2018
OUR REF. : JB1804215
PROJECT : Environmental Impact Assessment (EIA) of the Pengerang Energy Complex, Johor
Sample Type : Ambient Air

ALS Technichem

		Lab I.D		001	002	003
		Sample I.D		A1	A2	A3
		Units	LOR			
Method Reference	**Analysis Description**	Date of Analysis		12 October 2018		
USEPA 5030B, 8260B	**Volatile Organic Carbon (VOC)**					
USEPA 5030B, 8260B	**Monocylic Aromatics**					
USEPA 5030B, 8260B	Benzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Toluene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Ethylbenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	m & p-Xylene	ug/m³	21	< 21	< 21	< 21
USEPA 5030B, 8260B	Styrene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	o-Xylene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Isopropylbenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	n-Propylbenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,3,5-Trimethylbenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	sec-Butylbenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,2,4-Trimethylbenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	tert-Butylbenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	p-Isopropyltoluene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	n-Butylbenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	**Oxygenated Compounds**					
USEPA 5030B, 8260B	2-Butanone (MEK)	ug/m³	104	< 104	< 104	< 104
USEPA 5030B, 8260B	4-Methyl-2-pentanone (MIBK	ug/m³	104	< 104	< 104	< 104
USEPA 5030B, 8260B	2-Hexanone (MBK)	ug/m³	104	< 104	< 104	< 104
USEPA 5030B, 8260B	**Fumigants**					
USEPA 5030B, 8260B	2,2-Dichloropropane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,2-Dichloropropane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	cis-1,3-Dichloropropylene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	trans-1,3-Dichloropropylene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,2-Dibromoethane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	**Halogenated Aliphatics**					
USEPA 5030B, 8260B	Dichlorodifluoromethane	ug/m³	104	< 104	< 104	< 104
USEPA 5030B, 8260B	Chloromethane	ug/m³	104	< 104	< 104	< 104
USEPA 5030B, 8260B	Vinyl chloride	ug/m³	104	< 104	< 104	< 104
USEPA 5030B, 8260B	Bromomethane	ug/m³	104	< 104	< 104	< 104
USEPA 5030B, 8260B	Chloroethane	ug/m³	104	< 104	< 104	< 104
USEPA 5030B, 8260B	Trichlorofluoromethane	ug/m³	104	< 104	< 104	< 104
USEPA 5030B, 8260B	1,1-Dichloroethylene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	trans-1,2-Dichloroethylene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,1-Dichloroethane	ug/m³	10	< 10	< 10	< 10

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DATE : 18 October 2018
OUR REF. : JB1804215
PROJECT : Environmental Impact Assessment (EIA) of the Pengerang Energy Complex, Johor
Sample Type : Ambient Air

ALS Technichem

		Lab I.D		001	002	003
		Sample I.D		A1	A2	A3
		Units	LOR			
USEPA 5030B, 8260B	cis-1,2-Dichloroethylene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,1,1-Trichloroethane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,1-Dichloropropylene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Carbon tetrachloride	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,2-Dichloroethane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Trichloroethylene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Dibromomethane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,1,2-Trichloroethane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,3-Dichloropropane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Tetrachloroethylene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,1,1,2-Tetrachloroethane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,1,2,2-Tetrachloroethane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,2,3-Trichloropropane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,2-Dibromo-3-chloropropane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Hexachlorobutadiene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	**Halogenated Aromatics**					
USEPA 5030B, 8260B	Chlorobenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Bromobenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	2-Chlorotoluene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	4-Chlorotoluene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,3-Dichlorobenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,4-Dichlorobenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,2-Dichlorobenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,2,4-Trichlorobenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,2,3-Trichlorobenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	**Trihalomethanes**					
USEPA 5030B, 8260B	Chloroform	ug/m³	42	< 42	< 42	< 42
USEPA 5030B, 8260B	Bromodichloromethane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Dibromochloromethane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Bromoform	ug/m³	10	< 10	< 10	< 10

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DATE : 18 October 2018
OUR REF. : JB1804215
PROJECT : Environmental Impact Assessment (EIA) of the Pengerang Energy Complex, Johor
Sample Type : Ambient Air

ALS Technichem

		Lab I.D		004	005	006
		Sample I.D		A4	A5	A6
		Units	LOR			
Method Reference	**Analysis Description**	Date of Analysis		12 October 2018		
USEPA 5030B, 8260B	**Volatile Organic Carbon (VOC)**					
USEPA 5030B, 8260B	**Monocylic Aromatics**					
USEPA 5030B, 8260B	Benzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Toluene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Ethylbenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	m & p-Xylene	ug/m³	21	< 21	< 21	< 21
USEPA 5030B, 8260B	Styrene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	o-Xylene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Isopropylbenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	n-Propylbenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,3,5-Trimethylbenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	sec-Butylbenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,2,4-Trimethylbenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	tert-Butylbenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	p-Isopropyltoluene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	n-Butylbenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	**Oxygenated Compounds**					
USEPA 5030B, 8260B	2-Butanone (MEK)	ug/m³	104	< 104	< 104	< 104
USEPA 5030B, 8260B	4-Methyl-2-pentanone (MIBK	ug/m³	104	< 104	< 104	< 104
USEPA 5030B, 8260B	2-Hexanone (MBK)	ug/m³	104	< 104	< 104	< 104
USEPA 5030B, 8260B	**Fumigants**					
USEPA 5030B, 8260B	2,2-Dichloropropane	ug/m³	10	< 10	< 10	
USEPA 5030B, 8260B	1,2-Dichloropropane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	cis-1,3-Dichloropropylene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	trans-1,3-Dichloropropylene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,2-Dibromoethane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	**Halogenated Aliphatics**					
USEPA 5030B, 8260B	Dichlorodifluoromethane	ug/m³	104	< 104	< 104	< 104
USEPA 5030B, 8260B	Chloromethane	ug/m³	104	< 104	< 104	< 104
USEPA 5030B, 8260B	Vinyl chloride	ug/m³	104	< 104	< 104	< 104
USEPA 5030B, 8260B	Bromomethane	ug/m³	104	< 104	< 104	< 104
USEPA 5030B, 8260B	Chloroethane	ug/m³	104	< 104	< 104	< 104
USEPA 5030B, 8260B	Trichlorofluoromethane	ug/m³	104	< 104	< 104	< 104
USEPA 5030B, 8260B	1,1-Dichloroethylene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	trans-1,2-Dichloroethylene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,1-Dichloroethane	ug/m³	10	< 10	< 10	< 10

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DATE : 18 October 2018
OUR REF. : JB1804215
PROJECT : Environmental Impact Assessment (EIA) of the Pengerang Energy Complex, Johor
Sample Type : Ambient Air

ALS Technichem

		Lab I.D		004	005	006
		Sample I.D		A4	A5	A6
		Units	LOR			
USEPA 5030B, 8260B	cis-1,2-Dichloroethylene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,1,1-Trichloroethane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,1-Dichloropropylene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Carbon tetrachloride	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,2-Dichloroethane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Trichloroethylene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Dibromomethane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,1,2-Trichloroethane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,3-Dichloropropane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Tetrachloroethylene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,1,1,2-Tetrachloroethane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,1,2,2-Tetrachloroethane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,2,3-Trichloropropane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,2-Dibromo-3-chloropropane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Hexachlorobutadiene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	**Halogenated Aromatics**					
USEPA 5030B, 8260B	Chlorobenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Bromobenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	2-Chlorotoluene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	4-Chlorotoluene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,3-Dichlorobenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,4-Dichlorobenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,2-Dichlorobenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,2,4-Trichlorobenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	1,2,3-Trichlorobenzene	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	**Trihalomethanes**					
USEPA 5030B, 8260B	Chloroform	ug/m³	42	< 42	< 42	< 42
USEPA 5030B, 8260B	Bromodichloromethane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Dibromochloromethane	ug/m³	10	< 10	< 10	< 10
USEPA 5030B, 8260B	Bromoform	ug/m³	10	< 10	< 10	< 10

LOR: Level of Reporting

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DATE : 18 October 2018
OUR REF. : JB1804215
PROJECT : Environmental Impact Assessment (EIA) of the Pengerang Energy Complex, Johor
Sample Type : Ambient Air

ALS Technichem

		Lab I.D		007	008
		Sample I.D		A7	A8
		Units	LOR		
Method Reference	**Analysis Description**	Date of Analysis		12 October 2018	
USEPA 5030B, 8260B	**Volatile Organic Carbon (VOC)**				
USEPA 5030B, 8260B	**Monocylic Aromatics**				
USEPA 5030B, 8260B	Benzene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	Toluene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	Ethylbenzene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	m & p-Xylene	ug/m³	21	< 21	< 21
USEPA 5030B, 8260B	Styrene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	o-Xylene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	Isopropylbenzene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	n-Propylbenzene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	1,3,5-Trimethylbenzene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	sec-Butylbenzene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	1,2,4-Trimethylbenzene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	tert-Butylbenzene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	p-Isopropyltoluene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	n-Butylbenzene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	**Oxygenated Compounds**				
USEPA 5030B, 8260B	2-Butanone (MEK)	ug/m³	104	< 104	< 104
USEPA 5030B, 8260B	4-Methyl-2-pentanone (MIBK	ug/m³	104	< 104	< 104
USEPA 5030B, 8260B	2-Hexanone (MBK)	ug/m³	104	< 104	< 104
USEPA 5030B, 8260B	**Fumigants**				
USEPA 5030B, 8260B	2,2-Dichloropropane	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	1,2-Dichloropropane	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	cis-1,3-Dichloropropylene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	trans-1,3-Dichloropropylene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	1,2-Dibromoethane	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	**Halogenated Aliphatics**				
USEPA 5030B, 8260B	Dichlorodifluoromethane	ug/m³	104	< 104	< 104
USEPA 5030B, 8260B	Chloromethane	ug/m³	104	< 104	< 104
USEPA 5030B, 8260B	Vinyl chloride	ug/m³	104	< 104	< 104
USEPA 5030B, 8260B	Bromomethane	ug/m³	104	< 104	< 104
USEPA 5030B, 8260B	Chloroethane	ug/m³	104	< 104	< 104
USEPA 5030B, 8260B	Trichlorofluoromethane	ug/m³	104	< 104	< 104
USEPA 5030B, 8260B	1,1-Dichloroethylene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	trans-1,2-Dichloroethylene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	1,1-Dichloroethane	ug/m³	10	< 10	< 10

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Sample Type : Ambient Air

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		Sample I.D		A7	A8
		Units	LOR		
USEPA 5030B, 8260B	cis-1,2-Dichloroethylene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	1,1,1-Trichloroethane	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	1,1-Dichloropropylene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	Carbon tetrachloride	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	1,2-Dichloroethane	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	Trichloroethylene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	Dibromomethane	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	1,1,2-Trichloroethane	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	1,3-Dichloropropane	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	Tetrachloroethylene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	1,1,1,2-Tetrachloroethane	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	1,1,2,2-Tetrachloroethane	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	1,2,3-Trichloropropane	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	1,2-Dibromo-3-chloropropane	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	Hexachlorobutadiene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	**Halogenated Aromatics**				
USEPA 5030B, 8260B	Chlorobenzene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	Bromobenzene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	2-Chlorotoluene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	4-Chlorotoluene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	1,3-Dichlorobenzene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	1,4-Dichlorobenzene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	1,2-Dichlorobenzene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	1,2,4-Trichlorobenzene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	1,2,3-Trichlorobenzene	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	**Trihalomethanes**				
USEPA 5030B, 8260B	Chloroform	ug/m³	42	< 42	< 42
USEPA 5030B, 8260B	Bromodichloromethane	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	Dibromochloromethane	ug/m³	10	< 10	< 10
USEPA 5030B, 8260B	Bromoform	ug/m³	10	< 10	< 10

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ALS TECHNICHEM (M) SDN BHD

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ALS Technichem

CERTIFICATE OF ANALYSIS

DATE : 18 October 2018

OUR REF. : JB1804215

COMPANY : ENVIROSOLUTIONS & CONSULTING SDN BHD.
No 65b, Jalan SS21/60,
Damandara Utama
47400 Petaling Jaya, Selangor
(Attn.: Ms Chuah Li Mor)

PROJECT : Environmental Impact Assessment (EIA) of the Pengerang Energy Complex, Johor for Chemone Holdings Pte Ltd

DATE RECEIVED: 8th October 2018

SAMPLING DATE: 24th September to 6th October 2018

ANALYSIS RESULTS
(As per sample)

MONITORING : Noise Level Measurement

Sampling Points	Parameters	Sampling Dates	Sampling Time (hrs)
N1	L_{eq}, L_{max}, L_{min}, L_{10}, L_{90}	04 – 05 October 2018	0700 – 2200 2200 – 0700
N2		01 – 02 October 2018	
N3		02 – 03 October 2018	
N4		26 – 27 September 2018	
N5		25 – 26 September 2018	
N6		03 – 04 October 2018	

Muhamad Farid Bin Mohammed Noh
Project Chemist
BSc. (Hons) Chem, MSc. (Environmental), MMIC
IKM No. : M/4344/7239/15

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Seksyen U8, Bukit Jelutong,
40150 Shah Alam, Selangor.
Tel : (603) – 7845 8257
Fax : (603) – 7845 8258

(KK): Mezzanine Floor, No.3, Lot 5, Lorong Kilang (SLIE),
Off Jalan Kilang Kelombong, Jalan Ulam Raja, Kelombong
Kota Kinabalu 88450 Sabah.
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CERTIFICATE OF ANALYSIS

DATE : 18 October 2018

OUR REF. : JB1804215

RESULTS
(As per sample)

Time: 0700 to 2200

Sample Marking (Day)	Noise Level, dB (A)					Method
	L_{eq}	L_{min}	L_{max}	L_{10}	L_{90}	
N1	63.4	45.9	88.7	66.8	56.5	ISO 1996 Part 1 and Part 2
N2	63.4	55.0	102.7	64.6	56.7	
N3	50.0	45.2	63.8	52.6	45.7	
N4	58.5	36.7	89.5	60.7	52.9	
N5	65.8	43.4	98.5	63.8	61.6	
N6	66.8	37.8	92.1	68.5	61.5	

Time: 2200 to 0700

Sample Marking (Night)	Noise Level, dB (A)					Method
	L_{eq}	L_{min}	L_{max}	L_{10}	L_{90}	
N1	57.6	37.0	89.5	60.0	51.0	ISO 1996 Part 1 and Part 2
N2	58.6	55.1	97.6	57.4	56.3	
N3	48.5	45.7	55.5	52.5	46.1	
N4	56.0	36.7	89.5	59.1	39.1	
N5	57.9	48.5	98.5	59.8	50.7	
N6	57.2	36.7	89.5	59.7	47.3	

Sound Level Meter Model: BSWA308

Muhamad Farid Bin Mohammed Noh
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CERTIFICATE OF ANALYSIS

Work Order	: **JB1804254**	Page	: 1 of 4
Client	: **ENVIROSOLUTIONS & CONSULTING SDN BHD**	Laboratory	: ALS Technichem (M) Sdn. Bhd.
Contact	: MS CHUAH LI MOR	Contact	: Boo Chuanyong
Address	: NO 65B, JALAN SS21/60, DAMANSARA UTAMA, PETALING JAYA, SELANGOR 47400	Address	: No. 19, Jalan Kencana Mas 1/1, Tebrau Business Park Taman Daya Johor Bahru Malaysia 81100
E-mail	: limor@envirosc.com	E-mail	: boo.chuanyong@alsglobal.com
Telephone	: 03 7733 8816	Telephone	: +607 3549604
Facsimile	: 03 7733 8817	Facsimile	: +607 3549554
Project	: PENGERANG ENERGY COMPLEX (PEC)	QC Level	: ALS Malaysia Standard Quality Schedule
Order number	: MY-18/0018	Date Samples Received	: 05-Oct-2018 14:30
C-O-C number	: 15649	Date Analysis Commenced	: 08-Oct-2018
Sampler	: FARID/SHAH	Issue Date	: 18-Oct-2018 17:01
Site	: ----		
		No. of samples received	: 6
Quote number	: PENGERANG PROJECT	No. of samples analysed	: 6

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

MS ISO/IEC 17025
TESTING
SAMM NO. 047

Signatories

This laboratory is accredited under STANDARDS MALAYSIA. The tests reported herein have been performed in accordance with laboratory's Terms of Accreditation. This document has been electronically signed by authorized signatories indicated below. Electronic signing has been carried out in compliance with procedure specified in 21 CFR Part 11.

Signatories	*Position*
Farid Noh	Project Chemist (IKM No : M/4344/7239/15)
Norain Yahya	Chemist (IKM No: M/4233/7042/15)
Prazanna Lakxmy	Project Microbiologist (MJMM No: 0646)
Sarah Sungib	Chemist (IKM No : M/3994/6737/14)

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, ASTM, NIOSH and BS EN. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not accredited for these tests.
~ = Indicates an estimated value.

- ALS TECHNICHEM prepares this Test Report based on the tests requested and on the specific sample(s) submitted for analysis. The significance of this Report is subject to the adequacy and representative character of the sample(s) and to the comprehensiveness of the tests requested or made. ALS TECHNICHEM assumes no responsibility for variations in quality or other characteristic of the product produced or supplied under conditions over which ALS TECHNICHEM has no control.
  ALS TECHNICHEM acts for the customer from whom the instructions to act have originated. No other party is entitled to give instructions, particularly on the scope of analysis or delivery of report or certificate, unless so authorized by the customer.
- ALS TECHNICHEM undertakes to exercise due care and skill in the performance of its analytical and consultancy services but no warranties are given and none may be implied directly or indirectly relating to ALS TECHNICHEM's test results, services or facilities. In no event shall ALS TECHNICHEM be liable to collateral, special or consequential damage.
- Result < LOR = Not Detected (ND)
- Soil sample(s) were analysed on an as received basis. Result(s) were reported on a dry weight basis unless notified.
- Where moisture determination has been performed, results are reported on a dry weight basis.

Analytical Results

Sub-Matrix: **WATER**

Compound	Method	LOR	Unit	Client sample ID: SW1 Sampling date/time: 04-Oct-2018 13:14 JB1804254-001	SW2 04-Oct-2018 13:38 JB1804254-002	SW3 04-Oct-2018 10:50 JB1804254-003	SW4 04-Oct-2018 11:00 JB1804254-004	SW5 04-Oct-2018 14:00 JB1804254-005
Physical and Aggregate Properties								
Conductivity	APHA2510B	1	µS/cm	487	27700	41200	42400	1100
Floatables	Observation	-	Yes/No	No	No	No	No	No
Odour	Sensory	-	Yes/No	No	No	No	No	No
pH Value	APHA4500H+B	0.1	pH Unit	5.8	4.5	6.6	6.8	5.7
ø Salinity	APHA2520B	0.1	parts/1000	0.2	16.6	25.8	26.6	0.5
ø Temperature	APHA2550B	0.1	°C	28.6	28.6	28.6	28.5	28.5
Total Dissolved Solids	APHA2540C	1	mg/L	228	21300	31100	32000	223
Total Suspended Solids	APHA2540D	1	mg/L	11	48	36	46	38
ø Turbidity	APHA2130B	1.0	NTU	136	225	14.6	14.6	247
Colour (True)	APHA2120B	5	TCU	40	30	10	10	50
Aggregate Organics								
Biochemical Oxygen Demand	APHA5210B	1	mg/L	6	8	7	6	8
Chemical Oxygen Demand	APHA5220C	10	mg/L	19	23	23	19	23
Inorganic and Nonmetallic Properties								
Ammonia as N	APHA4500 NH3 G	0.01	mg/L	5.77	0.04	1.71	0.16	0.59
ø Dissolved Oxygen	APHA4500 O G	0.01	mg/L	8.20	7.27	7.75	7.93	8.59
Microbiological Testing								
Total Coliform Count	APHA9222B	1	CFU/100mL	2.5 x 10^3	3.4 x 10^2	3.6 x 10^3	1.8 x 10^2	1.9 x 10^3
Total Faecal Coliform Count	APHA9222D	1	CFU/100mL	1.2 x 10^2	1.4 x 10^2	<1	<1	1.0 x 10^2

Analytical Results

Sub-Matrix: **WATER**

Compound	Method	LOR	Unit	Client sample ID: SW6 / Sampling date/time: 04-Oct-2018 10:30 / JB1804254-006	---- / ---- / --------	---- / ---- / --------	---- / ---- / --------	---- / ---- / --------
Physical and Aggregate Properties								
Conductivity	APHA2510B	1	µS/cm	40000	----	----	----	----
Floatables	Observation	-	Yes/No	No	----	----	----	----
Odour	Sensory	-	Yes/No	No	----	----	----	----
pH Value	APHA4500H+B	0.1	pH Unit	6.6	----	----	----	----
ø Salinity	APHA2520B	0.1	parts/1000	24.9	----	----	----	----
ø Temperature	APHA2550B	0.1	°C	28.5	----	----	----	----
Total Dissolved Solids	APHA2540C	1	mg/L	30000	----	----	----	----
Total Suspended Solids	APHA2540D	1	mg/L	43	----	----	----	----
ø Turbidity	APHA2130B	1.0	NTU	11.9	----	----	----	----
Colour (True)	APHA2120B	5	TCU	25	----	----	----	----
Aggregate Organics								
Biochemical Oxygen Demand	APHA5210B	1	mg/L	6	----	----	----	----
Chemical Oxygen Demand	APHA5220C	10	mg/L	19	----	----	----	----
Inorganic and Nonmetallic Properties								
Ammonia as N	APHA4500 NH3 G	0.01	mg/L	0.06	----	----	----	----
ø Dissolved Oxygen	APHA4500 O G	0.01	mg/L	8.05	----	----	----	----
Microbiological Testing								
Total Coliform Count	APHA9222B	1	CFU/100mL	1.3 x 10^3	----	----	----	----
Total Faecal Coliform Count	APHA9222D	1	CFU/100mL	<1	----	----	----	----

ALS Life Sciences

CERTIFICATE OF ANALYSIS

Work Order	: **JB1804254**	Page	: 1 of 4
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E-mail	: limor@envirosc.com	E-mail	: boo.chuanyong@alsglobal.com
Telephone	: 03 7733 8816	Telephone	: +607 3549604
Facsimile	: 03 7733 8817	Facsimile	: +607 3549554
Project	: PENGERANG ENERGY COMPLEX (PEC)	QC Level	: ALS Malaysia Standard Quality Schedule
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When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not accredited for these tests.
~ = Indicates an estimated value.

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- ALS TECHNICHEM undertakes to exercise due care and skill in the performance of its analytical and consultancy services but no warranties are given and none may be implied directly or indirectly relating to ALS TECHNICHEM's test results, services or facilities. In no event shall ALS TECHNICHEM be liable to collateral, special or consequential damage.
- Result < LOR = Not Detected (ND)
- Soil sample(s) were analysed on an as received basis. Result(s) were reported on a dry weight basis unless notified.
- Where moisture determination has been performed, results are reported on a dry weight basis.

Analytical Results

Sub-Matrix: **WATER**

Compound	Method	LOR	Unit	Client sample ID: SW1 Sampling date/time: 04-Oct-2018 13:14 JB1804254-001	SW2 04-Oct-2018 13:38 JB1804254-002	SW3 04-Oct-2018 10:50 JB1804254-003	SW4 04-Oct-2018 11:00 JB1804254-004	SW5 04-Oct-2018 14:00 JB1804254-005
Physical and Aggregate Properties								
Conductivity	APHA2510B	1	µS/cm	487	27700	41200	42400	1100
Floatables	Observation	-	Yes/No	No	No	No	No	No
Odour	Sensory	-	Yes/No	No	No	No	No	No
pH Value	APHA4500H+B	0.1	pH Unit	5.8	4.5	6.6	6.8	5.7
ø Salinity	APHA2520B	0.1	parts/1000	0.2	16.6	25.8	26.6	0.5
ø Temperature	APHA2550B	0.1	°C	28.6	28.6	28.6	28.5	28.5
Total Dissolved Solids	APHA2540C	1	mg/L	228	21300	31100	32000	223
Total Suspended Solids	APHA2540D	1	mg/L	11	48	36	46	38
ø Turbidity	APHA2130B	1.0	NTU	136	225	14.6	14.6	247
Colour (True)	APHA2120B	5	TCU	40	30	10	10	50
Aggregate Organics								
Biochemical Oxygen Demand	APHA5210B	1	mg/L	6	8	7	6	8
Chemical Oxygen Demand	APHA5220C	10	mg/L	19	23	23	19	23
Inorganic and Nonmetallic Properties								
Ammonia as N	APHA4500 NH3 G	0.01	mg/L	5.77	0.04	1.71	0.16	0.59
ø Dissolved Oxygen	APHA4500 O G	0.01	mg/L	8.20	7.27	7.75	7.93	8.59
Microbiological Testing								
Total Coliform Count	APHA9222B	1	CFU/100mL	2.5 x 10^3	3.4 x 10^2	3.6 x 10^3	1.8 x 10^2	1.9 x 10^3
Total Faecal Coliform Count	APHA9222D	1	CFU/100mL	1.2 x 10^2	1.4 x 10^2	<1	<1	1.0 x 10^2

Analytical Results

Sub-Matrix: **WATER**

Compound	Method	LOR	Unit	Client sample ID: SW6 / Sampling date/time: 04-Oct-2018 10:30 / JB1804254-006	---- / ---- / --------	---- / ---- / --------	---- / ---- / --------	---- / ---- / --------
Physical and Aggregate Properties								
Conductivity	APHA2510B	1	µS/cm	40000	----	----	----	----
Floatables	Observation	-	Yes/No	No	----	----	----	----
Odour	Sensory	-	Yes/No	No	----	----	----	----
pH Value	APHA4500H+B	0.1	pH Unit	6.6	----	----	----	----
ø Salinity	APHA2520B	0.1	parts/1000	24.9	----	----	----	----
ø Temperature	APHA2550B	0.1	°C	28.5	----	----	----	----
Total Dissolved Solids	APHA2540C	1	mg/L	30000	----	----	----	----
Total Suspended Solids	APHA2540D	1	mg/L	43	----	----	----	----
ø Turbidity	APHA2130B	1.0	NTU	11.9	----	----	----	----
Colour (True)	APHA2120B	5	TCU	25	----	----	----	----
Aggregate Organics								
Biochemical Oxygen Demand	APHA5210B	1	mg/L	6	----	----	----	----
Chemical Oxygen Demand	APHA5220C	10	mg/L	19	----	----	----	----
Inorganic and Nonmetallic Properties								
Ammonia as N	APHA4500 NH3 G	0.01	mg/L	0.06	----	----	----	----
ø Dissolved Oxygen	APHA4500 O G	0.01	mg/L	8.05	----	----	----	----
Microbiological Testing								
Total Coliform Count	APHA9222B	1	CFU/100mL	1.3 x 10^3	----	----	----	----
Total Faecal Coliform Count	APHA9222D	1	CFU/100mL	<1	----	----	----	----

CERTIFICATE OF ANALYSIS

Work Order	: **KL1812717**	Page	: 1 of 15
Client	: **ENVIROSOLUTIONS & CONSULTING SDN BHD**	Laboratory	: ALS Technichem (M) Sdn. Bhd.
Contact	: MS CHUAH LI MOR	Contact	: Boo Chuanyong
Address	: NO 65B, JALAN SS21/60, DAMANSARA UTAMA, PETALING JAYA, SELANGOR 47400	Address	: WISMA ALS, 21, Jalan Astaka U8/84, Bukit Jelutong Shah Alam Selangor Malaysia 40150
E-mail	: limor@envirosc.com	E-mail	: boo.chuanyong@alsglobal.com
Telephone	: 03 7733 8816	Telephone	: +603 7845 8257
Facsimile	: 03 7733 8817	Facsimile	: +603 7845 8258
Project	: J18-780	QC Level	: ALS Malaysia Standard Quality Schedule
Order number	:	Date Samples Received	: 14-Dec-2018 20:35
C-O-C number	: 12255	Date Analysis Commenced	: 18-Dec-2018
Sampler	: CHUAH LIMOR	Issue Date	: 27-Dec-2018 16:57
Site	: PENGERANG PROJECT		
		No. of samples received	: 7
Quote number	: ----	No. of samples analysed	: 7

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

MS ISO/IEC 17025
TESTING
SAMM NO. 147

Signatories

This laboratory is accredited under STANDARDS MALAYSIA. The tests reported herein have been performed in accordance with laboratory's Terms of Accreditation. This document has been electronically signed by authorized signatories indicated below. Electronic signing has been carried out in compliance with procedure specified in 21 CFR Part 11.

Signatories	*Position*
Norain Yahya	Chemist (IKM No: M/4233/7042/15)
Nuramira Abdmalek	Chemist (IKM No: M/4867/8027/18)

*Please direct all technical queries to the laboratory (Reports.KL@alsglobal.com)

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, ASTM, NIOSH and BS EN. In house developed procedures are employed in the absence of documented standards or by client request.

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- Where moisture determination has been performed, results are reported on a dry weight basis.

Analytical Results

Sub-Matrix: **WATER**

Compound	Method	LOR	Unit	Client sample ID: BH1 Sampling date/time: 14-Dec-2018 09:30 KL1812717-001	BH2 14-Dec-2018 09:40 KL1812717-002	BH3 14-Dec-2018 10:20 KL1812717-003	BH4 14-Dec-2018 10:40 KL1812717-004	BH5 14-Dec-2018 11:20 KL1812717-005
Metals and Major Cations								
Antimony	USEPA6020A	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	USEPA6020A	1.0	µg/L	1.9	2.4	<1.0	3.2	<1.0
Beryllium	USEPA6020A	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	USEPA6020A	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Chromium	USEPA6020A	1.0	µg/L	<1.0	<1.0	1.1	<1.0	<1.0
Copper	USEPA6020A	1.0	µg/L	1.3	<1.0	<1.0	<1.0	<1.0
Lead	USEPA6020A	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	1.2
Mercury	USEPA6020A	1.0	µg/L	<1.0	<1.0	1.3	<1.0	<1.0
Nickel	USEPA6020A	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Selenium	USEPA6020A	10.0	µg/L	<10.0	<10.0	<10.0	<10.0	<10.0
Silver	USEPA6020A	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Thallium	USEPA6020A	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Zinc	USEPA6020A	1.0	µg/L	4.6	2.4	17.2	25.2	44.2
Total Petroleum Hydrocarbon (TPH)								
TPH C6-C9	USEPA8260B	50	µg/L	<50	<50	<50	<50	<50
TPH C10-C14	USEPA8015B	50	µg/L	<50	<50	<50	<50	<50
TPH C15-C28	USEPA8015B	100	µg/L	<100	<100	<100	<100	<100
TPH C29-C36	USEPA8015B	50	µg/L	<50	<50	<50	<50	<50
VOC: Monocylic Aromatics								
Benzene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
Toluene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
Ethylbenzene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
meta- & para-Xylene	USEPA8260B	10	µg/L	<10	<10	<10	<10	<10
Styrene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
ortho-Xylene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
Isopropylbenzene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
n-Propylbenzene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
1.3.5-Trimethylbenzene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
sec-Butylbenzene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
1.2.4-Trimethylbenzene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
tert-Butylbenzene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
p-Isopropyltoluene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
n-Butylbenzene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
VOC: Oxygenated Compounds								

Analytical Results

Sub-Matrix: **WATER**

Compound	Method	LOR	Unit	Client sample ID: BH1 Sampling date/time: 14-Dec-2018 09:30 KL1812717-001	BH2 14-Dec-2018 09:40 KL1812717-002	BH3 14-Dec-2018 10:20 KL1812717-003	BH4 14-Dec-2018 10:40 KL1812717-004	BH5 14-Dec-2018 11:20 KL1812717-005
VOC: Oxygenated Compounds - Continued								
2-Butanone (MEK)	USEPA8260B	50	µg/L	<50	<50	<50	<50	<50
4-Methyl-2-pentanone (MIBK)	USEPA8260B	50	µg/L	<50	<50	<50	<50	<50
2-Hexanone (MBK)	USEPA8260B	50	µg/L	<50	<50	<50	<50	<50
VOC: Fumigants								
2.2-Dichloropropane	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
1.2-Dichloropropane	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
cis-1.3-Dichloropropylene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
trans-1.3-Dichloropropylene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
1.2-Dibromoethane (EDB)	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
VOC: Halogenated Aliphatics								
Dichlorodifluoromethane	USEPA8260B	50	µg/L	<50	<50	<50	<50	<50
Chloromethane	USEPA8260B	50	µg/L	<50	<50	<50	<50	<50
Vinyl chloride	USEPA8260B	50	µg/L	<50	<50	<50	<50	<50
Bromomethane	USEPA8260B	50	µg/L	<50	<50	<50	<50	<50
Chloroethane	USEPA8260B	50	µg/L	<50	<50	<50	<50	<50
Trichlorofluoromethane	USEPA8260B	50	µg/L	<50	<50	<50	<50	<50
1.1-Dichloroethene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
Iodomethane	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
trans-1.2-Dichloroethene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
1.1-Dichloroethane	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
cis-1.2-Dichloroethene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
1.1.1-Trichloroethane	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
1.1-Dichloropropylene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
Carbon Tetrachloride	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
1.2-Dichloroethane	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
Trichloroethene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
Dibromomethane	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
1.1.2-Trichloroethane	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
1.3-Dichloropropane	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
Tetrachloroethene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
1.1.1.2-Tetrachloroethane	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
trans-1.4-Dichloro-2-butene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
cis-1.4-Dichloro-2-butene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
1.1.2.2-Tetrachloroethane	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5

Analytical Results

Sub-Matrix: WATER		Client sample ID		BH1	BH2	BH3	BH4	BH5
		Sampling date/time		14-Dec-2018 09:30	14-Dec-2018 09:40	14-Dec-2018 10:20	14-Dec-2018 10:40	14-Dec-2018 11:20
Compound	Method	LOR	Unit	KL1812717-001	KL1812717-002	KL1812717-003	KL1812717-004	KL1812717-005
VOC: Halogenated Aliphatics - Continued								
1.2.3-Trichloropropane	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
Pentachloroethane	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
1.2-Dibromo-3-chloropropane	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
Hexachlorobutadiene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
VOC: Halogenated Aromatics								
Chlorobenzene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
Bromobenzene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
2-Chlorotoluene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
4-Chlorotoluene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
1.3-Dichlorobenzene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
1.4-Dichlorobenzene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
1.2-Dichlorobenzene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
1.2.4-Trichlorobenzene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
1.2.3-Trichlorobenzene	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
VOC: Trihalomethanes								
Chloroform	USEPA8260B	20	µg/L	<20	<20	<20	<20	<20
Bromodichloromethane	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
Dibromochloromethane	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
Bromoform	USEPA8260B	5	µg/L	<5	<5	<5	<5	<5
SVOC: Phenolic Compounds								
Phenol	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
2-Chlorophenol	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
2-Methylphenol	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
3- & 4-Methylphenol	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
2-Nitrophenol	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
2.4-Dimethylphenol	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
2.4-Dichlorophenol	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
2.6-Dichlorophenol	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
4-Chloro-3-methylphenol	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
2.4.6-Trichlorophenol	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
2.4.5-Trichlorophenol	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Pentachlorophenol	USEPA8270C	10	µg/L	<10	<10	<10	<10	<10
SVOC: Phthalate Esters								
Dimethyl phthalate	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5

Analytical Results

Sub-Matrix: **WATER**

Compound	Method	LOR	Unit	Client sample ID: BH1 Sampling date/time: 14-Dec-2018 09:30 KL1812717-001	BH2 14-Dec-2018 09:40 KL1812717-002	BH3 14-Dec-2018 10:20 KL1812717-003	BH4 14-Dec-2018 10:40 KL1812717-004	BH5 14-Dec-2018 11:20 KL1812717-005
SVOC: Phthalate Esters - Continued								
Diethyl phthalate	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Di-n-butyl phthalate	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Butyl benzyl phthalate	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Bis(2-ethylhexyl)phthalate	USEPA8270C	50	µg/L	<50	<50	<50	<50	<50
Di-n-octylphthalate	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
SVOC: Nitrosamines								
N-Nitrosomethylethylamine	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
N-Nitrosodiethylamine	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
N-Nitrosopyrrolidine	USEPA8270C	10	µg/L	<10	<10	<10	<10	<10
N-Nitrosomorpholine	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
N-Nitrosodi-n-propylamine	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
N-Nitrosopiperidine	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
N-Nitrosodibutylamine	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Diphenylamine & N-Nitrosodiphenylamine	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Diallate	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Methapyrilene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
SVOC: Nitroaromatics and Ketones								
2-Picoline	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Acetophenone	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Nitrobenzene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Isophorone	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
2.6-Dinitrotoluene	USEPA8270C	10	µg/L	<10	<10	<10	<10	<10
2.4-Dinitrotoluene	USEPA8270C	10	µg/L	<10	<10	<10	<10	<10
1-Naphthylamine	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
4-Nitroquinoline-N-oxide	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
5-Nitro-o-toluidine	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Azobenzene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
1.3.5-Trinitrobenzene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Phenacetin	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
4-Aminobiphenyl	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Pentachloronitrobenzene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Pronamide	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Dimethylaminoazobenzene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5

Analytical Results

Sub-Matrix: **WATER**

Compound	Method	LOR	Unit	Client sample ID: BH1 Sampling date/time: 14-Dec-2018 09:30 KL1812717-001	BH2 14-Dec-2018 09:40 KL1812717-002	BH3 14-Dec-2018 10:20 KL1812717-003	BH4 14-Dec-2018 10:40 KL1812717-004	BH5 14-Dec-2018 11:20 KL1812717-005
SVOC: Nitroaromatics and Ketones - Continued								
Chlorobenzilate	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
SVOC: Haloethers								
Bis(2-chloroethyl) ether	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Bis(2-chloroethoxy) methane	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
4-Chlorophenyl phenyl ether	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
4-Bromophenyl phenyl ether	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
SVOC: Chlorinated Hydrocarbons								
1.3-Dichlorobenzene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
1.4-Dichlorobenzene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
1.2-Dichlorobenzene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Hexachloroethane	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
1.2.4-Trichlorobenzene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Hexachloropropylene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Hexachlorobutadiene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Hexachlorocyclopentadiene	USEPA8270C	25	µg/L	<25	<25	<25	<25	<25
Pentachlorobenzene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Hexachlorobenzene (HCB)	USEPA8270C	10	µg/L	<10	<10	<10	<10	<10
SVOC: Anilines and Benzidines								
Aniline	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
4-Chloroaniline	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
2-Nitroaniline	USEPA8270C	10	µg/L	<10	<10	<10	<10	<10
3-Nitroaniline	USEPA8270C	10	µg/L	<10	<10	<10	<10	<10
Dibenzofuran	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
4-Nitroaniline	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Carbazole	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
3.3`-Dichlorobenzidine	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
SVOC: Polycyclic Aromatic Hydrocarbons (PAHs)								
Naphthalene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Acenaphthylene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Acenaphthene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Fluorene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Phenanthrene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Anthracene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Fluoranthene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5

Analytical Results

Sub-Matrix: **WATER**

Compound	Method	LOR	Unit	Client sample ID: BH1 Sampling date/time: 14-Dec-2018 09:30 KL1812717-001	BH2 14-Dec-2018 09:40 KL1812717-002	BH3 14-Dec-2018 10:20 KL1812717-003	BH4 14-Dec-2018 10:40 KL1812717-004	BH5 14-Dec-2018 11:20 KL1812717-005
SVOC: Polycyclic Aromatic Hydrocarbons (PAHs) - Continued								
Pyrene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Benz(a)anthracene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Chrysene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Benzo(b) & Benzo(k)fluoranthene	USEPA8270C	10	µg/L	<10	<10	<10	<10	<10
Benzo(a)pyrene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Indeno(1.2.3.cd)pyrene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Dibenz(a.h)anthracene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
Benzo(g.h.i)perylene	USEPA8270C	5	µg/L	<5	<5	<5	<5	<5
VOC: Surrogates								
1.2-Dichloroethane-D4	USEPA8260B	5	%	96.0	100	105	102	106
Toluene-D8	USEPA8260B	5	%	87.0	92.3	92.0	92.8	87.6
4-Bromofluorobenzene	USEPA8260B	5	%	119	106	102	101	99.1
Volatile Organic Compound -Surrogates								
Toluene-D8	USEPA8260B	1	%	88.7	93.4	93.6	94.3	89.3
1.2-Dichloroethane-D4	USEPA8260B	1	%	110	106	103	106	111
4-Bromofluorobenzene	USEPA8260B	1	%	112	106	95.6	101	100
SVOC: Acid Extractable Surrogates								
2-Fluorophenol	USEPA8270C	0.1	%	38.3	34.0	41.2	38.4	38.4
Phenol-d5	USEPA8270C	0.1	%	36.1	38.3	47.7	36.1	34.1
2.4.6-Tribromophenol	USEPA8270C	0.1	%	54.6	57.2	56.5	78.0	59.6
SVOC: Base/NeutralExtractable Surrogates								
Nitrobenzene -d5	USEPA8270C	0.1	%	58.4	50.9	57.9	52.4	53.0
2-Fluorobiphenyl	USEPA8270C	0.1	%	67.8	68.4	74.5	69.1	67.6
4-Terphenyl-d14	USEPA8270C	0.1	%	59.8	59.6	66.7	61.2	58.3

Analytical Results

Sub-Matrix: **WATER**

Compound	Method	LOR	Unit	Client sample ID: BH6 Sampling date/time: 14-Dec-2018 12:00 KL1812717-006	Client sample ID: MW-QC Sampling date/time: 14-Dec-2018 00:00 KL1812717-007	---- ---- --------	---- ---- --------	---- ---- --------
Metals and Major Cations								
Antimony	USEPA6020A	1.0	µg/L	<1.0	<1.0	----	----	----
Arsenic	USEPA6020A	1.0	µg/L	1.2	3.2	----	----	----
Beryllium	USEPA6020A	1.0	µg/L	<1.0	<1.0	----	----	----
Cadmium	USEPA6020A	1.0	µg/L	<1.0	<1.0	----	----	----
Chromium	USEPA6020A	1.0	µg/L	<1.0	<1.0	----	----	----
Copper	USEPA6020A	1.0	µg/L	<1.0	<1.0	----	----	----
Lead	USEPA6020A	1.0	µg/L	<1.0	<1.0	----	----	----
Mercury	USEPA6020A	1.0	µg/L	<1.0	<1.0	----	----	----
Nickel	USEPA6020A	1.0	µg/L	<1.0	<1.0	----	----	----
Selenium	USEPA6020A	10.0	µg/L	<10.0	<10.0	----	----	----
Silver	USEPA6020A	1.0	µg/L	<1.0	<1.0	----	----	----
Thallium	USEPA6020A	1.0	µg/L	<1.0	<1.0	----	----	----
Zinc	USEPA6020A	1.0	µg/L	10.9	27.1	----	----	----
Total Petroleum Hydrocarbon (TPH)								
TPH C6-C9	USEPA8260B	50	µg/L	<50	<50	----	----	----
TPH C10-C14	USEPA8015B	50	µg/L	<50	<50	----	----	----
TPH C15-C28	USEPA8015B	100	µg/L	<100	<100	----	----	----
TPH C29-C36	USEPA8015B	50	µg/L	<50	<50	----	----	----
VOC: Monocylic Aromatics								
Benzene	USEPA8260B	5	µg/L	<5	<5	----	----	----
Toluene	USEPA8260B	5	µg/L	<5	<5	----	----	----
Ethylbenzene	USEPA8260B	5	µg/L	<5	<5	----	----	----
meta- & para-Xylene	USEPA8260B	10	µg/L	<10	<10	----	----	----
Styrene	USEPA8260B	5	µg/L	<5	<5	----	----	----
ortho-Xylene	USEPA8260B	5	µg/L	<5	<5	----	----	----
Isopropylbenzene	USEPA8260B	5	µg/L	<5	<5	----	----	----
n-Propylbenzene	USEPA8260B	5	µg/L	<5	<5	----	----	----
1.3.5-Trimethylbenzene	USEPA8260B	5	µg/L	<5	<5	----	----	----
sec-Butylbenzene	USEPA8260B	5	µg/L	<5	<5	----	----	----
1.2.4-Trimethylbenzene	USEPA8260B	5	µg/L	<5	<5	----	----	----
tert-Butylbenzene	USEPA8260B	5	µg/L	<5	<5	----	----	----
p-Isopropyltoluene	USEPA8260B	5	µg/L	<5	<5	----	----	----
n-Butylbenzene	USEPA8260B	5	µg/L	<5	<5	----	----	----
VOC: Oxygenated Compounds								

Analytical Results

Sub-Matrix: **WATER**

Compound	Method	LOR	Unit	Client sample ID: BH6 Sampling date/time: 14-Dec-2018 12:00 KL1812717-006	Client sample ID: MW-QC Sampling date/time: 14-Dec-2018 00:00 KL1812717-007	---- ---- --------	---- ---- --------	---- ---- --------
VOC: Oxygenated Compounds - Continued								
2-Butanone (MEK)	USEPA8260B	50	µg/L	<50	<50	----	----	----
4-Methyl-2-pentanone (MIBK)	USEPA8260B	50	µg/L	<50	<50	----	----	----
2-Hexanone (MBK)	USEPA8260B	50	µg/L	<50	<50	----	----	----
VOC: Fumigants								
2.2-Dichloropropane	USEPA8260B	5	µg/L	<5	<5	----	----	----
1.2-Dichloropropane	USEPA8260B	5	µg/L	<5	<5	----	----	----
cis-1.3-Dichloropropylene	USEPA8260B	5	µg/L	<5	<5	----	----	----
trans-1.3-Dichloropropylene	USEPA8260B	5	µg/L	<5	<5	----	----	----
1.2-Dibromoethane (EDB)	USEPA8260B	5	µg/L	<5	<5	----	----	----
VOC: Halogenated Aliphatics								
Dichlorodifluoromethane	USEPA8260B	50	µg/L	<50	<50	----	----	----
Chloromethane	USEPA8260B	50	µg/L	<50	<50	----	----	----
Vinyl chloride	USEPA8260B	50	µg/L	<50	<50	----	----	----
Bromomethane	USEPA8260B	50	µg/L	<50	<50	----	----	----
Chloroethane	USEPA8260B	50	µg/L	<50	<50	----	----	----
Trichlorofluoromethane	USEPA8260B	50	µg/L	<50	<50	----	----	----
1.1-Dichloroethene	USEPA8260B	5	µg/L	<5	<5	----	----	----
Iodomethane	USEPA8260B	5	µg/L	<5	<5	----	----	----
trans-1.2-Dichloroethene	USEPA8260B	5	µg/L	<5	<5	----	----	----
1.1-Dichloroethane	USEPA8260B	5	µg/L	<5	<5	----	----	----
cis-1.2-Dichloroethene	USEPA8260B	5	µg/L	<5	<5	----	----	----
1.1.1-Trichloroethane	USEPA8260B	5	µg/L	<5	<5	----	----	----
1.1-Dichloropropylene	USEPA8260B	5	µg/L	<5	<5	----	----	----
Carbon Tetrachloride	USEPA8260B	5	µg/L	<5	<5	----	----	----
1.2-Dichloroethane	USEPA8260B	5	µg/L	<5	<5	----	----	----
Trichloroethene	USEPA8260B	5	µg/L	<5	<5	----	----	----
Dibromomethane	USEPA8260B	5	µg/L	<5	<5	----	----	----
1.1.2-Trichloroethane	USEPA8260B	5	µg/L	<5	<5	----	----	----
1.3-Dichloropropane	USEPA8260B	5	µg/L	<5	<5	----	----	----
Tetrachloroethene	USEPA8260B	5	µg/L	<5	<5	----	----	----
1.1.1.2-Tetrachloroethane	USEPA8260B	5	µg/L	<5	<5	----	----	----
trans-1.4-Dichloro-2-butene	USEPA8260B	5	µg/L	<5	<5	----	----	----
cis-1.4-Dichloro-2-butene	USEPA8260B	5	µg/L	<5	<5	----	----	----
1.1.2.2-Tetrachloroethane	USEPA8260B	5	µg/L	<5	<5	----	----	----

Analytical Results

Sub-Matrix: **WATER**

Compound	Method	LOR	Unit	Client sample ID: BH6 Sampling date/time: 14-Dec-2018 12:00 KL1812717-006	Client sample ID: MW-QC Sampling date/time: 14-Dec-2018 00:00 KL1812717-007	---- ---- --------	---- ---- --------	---- ---- --------
VOC: Halogenated Aliphatics - Continued								
1.2.3-Trichloropropane	USEPA8260B	5	µg/L	<5	<5	----	----	----
Pentachloroethane	USEPA8260B	5	µg/L	<5	<5	----	----	----
1.2-Dibromo-3-chloropropane	USEPA8260B	5	µg/L	<5	<5	----	----	----
Hexachlorobutadiene	USEPA8260B	5	µg/L	<5	<5	----	----	----
VOC: Halogenated Aromatics								
Chlorobenzene	USEPA8260B	5	µg/L	<5	<5	----	----	----
Bromobenzene	USEPA8260B	5	µg/L	<5	<5	----	----	----
2-Chlorotoluene	USEPA8260B	5	µg/L	<5	<5	----	----	----
4-Chlorotoluene	USEPA8260B	5	µg/L	<5	<5	----	----	----
1.3-Dichlorobenzene	USEPA8260B	5	µg/L	<5	<5	----	----	----
1.4-Dichlorobenzene	USEPA8260B	5	µg/L	<5	<5	----	----	----
1.2-Dichlorobenzene	USEPA8260B	5	µg/L	<5	<5	----	----	----
1.2.4-Trichlorobenzene	USEPA8260B	5	µg/L	<5	<5	----	----	----
1.2.3-Trichlorobenzene	USEPA8260B	5	µg/L	<5	<5	----	----	----
VOC: Trihalomethanes								
Chloroform	USEPA8260B	20	µg/L	<20	<20	----	----	----
Bromodichloromethane	USEPA8260B	5	µg/L	<5	<5	----	----	----
Dibromochloromethane	USEPA8260B	5	µg/L	<5	<5	----	----	----
Bromoform	USEPA8260B	5	µg/L	<5	<5	----	----	----
SVOC: Phenolic Compounds								
Phenol	USEPA8270C	5	µg/L	<5	<5	----	----	----
2-Chlorophenol	USEPA8270C	5	µg/L	<5	<5	----	----	----
2-Methylphenol	USEPA8270C	5	µg/L	<5	<5	----	----	----
3- & 4-Methylphenol	USEPA8270C	5	µg/L	<5	<5	----	----	----
2-Nitrophenol	USEPA8270C	5	µg/L	<5	<5	----	----	----
2.4-Dimethylphenol	USEPA8270C	5	µg/L	<5	<5	----	----	----
2.4-Dichlorophenol	USEPA8270C	5	µg/L	<5	<5	----	----	----
2.6-Dichlorophenol	USEPA8270C	5	µg/L	<5	<5	----	----	----
4-Chloro-3-methylphenol	USEPA8270C	5	µg/L	<5	<5	----	----	----
2.4.6-Trichlorophenol	USEPA8270C	5	µg/L	<5	<5	----	----	----
2.4.5-Trichlorophenol	USEPA8270C	5	µg/L	<5	<5	----	----	----
Pentachlorophenol	USEPA8270C	10	µg/L	<10	<10	----	----	----
SVOC: Phthalate Esters								
Dimethyl phthalate	USEPA8270C	5	µg/L	<5	<5	----	----	----

Analytical Results

Sub-Matrix: **WATER**

Compound	Method	LOR	Unit	Client sample ID: BH6 Sampling date/time: 14-Dec-2018 12:00 KL1812717-006	Client sample ID: MW-QC Sampling date/time: 14-Dec-2018 00:00 KL1812717-007	---- ---- --------	---- ---- --------	---- ---- --------
SVOC: Phthalate Esters - Continued								
Diethyl phthalate	USEPA8270C	5	µg/L	<5	<5	----	----	----
Di-n-butyl phthalate	USEPA8270C	5	µg/L	<5	<5	----	----	----
Butyl benzyl phthalate	USEPA8270C	5	µg/L	<5	<5	----	----	----
Bis(2-ethylhexyl)phthalate	USEPA8270C	50	µg/L	<50	<50	----	----	----
Di-n-octylphthalate	USEPA8270C	5	µg/L	<5	<5	----	----	----
SVOC: Nitrosamines								
N-Nitrosomethylethylamine	USEPA8270C	5	µg/L	<5	<5	----	----	----
N-Nitrosodiethylamine	USEPA8270C	5	µg/L	<5	<5	----	----	----
N-Nitrosopyrrolidine	USEPA8270C	10	µg/L	<10	<10	----	----	----
N-Nitrosomorpholine	USEPA8270C	5	µg/L	<5	<5	----	----	----
N-Nitrosodi-n-propylamine	USEPA8270C	5	µg/L	<5	<5	----	----	----
N-Nitrosopiperidine	USEPA8270C	5	µg/L	<5	<5	----	----	----
N-Nitrosodibutylamine	USEPA8270C	5	µg/L	<5	<5	----	----	----
Diphenylamine & N-Nitrosodiphenylamine	USEPA8270C	5	µg/L	<5	<5	----	----	----
Diallate	USEPA8270C	5	µg/L	<5	<5	----	----	----
Methapyrilene	USEPA8270C	5	µg/L	<5	<5	----	----	----
SVOC: Nitroaromatics and Ketones								
2-Picoline	USEPA8270C	5	µg/L	<5	<5	----	----	----
Acetophenone	USEPA8270C	5	µg/L	<5	<5	----	----	----
Nitrobenzene	USEPA8270C	5	µg/L	<5	<5	----	----	----
Isophorone	USEPA8270C	5	µg/L	<5	<5	----	----	----
2.6-Dinitrotoluene	USEPA8270C	10	µg/L	<10	<10	----	----	----
2.4-Dinitrotoluene	USEPA8270C	10	µg/L	<10	<10	----	----	----
1-Naphthylamine	USEPA8270C	5	µg/L	<5	<5	----	----	----
4-Nitroquinoline-N-oxide	USEPA8270C	5	µg/L	<5	<5	----	----	----
5-Nitro-o-toluidine	USEPA8270C	5	µg/L	<5	<5	----	----	----
Azobenzene	USEPA8270C	5	µg/L	<5	<5	----	----	----
1.3.5-Trinitrobenzene	USEPA8270C	5	µg/L	<5	<5	----	----	----
Phenacetin	USEPA8270C	5	µg/L	<5	<5	----	----	----
4-Aminobiphenyl	USEPA8270C	5	µg/L	<5	<5	----	----	----
Pentachloronitrobenzene	USEPA8270C	5	µg/L	<5	<5	----	----	----
Pronamide	USEPA8270C	5	µg/L	<5	<5	----	----	----
Dimethylaminoazobenzene	USEPA8270C	5	µg/L	<5	<5	----	----	----

Analytical Results

Sub-Matrix: **WATER**

Compound	Method	LOR	Unit	Client sample ID: BH6 Sampling date/time: 14-Dec-2018 12:00 KL1812717-006	Client sample ID: MW-QC Sampling date/time: 14-Dec-2018 00:00 KL1812717-007	---- ---- --------	---- ---- --------	---- ---- --------
SVOC: Nitroaromatics and Ketones - Continued								
Chlorobenzilate	USEPA8270C	5	µg/L	<5	<5	----	----	----
SVOC: Haloethers								
Bis(2-chloroethyl) ether	USEPA8270C	5	µg/L	<5	<5	----	----	----
Bis(2-chloroethoxy) methane	USEPA8270C	5	µg/L	<5	<5	----	----	----
4-Chlorophenyl phenyl ether	USEPA8270C	5	µg/L	<5	<5	----	----	----
4-Bromophenyl phenyl ether	USEPA8270C	5	µg/L	<5	<5	----	----	----
SVOC: Chlorinated Hydrocarbons								
1.3-Dichlorobenzene	USEPA8270C	5	µg/L	<5	<5	----	----	----
1.4-Dichlorobenzene	USEPA8270C	5	µg/L	<5	<5	----	----	----
1.2-Dichlorobenzene	USEPA8270C	5	µg/L	<5	<5	----	----	----
Hexachloroethane	USEPA8270C	5	µg/L	<5	<5	----	----	----
1.2.4-Trichlorobenzene	USEPA8270C	5	µg/L	<5	<5	----	----	----
Hexachloropropylene	USEPA8270C	5	µg/L	<5	<5	----	----	----
Hexachlorobutadiene	USEPA8270C	5	µg/L	<5	<5	----	----	----
Hexachlorocyclopentadiene	USEPA8270C	25	µg/L	<25	<25	----	----	----
Pentachlorobenzene	USEPA8270C	5	µg/L	<5	<5	----	----	----
Hexachlorobenzene (HCB)	USEPA8270C	10	µg/L	<10	<10	----	----	----
SVOC: Anilines and Benzidines								
Aniline	USEPA8270C	5	µg/L	<5	<5	----	----	----
4-Chloroaniline	USEPA8270C	5	µg/L	<5	<5	----	----	----
2-Nitroaniline	USEPA8270C	10	µg/L	<10	<10	----	----	----
3-Nitroaniline	USEPA8270C	10	µg/L	<10	<10	----	----	----
Dibenzofuran	USEPA8270C	5	µg/L	<5	<5	----	----	----
4-Nitroaniline	USEPA8270C	5	µg/L	<5	<5	----	----	----
Carbazole	USEPA8270C	5	µg/L	<5	<5	----	----	----
3.3`-Dichlorobenzidine	USEPA8270C	5	µg/L	<5	<5	----	----	----
SVOC: Polycyclic Aromatic Hydrocarbons (PAHs)								
Naphthalene	USEPA8270C	5	µg/L	<5	<5	----	----	----
Acenaphthylene	USEPA8270C	5	µg/L	<5	<5	----	----	----
Acenaphthene	USEPA8270C	5	µg/L	<5	<5	----	----	----
Fluorene	USEPA8270C	5	µg/L	<5	<5	----	----	----
Phenanthrene	USEPA8270C	5	µg/L	<5	<5	----	----	----
Anthracene	USEPA8270C	5	µg/L	<5	<5	----	----	----
Fluoranthene	USEPA8270C	5	µg/L	<5	<5	----	----	----

Analytical Results

Sub-Matrix: **WATER**

Compound	Method	LOR	Unit	Client sample ID: BH6 Sampling date/time: 14-Dec-2018 12:00 KL1812717-006	Client sample ID: MW-QC Sampling date/time: 14-Dec-2018 00:00 KL1812717-007	---- ---- --------	---- ---- --------	---- ---- --------
SVOC: Polycyclic Aromatic Hydrocarbons (PAHs) - Continued								
Pyrene	USEPA8270C	5	µg/L	<5	<5	----	----	----
Benz(a)anthracene	USEPA8270C	5	µg/L	<5	<5	----	----	----
Chrysene	USEPA8270C	5	µg/L	<5	<5	----	----	----
Benzo(b) & Benzo(k)fluoranthene	USEPA8270C	10	µg/L	<10	<10	----	----	----
Benzo(a)pyrene	USEPA8270C	5	µg/L	<5	<5	----	----	----
Indeno(1.2.3.cd)pyrene	USEPA8270C	5	µg/L	<5	<5	----	----	----
Dibenz(a.h)anthracene	USEPA8270C	5	µg/L	<5	<5	----	----	----
Benzo(g.h.i)perylene	USEPA8270C	5	µg/L	<5	<5	----	----	----
VOC: Surrogates								
1.2-Dichloroethane-D4	USEPA8260B	5	%	96.4	95.2	----	----	----
Toluene-D8	USEPA8260B	5	%	91.6	88.0	----	----	----
4-Bromofluorobenzene	USEPA8260B	5	%	109	109	----	----	----
Volatile Organic Compound -Surrogates								
Toluene-D8	USEPA8260B	1	%	93.2	89.8	----	----	----
1.2-Dichloroethane-D4	USEPA8260B	1	%	102	101	----	----	----
4-Bromofluorobenzene	USEPA8260B	1	%	110	109	----	----	----
SVOC: Acid Extractable Surrogates								
2-Fluorophenol	USEPA8270C	0.1	%	40.2	34.0	----	----	----
Phenol-d5	USEPA8270C	0.1	%	40.5	32.2	----	----	----
2.4.6-Tribromophenol	USEPA8270C	0.1	%	69.7	64.1	----	----	----
SVOC: Base/NeutralExtractable Surrogates								
Nitrobenzene -d5	USEPA8270C	0.1	%	54.0	52.0	----	----	----
2-Fluorobiphenyl	USEPA8270C	0.1	%	73.5	68.5	----	----	----
4-Terphenyl-d14	USEPA8270C	0.1	%	63.3	58.6	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	High
VOC: Surrogates			
1.2-Dichloroethane-D4	17060-07-0	70	130
Toluene-D8	2037-26-5	70	130
4-Bromofluorobenzene	460-00-4	70	130
Volatile Organic Compound -Surrogates			
Toluene-D8	2037-26-5	70	130
1.2-Dichloroethane-D4	17060-07-0	70	130
4-Bromofluorobenzene	460-00-4	70	130
SVOC: Acid Extractable Surrogates			
2-Fluorophenol	367-12-4	20	60
Phenol-d5	----	20	60
2.4.6-Tribromophenol	118-79-6	50	140
SVOC: Base/NeutralExtractable Surrogates			
Nitrobenzene -d5	4165-60-0	50	140
2-Fluorobiphenyl	321-60-8	50	140
4-Terphenyl-d14	1718-51-0	50	140

CERTIFICATE OF ANALYSIS

Work Order	: **KL1812718**	Page	: 1 of 15
Client	: **ENVIROSOLUTIONS & CONSULTING SDN BHD**	Laboratory	: ALS Technichem (M) Sdn. Bhd.
Contact	: MS CHUAH LI MOR	Contact	: Boo Chuanyong
Address	: NO 65B, JALAN SS21/60, DAMANSARA UTAMA, PETALING JAYA, SELANGOR 47400	Address	: WISMA ALS, 21, Jalan Astaka U8/84, Bukit Jelutong Shah Alam Selangor Malaysia 40150
E-mail	: limor@envirosc.com	E-mail	: boo.chuanyong@alsglobal.com
Telephone	: 03 7733 8816	Telephone	: +603 7845 8257
Facsimile	: 03 7733 8817	Facsimile	: +603 7845 8258
Project	: J18-780	QC Level	: ALS Malaysia Standard Quality Schedule
Order number	:	Date Samples Received	: 14-Dec-2018 20:35
C-O-C number	: 12257	Date Analysis Commenced	: 17-Dec-2018
Sampler	: CHUAH LIMOR	Issue Date	: 27-Dec-2018 16:59
Site	: PENGERANG PROJECT		
		No. of samples received	: 8
Quote number	: ----	No. of samples analysed	: 8

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

MS ISO/IEC 17025
TESTING
SAMM NO. 147

Signatories

This laboratory is accredited under STANDARDS MALAYSIA. The tests reported herein have been performed in accordance with laboratory's Terms of Accreditation. This document has been electronically signed by authorized signatories indicated below. Electronic signing has been carried out in compliance with procedure specified in 21 CFR Part 11.

Signatories	*Position*
Norain Yahya	Chemist (IKM No: M/4233/7042/15)
Nuramira Abdmalek	Chemist (IKM No: M/4867/8027/18)

*Please direct all technical queries to the laboratory (Reports.KL@alsglobal.com)

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, ASTM, NIOSH and BS EN. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not accredited for these tests.
~ = Indicates an estimated value.

- ALS TECHNICHEM prepares this Test Report based on the tests requested and on the specific sample(s) submitted for analysis. The significance of this Report is subject to the adequacy and representative character of the sample(s) and to the comprehensiveness of the tests requested or made. ALS TECHNICHEM assumes no responsibility for variations in quality or other characteristic of the product produced or supplied under conditions over which ALS TECHNICHEM has no control.
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- Result < LOR = Not Detected (ND)
- Where moisture determination has been performed, results are reported on a dry weight basis.

Analytical Results

Sub-Matrix: **SOIL**

Compound	Method	LOR	Unit	Client sample ID: BH1-2.0 Sampling date/time: 12-Dec-2018 11:30 KL1812718-001	BH2-1.0 12-Dec-2018 14:28 KL1812718-002	BH2-5.0 12-Dec-2018 15:05 KL1812718-003	BH3-4.0 12-Dec-2018 17:00 KL1812718-004	BH4-3.0 13-Dec-2018 10:00 KL1812718-005
Metals and Major Cations - Total								
Antimony	USEPA6010B	5	mg/kg	<5	<5	<5	<5	<5
Arsenic	USEPA6010B	1	mg/kg	<1	<1	<1	<1	<1
Beryllium	USEPA6010B	1	mg/kg	<1	<1	<1	<1	<1
Cadmium	USEPA6010B	1	mg/kg	<1	<1	<1	<1	<1
Chromium	USEPA6010B	1	mg/kg	4	2	3	3	4
Copper	USEPA6010B	1	mg/kg	6	2	1	1	4
Lead	USEPA6010B	1	mg/kg	15	4	4	5	2
Mercury	USEPA7471A	0.10	mg/kg	0.32	<0.10	<0.10	0.15	0.25
Nickel	USEPA6010B	1	mg/kg	<1	<1	<1	<1	<1
Selenium	USEPA6010B	5	mg/kg	<5	<5	<5	<5	<5
Silver	USEPA6010B	1	mg/kg	<1	<1	<1	<1	<1
Thallium	USEPA6010B	5	mg/kg	<5	<5	<5	<5	<5
Zinc	USEPA6010B	1	mg/kg	9	8	4	3	9
Total Petroleum Hydrocarbon (TPH)								
TPH C6-C9	USEPA8260B	5	mg/kg	<5	<5	<5	<5	<5
TPH C10-C14	USEPA8015B	50	mg/kg	<50	<50	<50	<50	<50
TPH C15-C28	USEPA8015B	100	mg/kg	<100	<100	<100	<100	<100
TPH C29-C36	USEPA8015B	100	mg/kg	<100	<100	<100	<100	<100
VOC: Monocylic Aromatics								
Benzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Toluene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	USEPA8260B	1	mg/kg	<1	<1	<1	<1	<1
Styrene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Isopropylbenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
n-Propylbenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.3.5-Trimethylbenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
sec-Butylbenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.2.4-Trimethylbenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
tert-Butylbenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
p-Isopropyltoluene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
n-Butylbenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
VOC: Oxygenated Compounds								

Analytical Results

Sub-Matrix: **SOIL**

Compound	Method	LOR	Unit	Client sample ID: BH1-2.0 Sampling date/time: 12-Dec-2018 11:30 KL1812718-001	BH2-1.0 12-Dec-2018 14:28 KL1812718-002	BH2-5.0 12-Dec-2018 15:05 KL1812718-003	BH3-4.0 12-Dec-2018 17:00 KL1812718-004	BH4-3.0 13-Dec-2018 10:00 KL1812718-005
VOC: Oxygenated Compounds - Continued								
2-Butanone (MEK)	USEPA8260B	5	mg/kg	<5	<5	<5	<5	<5
4-Methyl-2-pentanone (MIBK)	USEPA8260B	5	mg/kg	<5	<5	<5	<5	<5
2-Hexanone (MBK)	USEPA8260B	5	mg/kg	<5	<5	<5	<5	<5
VOC: Fumigants								
2.2-Dichloropropane	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.2-Dichloropropane	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1.3-Dichloropropylene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1.3-Dichloropropylene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.2-Dibromoethane (EDB)	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
VOC: Halogenated Aliphatics								
Dichlorodifluoromethane	USEPA8260B	5	mg/kg	<5	<5	<5	<5	<5
Chloromethane	USEPA8260B	5	mg/kg	<5	<5	<5	<5	<5
Vinyl chloride	USEPA8260B	5	mg/kg	<5	<5	<5	<5	<5
Bromomethane	USEPA8260B	5	mg/kg	<5	<5	<5	<5	<5
Chloroethane	USEPA8260B	5	mg/kg	<5	<5	<5	<5	<5
Trichlorofluoromethane	USEPA8260B	5	mg/kg	<5	<5	<5	<5	<5
1.1-Dichloroethene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Iodomethane	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1.2-Dichloroethene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.1-Dichloroethane	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1.2-Dichloroethene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.1.1-Trichloroethane	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.1-Dichloropropylene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Carbon Tetrachloride	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.2-Dichloroethane	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dibromomethane	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.1.2-Trichloroethane	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.3-Dichloropropane	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.1.1.2-Tetrachloroethane	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1.4-Dichloro-2-butene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1.4-Dichloro-2-butene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.1.2.2-Tetrachloroethane	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: **SOIL**

Compound	Method	LOR	Unit	Client sample ID: BH1-2.0 Sampling date/time: 12-Dec-2018 11:30 KL1812718-001	BH2-1.0 12-Dec-2018 14:28 KL1812718-002	BH2-5.0 12-Dec-2018 15:05 KL1812718-003	BH3-4.0 12-Dec-2018 17:00 KL1812718-004	BH4-3.0 13-Dec-2018 10:00 KL1812718-005
VOC: Halogenated Aliphatics - Continued								
1.2.3-Trichloropropane	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Pentachloroethane	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.2-Dibromo-3-chloropropane	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Hexachlorobutadiene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
VOC: Halogenated Aromatics								
Chlorobenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Bromobenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2-Chlorotoluene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
4-Chlorotoluene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.3-Dichlorobenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.4-Dichlorobenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.2-Dichlorobenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.2.4-Trichlorobenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.2.3-Trichlorobenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
VOC: Trihalomethanes								
Chloroform	USEPA8260B	2	mg/kg	<2	<2	<2	<2	<2
Bromodichloromethane	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dibromochloromethane	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoform	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
SVOC: Phenolic Compounds								
Phenol	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2-Chlorophenol	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2-Methylphenol	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
3- & 4-Methylphenol	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2-Nitrophenol	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.4-Dimethylphenol	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.4-Dichlorophenol	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.6-Dichlorophenol	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
4-Chloro-3-methylphenol	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.4.6-Trichlorophenol	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.4.5-Trichlorophenol	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Pentachlorophenol	USEPA8270C	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
SVOC: Phthalate Esters								
Dimethyl phthalate	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: **SOIL**

Compound	Method	LOR	Unit	Client sample ID: BH1-2.0 Sampling date/time: 12-Dec-2018 11:30 KL1812718-001	BH2-1.0 12-Dec-2018 14:28 KL1812718-002	BH2-5.0 12-Dec-2018 15:05 KL1812718-003	BH3-4.0 12-Dec-2018 17:00 KL1812718-004	BH4-3.0 13-Dec-2018 10:00 KL1812718-005
SVOC: Phthalate Esters - Continued								
Diethyl phthalate	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Di-n-butyl phthalate	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Butyl benzyl phthalate	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Bis(2-ethylhexyl)phthalate	USEPA8270C	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
Di-n-octylphthalate	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
SVOC: Nitrosamines								
N-Nitrosomethylethylamine	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
N-Nitrosodiethylamine	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
N-Nitrosopyrrolidine	USEPA8270C	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
N-Nitrosomorpholine	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
N-Nitrosodi-n-propylamine	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
N-Nitrosopiperidine	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
N-Nitrosodibutylamine	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Diphenylamine & N-Nitrosodiphenylamine	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Diallate	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Methapyrilene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
SVOC: Nitroaromatics and Ketones								
2-Picoline	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acetophenone	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Nitrobenzene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Isophorone	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.6-Dinitrotoluene	USEPA8270C	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
2.4-Dinitrotoluene	USEPA8270C	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
1-Naphthylamine	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
4-Nitroquinoline-N-oxide	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
5-Nitro-o-toluidine	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Azobenzene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.3.5-Trinitrobenzene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenacetin	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
4-Aminobiphenyl	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Pentachloronitrobenzene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Pronamide	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dimethylaminoazobenzene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: **SOIL**

Compound	Method	LOR	Unit	Client sample ID: BH1-2.0 Sampling date/time: 12-Dec-2018 11:30 KL1812718-001	BH2-1.0 12-Dec-2018 14:28 KL1812718-002	BH2-5.0 12-Dec-2018 15:05 KL1812718-003	BH3-4.0 12-Dec-2018 17:00 KL1812718-004	BH4-3.0 13-Dec-2018 10:00 KL1812718-005
SVOC: Nitroaromatics and Ketones - Continued								
Chlorobenzilate	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
SVOC: Haloethers								
Bis(2-chloroethyl) ether	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Bis(2-chloroethoxy) methane	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
4-Chlorophenyl phenyl ether	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
4-Bromophenyl phenyl ether	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
SVOC: Chlorinated Hydrocarbons								
1.3-Dichlorobenzene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.4-Dichlorobenzene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.2-Dichlorobenzene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Hexachloroethane	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
1.2.4-Trichlorobenzene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Hexachloropropylene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Hexachlorobutadiene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Hexachlorocyclopentadiene	USEPA8270C	2.5	mg/kg	<2.5	<2.5	<2.5	<2.5	<2.5
Pentachlorobenzene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Hexachlorobenzene (HCB)	USEPA8270C	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
SVOC: Anilines and Benzidines								
Aniline	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
4-Chloroaniline	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2-Nitroaniline	USEPA8270C	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
3-Nitroaniline	USEPA8270C	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Dibenzofuran	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
4-Nitroaniline	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Carbazole	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
3.3`-Dichlorobenzidine	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
SVOC: Polycyclic Aromatic Hydrocarbons (PAHs)								
Naphthalene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: **SOIL**

				Client sample ID	BH1-2.0	BH2-1.0	BH2-5.0	BH3-4.0	BH4-3.0
				Sampling date/time	12-Dec-2018 11:30	12-Dec-2018 14:28	12-Dec-2018 15:05	12-Dec-2018 17:00	13-Dec-2018 10:00
Compound	Method	LOR	Unit		KL1812718-001	KL1812718-002	KL1812718-003	KL1812718-004	KL1812718-005
SVOC: Polycyclic Aromatic Hydrocarbons (PAHs) - Continued									
Pyrene	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b) & Benzo(k)fluoranthene	USEPA8270C	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(a)pyrene	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
VOC: Surrogates									
1.2-Dichloroethane-D4	USEPA8260B	0.5	%		84.2	93.3	114	111	121
Toluene-D8	USEPA8260B	0.5	%		102	93.4	97.9	103	93.7
4-Bromofluorobenzene	USEPA8260B	0.5	%		93.4	101	91.4	90.1	89.0
Volatile Organic Compound -Surrogates									
1.2-Dichloroethane-D4	USEPA8260B	0.1	%		83.2	97.4	107	116	120
4-Bromofluorobenzene	USEPA8260B	0.1	%		88.9	96.6	87.0	85.8	84.7
Toluene-D8	USEPA8260B	0.1	%		102	93.5	98.0	103	93.8
SVOC: Acid Extractable Surrogates									
2-Fluorophenol	USEPA8270C	0.1	%		79.4	76.7	83.0	87.1	76.3
Phenol-d5	USEPA8270C	0.1	%		62.5	65.8	71.0	63.0	66.9
2.4.6-Tribromophenol	USEPA8270C	0.1	%		69.9	70.6	70.4	70.2	64.4
SVOC: Base/NeutralExtractable Surrogates									
Nitrobenzene -d5	USEPA8270C	0.1	%		89.8	98.3	102	94.9	96.6
2-Fluorobiphenyl	USEPA8270C	0.1	%		84.6	85.7	96.8	84.3	91.2
4-Terphenyl-d14	USEPA8270C	0.1	%		126	124	131	122	117

Analytical Results

Sub-Matrix: **SOIL**

Compound	Method	LOR	Unit	Client sample ID: BH5-5.0 Sampling date/time: 13-Dec-2018 11:55 KL1812718-006	Client sample ID: BH6-3.0 Sampling date/time: 13-Dec-2018 15:12 KL1812718-007	Client sample ID: BH-QC Sampling date/time: 12-Dec-2018 00:00 KL1812718-008	Client sample ID: ---- Sampling date/time: ---- --------	Client sample ID: ---- Sampling date/time: ---- --------
Metals and Major Cations - Total								
Antimony	USEPA6010B	5	mg/kg	<5	<5	<5	----	----
Arsenic	USEPA6010B	1	mg/kg	<1	<1	<1	----	----
Beryllium	USEPA6010B	1	mg/kg	<1	<1	<1	----	----
Cadmium	USEPA6010B	1	mg/kg	<1	<1	<1	----	----
Chromium	USEPA6010B	1	mg/kg	<1	<1	<1	----	----
Copper	USEPA6010B	1	mg/kg	4	<1	<1	----	----
Lead	USEPA6010B	1	mg/kg	3	<1	<1	----	----
Mercury	USEPA7471A	0.10	mg/kg	<0.10	0.27	0.17	----	----
Nickel	USEPA6010B	1	mg/kg	<1	<1	<1	----	----
Selenium	USEPA6010B	5	mg/kg	<5	<5	<5	----	----
Silver	USEPA6010B	1	mg/kg	<1	<1	<1	----	----
Thallium	USEPA6010B	5	mg/kg	<5	<5	<5	----	----
Zinc	USEPA6010B	1	mg/kg	3	<1	<1	----	----
Total Petroleum Hydrocarbon (TPH)								
TPH C6-C9	USEPA8260B	5	mg/kg	<5	<5	<5	----	----
TPH C10-C14	USEPA8015B	50	mg/kg	<50	<50	<50	----	----
TPH C15-C28	USEPA8015B	100	mg/kg	<100	<100	<100	----	----
TPH C29-C36	USEPA8015B	100	mg/kg	<100	<100	<100	----	----
VOC: Monocylic Aromatics								
Benzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Toluene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Ethylbenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
meta- & para-Xylene	USEPA8260B	1	mg/kg	<1	<1	<1	----	----
Styrene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
ortho-Xylene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Isopropylbenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
n-Propylbenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
1.3.5-Trimethylbenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
sec-Butylbenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
1.2.4-Trimethylbenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
tert-Butylbenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
p-Isopropyltoluene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
n-Butylbenzene	USEPA8260B	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
VOC: Oxygenated Compounds								

Analytical Results

Sub-Matrix: SOIL				Client sample ID	BH5-5.0	BH6-3.0	BH-QC	----	----
				Sampling date/time	13-Dec-2018 11:55	13-Dec-2018 15:12	12-Dec-2018 00:00	----	----
Compound	Method	LOR	Unit		KL1812718-006	KL1812718-007	KL1812718-008	--------	--------
VOC: Oxygenated Compounds - Continued									
2-Butanone (MEK)	USEPA8260B	5	mg/kg		<5	<5	<5	----	----
4-Methyl-2-pentanone (MIBK)	USEPA8260B	5	mg/kg		<5	<5	<5	----	----
2-Hexanone (MBK)	USEPA8260B	5	mg/kg		<5	<5	<5	----	----
VOC: Fumigants									
2.2-Dichloropropane	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
1.2-Dichloropropane	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
cis-1.3-Dichloropropylene	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
trans-1.3-Dichloropropylene	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
1.2-Dibromoethane (EDB)	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
VOC: Halogenated Aliphatics									
Dichlorodifluoromethane	USEPA8260B	5	mg/kg		<5	<5	<5	----	----
Chloromethane	USEPA8260B	5	mg/kg		<5	<5	<5	----	----
Vinyl chloride	USEPA8260B	5	mg/kg		<5	<5	<5	----	----
Bromomethane	USEPA8260B	5	mg/kg		<5	<5	<5	----	----
Chloroethane	USEPA8260B	5	mg/kg		<5	<5	<5	----	----
Trichlorofluoromethane	USEPA8260B	5	mg/kg		<5	<5	<5	----	----
1.1-Dichloroethene	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Iodomethane	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
trans-1.2-Dichloroethene	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
1.1-Dichloroethane	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
cis-1.2-Dichloroethene	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
1.1.1-Trichloroethane	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
1.1-Dichloropropylene	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Carbon Tetrachloride	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
1.2-Dichloroethane	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Trichloroethene	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Dibromomethane	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
1.1.2-Trichloroethane	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
1.3-Dichloropropane	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Tetrachloroethene	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
1.1.1.2-Tetrachloroethane	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
trans-1.4-Dichloro-2-butene	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
cis-1.4-Dichloro-2-butene	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
1.1.2.2-Tetrachloroethane	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----

Analytical Results

Sub-Matrix: SOIL				Client sample ID	BH5-5.0	BH6-3.0	BH-QC	----	----
				Sampling date/time	13-Dec-2018 11:55	13-Dec-2018 15:12	12-Dec-2018 00:00	----	----
Compound	Method	LOR	Unit		KL1812718-006	KL1812718-007	KL1812718-008	--------	--------
VOC: Halogenated Aliphatics - Continued									
1.2.3-Trichloropropane	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Pentachloroethane	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
1.2-Dibromo-3-chloropropane	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Hexachlorobutadiene	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
VOC: Halogenated Aromatics									
Chlorobenzene	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Bromobenzene	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
2-Chlorotoluene	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
4-Chlorotoluene	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
1.3-Dichlorobenzene	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
1.4-Dichlorobenzene	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
1.2-Dichlorobenzene	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
1.2.4-Trichlorobenzene	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
1.2.3-Trichlorobenzene	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
VOC: Trihalomethanes									
Chloroform	USEPA8260B	2	mg/kg		<2	<2	<2	----	----
Bromodichloromethane	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Dibromochloromethane	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Bromoform	USEPA8260B	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
SVOC: Phenolic Compounds									
Phenol	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
2-Chlorophenol	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
2-Methylphenol	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
3- & 4-Methylphenol	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
2-Nitrophenol	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
2.4-Dimethylphenol	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
2.4-Dichlorophenol	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
2.6-Dichlorophenol	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
4-Chloro-3-methylphenol	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
2.4.6-Trichlorophenol	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
2.4.5-Trichlorophenol	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Pentachlorophenol	USEPA8270C	1.0	mg/kg		<1.0	<1.0	<1.0	----	----
SVOC: Phthalate Esters									
Dimethyl phthalate	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----

Analytical Results

Sub-Matrix: **SOIL**

Compound	Method	LOR	Unit	Client sample ID: BH5-5.0 Sampling date/time: 13-Dec-2018 11:55 KL1812718-006	BH6-3.0 13-Dec-2018 15:12 KL1812718-007	BH-QC 12-Dec-2018 00:00 KL1812718-008	---- ---- --------	---- ---- --------
SVOC: Phthalate Esters - Continued								
Diethyl phthalate	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Di-n-butyl phthalate	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Butyl benzyl phthalate	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Bis(2-ethylhexyl)phthalate	USEPA8270C	5.0	mg/kg	<5.0	<5.0	<5.0	----	----
Di-n-octylphthalate	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
SVOC: Nitrosamines								
N-Nitrosomethylethylamine	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
N-Nitrosodiethylamine	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
N-Nitrosopyrrolidine	USEPA8270C	1.0	mg/kg	<1.0	<1.0	<1.0	----	----
N-Nitrosomorpholine	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
N-Nitrosodi-n-propylamine	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
N-Nitrosopiperidine	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
N-Nitrosodibutylamine	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Diphenylamine & N-Nitrosodiphenylamine	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Diallate	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Methapyrilene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
SVOC: Nitroaromatics and Ketones								
2-Picoline	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Acetophenone	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Nitrobenzene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Isophorone	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
2.6-Dinitrotoluene	USEPA8270C	1.0	mg/kg	<1.0	<1.0	<1.0	----	----
2.4-Dinitrotoluene	USEPA8270C	1.0	mg/kg	<1.0	<1.0	<1.0	----	----
1-Naphthylamine	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
4-Nitroquinoline-N-oxide	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
5-Nitro-o-toluidine	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Azobenzene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
1.3.5-Trinitrobenzene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Phenacetin	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
4-Aminobiphenyl	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Pentachloronitrobenzene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Pronamide	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Dimethylaminoazobenzene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----

Analytical Results

Sub-Matrix: SOIL				Client sample ID	BH5-5.0	BH6-3.0	BH-QC	----	----
				Sampling date/time	13-Dec-2018 11:55	13-Dec-2018 15:12	12-Dec-2018 00:00	----	----
Compound	Method	LOR	Unit		KL1812718-006	KL1812718-007	KL1812718-008	--------	--------
SVOC: Nitroaromatics and Ketones - Continued									
Chlorobenzilate	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
SVOC: Haloethers									
Bis(2-chloroethyl) ether	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Bis(2-chloroethoxy) methane	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
4-Chlorophenyl phenyl ether	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
4-Bromophenyl phenyl ether	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
SVOC: Chlorinated Hydrocarbons									
1.3-Dichlorobenzene	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
1.4-Dichlorobenzene	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
1.2-Dichlorobenzene	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Hexachloroethane	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
1.2.4-Trichlorobenzene	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Hexachloropropylene	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Hexachlorobutadiene	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Hexachlorocyclopentadiene	USEPA8270C	2.5	mg/kg		<2.5	<2.5	<2.5	----	----
Pentachlorobenzene	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Hexachlorobenzene (HCB)	USEPA8270C	1.0	mg/kg		<1.0	<1.0	<1.0	----	----
SVOC: Anilines and Benzidines									
Aniline	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
4-Chloroaniline	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
2-Nitroaniline	USEPA8270C	1.0	mg/kg		<1.0	<1.0	<1.0	----	----
3-Nitroaniline	USEPA8270C	1.0	mg/kg		<1.0	<1.0	<1.0	----	----
Dibenzofuran	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
4-Nitroaniline	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Carbazole	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
3.3`-Dichlorobenzidine	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
SVOC: Polycyclic Aromatic Hydrocarbons (PAHs)									
Naphthalene	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Acenaphthylene	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Acenaphthene	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Fluorene	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Phenanthrene	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Anthracene	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Fluoranthene	USEPA8270C	0.5	mg/kg		<0.5	<0.5	<0.5	----	----

Analytical Results

Sub-Matrix: **SOIL**

Compound	Method	LOR	Unit	Client sample ID: BH5-5.0 Sampling date/time: 13-Dec-2018 11:55 KL1812718-006	Client sample ID: BH6-3.0 Sampling date/time: 13-Dec-2018 15:12 KL1812718-007	Client sample ID: BH-QC Sampling date/time: 12-Dec-2018 00:00 KL1812718-008	Client sample ID: ---- Sampling date/time: ---- --------	Client sample ID: ---- Sampling date/time: ---- --------
SVOC: Polycyclic Aromatic Hydrocarbons (PAHs) - Continued								
Pyrene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Benz(a)anthracene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Chrysene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Benzo(b) & Benzo(k)fluoranthene	USEPA8270C	1.0	mg/kg	<1.0	<1.0	<1.0	----	----
Benzo(a)pyrene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Indeno(1.2.3.cd)pyrene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Dibenz(a.h)anthracene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Benzo(g.h.i)perylene	USEPA8270C	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
VOC: Surrogates								
1.2-Dichloroethane-D4	USEPA8260B	0.5	%	117	120	114	----	----
Toluene-D8	USEPA8260B	0.5	%	104	97.3	99.2	----	----
4-Bromofluorobenzene	USEPA8260B	0.5	%	93.0	94.5	102	----	----
Volatile Organic Compound -Surrogates								
1.2-Dichloroethane-D4	USEPA8260B	0.1	%	114	122	120	----	----
4-Bromofluorobenzene	USEPA8260B	0.1	%	88.6	89.9	97.4	----	----
Toluene-D8	USEPA8260B	0.1	%	104	97.5	99.4	----	----
SVOC: Acid Extractable Surrogates								
2-Fluorophenol	USEPA8270C	0.1	%	85.1	85.0	79.9	----	----
Phenol-d5	USEPA8270C	0.1	%	62.6	70.0	66.0	----	----
2.4.6-Tribromophenol	USEPA8270C	0.1	%	64.4	64.3	63.4	----	----
SVOC: Base/NeutralExtractable Surrogates								
Nitrobenzene -d5	USEPA8270C	0.1	%	97.1	100	94.8	----	----
2-Fluorobiphenyl	USEPA8270C	0.1	%	83.7	89.5	88.9	----	----
4-Terphenyl-d14	USEPA8270C	0.1	%	130	125	133	----	----

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	Recovery Limits (%) High
VOC: Surrogates			
1.2-Dichloroethane-D4	17060-07-0	70	130
Toluene-D8	2037-26-5	70	130
4-Bromofluorobenzene	460-00-4	70	130
Volatile Organic Compound -Surrogates			
1.2-Dichloroethane-D4	17060-07-0	70	130
4-Bromofluorobenzene	460-00-4	70	130
Toluene-D8	2037-26-5	70	130
SVOC: Acid Extractable Surrogates			
2-Fluorophenol	367-12-4	50	140
Phenol-d5	----	50	140
2.4.6-Tribromophenol	118-79-6	50	140
SVOC: Base/NeutralExtractable Surrogates			
Nitrobenzene -d5	4165-60-0	50	140
2-Fluorobiphenyl	321-60-8	50	140
4-Terphenyl-d14	1718-51-0	50	140

Baseline Odour Sampling and Determination Exercise at the Proposed Pengerang Energy Complex and Its Surrounding Areas, Pengerang, Johor

(18th - 19th July 2018)

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APPENDIX A BROCHURE ON NASAL RANGER® FIELD OLFACTOMETER

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SECTION 1: INTRODUCTION

1.1 ODOUR SAMPLING AND DETERMINATION OBJECTIVE

An odour sampling and determination exercise was carried out on 18th and 19th July 2018 (Wednesday and Thursday) at surrounding areas of Proposed Pengerang Energy Complex (PEC), Lot PTD 2083, Pengerang Industrial Park, Mukim Pengerang, Daerah Kota Tinggi, Johor Darul Ta'zim (hereinafter known as the **"Project Site"**).

The location plan of the Project Site is as shown in **Figure 1-1** and the identified odour sampling locations are as shown in **Figure 3-1**.

The objective of the odour sampling and determination exercise is to establish the perceived odour concentration in **Dilution to Threshold (D/T)** using Nasal Ranger® Field Olfactometer at identified sampling points for three (3) periods namely afternoon, night-time and morning.

SECTION 1: INTRODUCTION

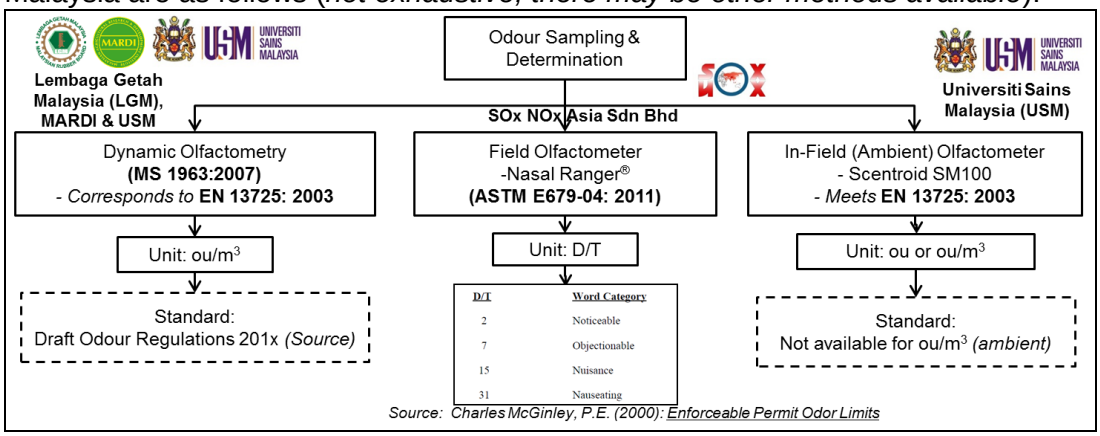
Figure 1-1: Location Map of the Project Site



Source: Google MyMaps (Accessed on 2 November 2018)

SECTION 2: METHODOLOGY

The current available common odour sampling and determination methods in Malaysia are as follows (*not exhaustive, there may be other methods available*):



In accordance to the United Kingdom (UK) Environment Agency as outlined in its document entitled **"H4 - Odour Management - How to comply with your environmental permit (March 2011)"**, the dynamic olfactometry is not suitable for measuring odours in ambient context. While, in the guidance document by the United Kingdom (UK) Institute of Air Quality Management entitled **"Guidance on the assessment of odour for planning"**, the Nasal Ranger® Field Olfactometer had being identified as one of the portable field olfactometry suitable for ambient measurements.

Currently, in Malaysia, there is no specific guideline formulated for odour measurement in ambient.

2.1 NASAL RANGER® FIELD OLFACTOMETER

Field olfactometer namely Nasal Ranger® developed by St. Croix Sensory Inc. (for details of the Nasal Ranger®, please refer to **Appendix A**) was employed on-site by SNA (SOx NOx Asia Sdn Bhd) personnel for this odour sampling and determination exercise.

The Nasal Ranger® Field Olfactometer is portable device with a source of clean filtered air and a dilution system based on several calibrated orifices: the assessor may gradually reduce the dilution of external air until he perceives its odour, obtaining its D/T value (dilution to threshold), according to the American Society for Testing and Materials technical standard namely **ASTM E679-04: 2011: Standard Practice for Determination of Odour and Taste Threshold by a Forced-Choice Ascending Concentration Series Method of Limits.**

The Nasal Ranger® Field Olfactometer uses carbon filters to directly clean ambient air to be used as the odour-free diluting gas. The filtered air is mixed with odourous ambient air at discrete volume ratios.

The Nasal Ranger® consists of a nasal mask at the edge; two carbon filters are attached to the opposite sides of the Nasal Ranger® housing. Dilution ratio of clean air to sample air is controlled via the D/T dial, which contains six D/T positions (six orifices with traceable calibration namely 60, 30, 15, 7, 4 and 2), alternating with six

SECTION 2: METHODOLOGY

blank positions for the user to inhale only odour-free filtered air. In determining of the odour detection level (D/T value), the assessor need to place his nose firmly inside the nasal mask, sets the D/T ratio turning the D/T dial, and inhales through the nasal mask; then the assessor turns the dial, slowly increasing concentration of the mix, until the odour in the ambient air is detected.

An electronic flowmeter built into the Nasal Ranger® barrel measures the total volume of mixed airflow that is inhaled by the assessor and is travelling down the barrel on the way to the nasal mask: the inhalation flowrate should be within the factory calibration flowrate of 16-20 liter per minute.

*Note: *The Nasal Ranger® Field Olfactometer is only suitable for determination of perceived odour at ambient level. It is not suitable for perceived odour at high concentration (i.e. at source) in term of health aspect due to exposure to odourous pollutants to the assessor.*

SECTION 3: RESULT

3.1 RESULT

Results of the odour sampling and determination exercise carried out on 18th and 18th July 2018 (Wednesday and Thursday) by SNA personnel are summarized in **Table 3-1** to **Table 3-3**. Wind direction and wind speed at each sampling location for the three (3) periods are indicated in **Figure 3-2** to **Figure 3-4.**

Currently, in Malaysia, there is no guideline or standard for ambient odour concentration perceived. Nevertheless, for the purpose of comparison, the following table from ***Charles McGinley, P.E. (2000): Enforceable Permit Odor Limits*** is being adopted.

D/T	Word Category
2	Noticeable
7	Objectionable
15	Nuisance
31	Nauseating

Source: Charles McGinley, P.E. (2000): Enforceable Permit Odor Limits.

Afternoon

The odour perceived at **Between Project Site (O1)** and **The Fairway Golf Villas (O5)** was occasional very faint green smell (pleasant) at odour concentration of less than 2 D/T and constant very faint combustion smell (unpleasant) at odour concentration of less than 2 D/T respectively.

No distinct odour i.e. neutral was perceived at **Nearby Existing Project Site Entrance (O2)**, **Sekolah Kebangsaan Lepau (O3)**, and **Kampung Bukit Pelali (O4)**.

Night-time

The odour perceived at **Nearby Existing Project Site Entrance (O2)** was occasional very faint combustion smell (unpleasant) at odour concentration of less than 2 D/T. Meanwhile, at **Kampung Bukit Pelali (O4)** the odour perceived was constant very faint green smell (pleasant) at odour concentration of less than 2 D/T. Whereas, at **The Fairway Golf Villas (O5)** the odour perceived was constant very faint grass smell (pleasant) at odour concentration of less than 2 D/T.

No distinct odour i.e. neutral was perceived at **Between Project Site (O1)** and **Sekolah Kebangsaan Lepau (O3).**

Morning

The odour perceived at **Nearby Existing Project Site Entrance (O2)** and **Sekolah Kebangsaan Lepau (O3)** was constant very faint combustion smell (unpleasant) at odour concentration of less than 2 D/T for both locations. Meanwhile, at **Between Project Site (O1)** the odour perceived was constant very faint green smell

SECTION 3: RESULT

(pleasant) at odour concentration of less than 2 D/T. At **Kampung Bukit Pelali (O4)**, the odour perceived was occasional very faint vehicle combustion smell (unpleasant) and constant very faint green smell (pleasant) with odour concentration of less than 2 D/T for both. Whereas, at **The Fairway Golf Villas (O5)** the odour perceived was constant very faint tar smell (unpleasant) and constant very faint green smell (pleasant) at odour concentration of less than 2 D/T for both.

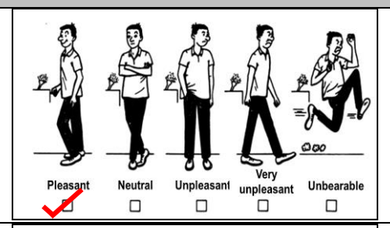
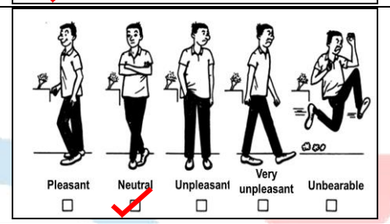
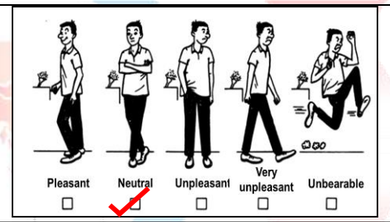
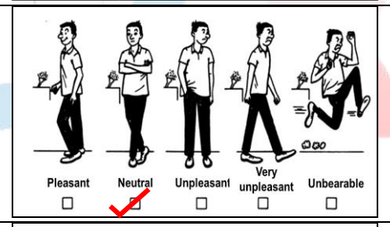
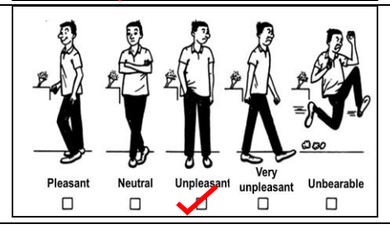
SECTION 3: RESULT

Figure 3-1: Location of Sampling Points



SECTION 3: RESULT

Table 3-1: Result of Odour Sampling and Determination during Afternoon Period (2.00 pm to 4.00 pm)

Sampling Location	Photo	Remarks	Hedonic Tone Scale	Odour Character Descriptor	Dilution-to-Threshold (D/T)
Between Project Site (O1) N 1° 23' 19.65" E 104° 10' 40.42"		Time of sampling: 3.29 pm Wind direction: North (N) Wind speed: 2.6 m/s Temperature: 32.2°C Relative humidity: 60.5%		Occasional very faint green smell (pleasant)	*<2* *(Green)*
Nearby Existing Project Site Entrance (O2) N 1° 23' 22.72" E 104° 10' 48.80"		Time of sampling: 3.36 pm Wind direction: North (N) Wind speed: 3.7 m/s Temperature: 31.7°C Relative humidity: 62.0%		Neutral	0
Sekolah Kebangsaan Lepau (O3) N 1° 23' 21.38" E 104° 8' 58.47"		Time of sampling: 3.53 pm Wind direction: Northwest (NW) Wind speed: 2.3 m/s Temperature: 32.1°C Relative humidity: 59.3%		Neutral	0
Kampung Bukit Pelali (O4) N 1° 23' 49.71" E 104° 12' 42.25"		Time of sampling: 4.12 pm Wind direction: Northeast (NE) Wind speed: 0.8 m/s Temperature: 32.6°C Relative humidity: 61.0%		Neutral	0
The Fairway Golf Villas (O5) N 1° 24' 41.26" E 104° 10' 7.40"		Time of sampling: 4.25 pm Wind direction: Northwest (NW) Wind speed: 1.4 m/s Temperature: 32.9°C Relative humidity: 62.7%		Constant very faint combustion smell (unpleasant)	<2 *(Combustion)*

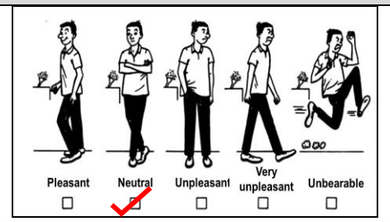
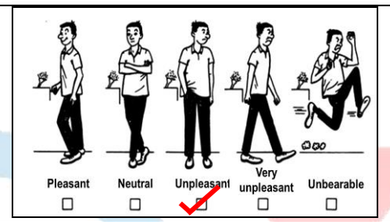
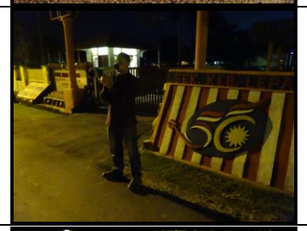
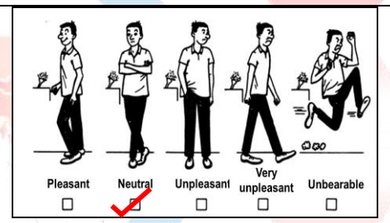
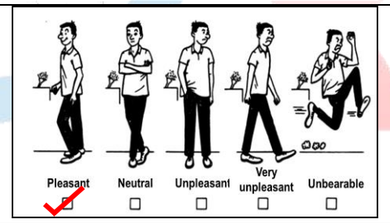
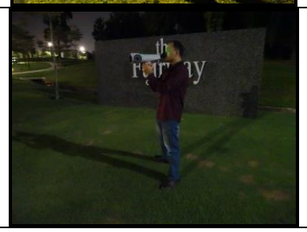
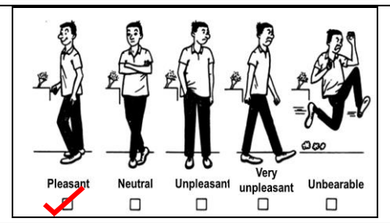
Note:
Hedonic Scale:

Pleasant	Neutral	Unpleasant	Very unpleasant	Unbearable

0 means not detected (no odour perceived) while <2 means very faint odour perceived (above odour threshold)
Calm = less than 0.3 m/s
Wind direction indicates blowing to

SECTION 3: RESULT

Table 3-2: Result of Odour Sampling and Determination during Night-time Period (9.00 pm to 11.00 pm)

Sampling Location	Photo	Remarks	Hedonic Tone Scale	Odour Character Descriptor	Dilution-to-Threshold (D/T)
Between Project Site (O1) N 1° 23' 19.65" E 104° 10' 40.42"		Time of sampling: 8.48 pm Wind direction: West (W) Wind speed: 1.2 m/s Temperature: 27.9°C Relative humidity: 78.9%		Neutral	0
Nearby Existing Project Site Entrance (O2) N 1° 23' 22.72" E 104° 10' 48.80"		Time of sampling: 8.55 pm Wind direction: North (N) Wind speed: 1.3 m/s Temperature: 27.8°C Relative humidity: 78.1%		Occasional very faint combustion smell (unpleasant)	<2 *(Combustion)*
Sekolah Kebangsaan Lepau (O3) N 1° 23' 21.38" E 104° 8' 58.47"		Time of sampling: 9.11 pm Wind direction: Northwest (NW) Wind speed: 2.2 m/s Temperature: 28.8°C Relative humidity: 77.0%		Neutral	0
Kampung Bukit Pelali (O4) N 1° 23' 49.71" E 104° 12' 42.25"		Time of sampling: 9.29 pm Wind direction: - Wind speed: Calm Temperature: 28.5°C Relative humidity: 76.0%		Constant very faint green smell (pleasant)	<2 *(Green)*
The Fairway Golf Villas (O5) N 1° 24' 41.26" E 104° 10' 7.40"		Time of sampling: 9.43 pm Wind direction: - Wind speed: Calm Temperature: 27.1°C Relative humidity: 81.9%		Constant very faint grass smell (pleasant)	<2 *(Green)*

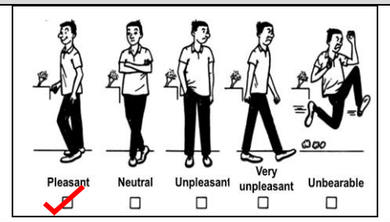
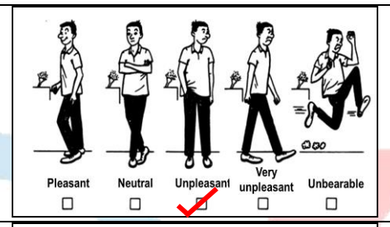
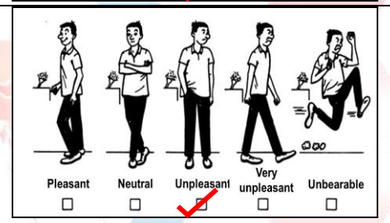
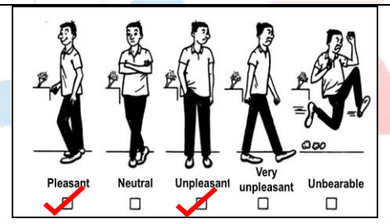
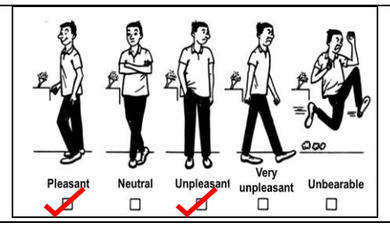
Note:
Hedonic Scale:

Pleasant	Neutral	Unpleasant	Very unpleasant	Unbearable

0 means not detected (no odour perceived) while <2 means very faint odour perceived (above odour threshold)
Calm = less than 0.3 m/s
Wind direction indicates blowing to

SECTION 3: RESULT

Table 3-3: Result of Odour Sampling and Determination during Morning Period (9.00 am to 11.00 am)

Sampling Location	Photo	Remarks	Hedonic Tone Scale	Odour Character Descriptor	Dilution-to-Threshold (D/T)
Between Project Site (O1) N 1° 23' 19.65" E 104° 10' 40.42"		Time of sampling: 9.07 am Wind direction: South (S) Wind speed: 0.6 m/s Temperature: 25.5°C Relative humidity: 89.9%		Constant very faint green smell (pleasant)	<2 *(Green)*
Nearby Existing Project Site Entrance (O2) N 1° 23' 22.72" E 104° 10' 48.80"		Time of sampling: 9.14 am Wind direction: Northwest (NW) Wind speed: 0.6 m/s Temperature: 27.2°C Relative humidity: 81.2%		Constant very faint combustion smell (unpleasant)	<2 *(Combustion)*
Sekolah Kebangsaan Lepau (O3) N 1° 23' 21.38" E 104° 8' 58.47"		Time of sampling: 9.28 am Wind direction: Northwest (NW) Wind speed: 0.5 m/s Temperature: 28.3°C Relative humidity: 79.6%		Constant very faint combustion smell (unpleasant)	<2 *(Combustion)*
Kampung Bukit Pelali (O4) N 1° 23' 49.71" E 104° 12' 42.25"		Time of sampling: 9.47 am Wind direction: West (W) Wind speed: 0.7 m/s Temperature: 29.4°C Relative humidity: 76.5%		Occasional very faint vehicle combustion smell (unpleasant) and constant very faint green smell (pleasant)	<2 *(Vehicle combustion);* <2 *(Green)*
The Fairway Golf Villas (O5) N 1° 24' 41.26" E 104° 10' 7.40"		Time of sampling: 9.58 am Wind direction: - Wind speed: Calm Temperature: 30.3°C Relative humidity: 76.5%		Constant very faint tar smell (unpleasant) and constant very faint green smell (pleasant)	<2 *(Tar);* <2 *(Green)*

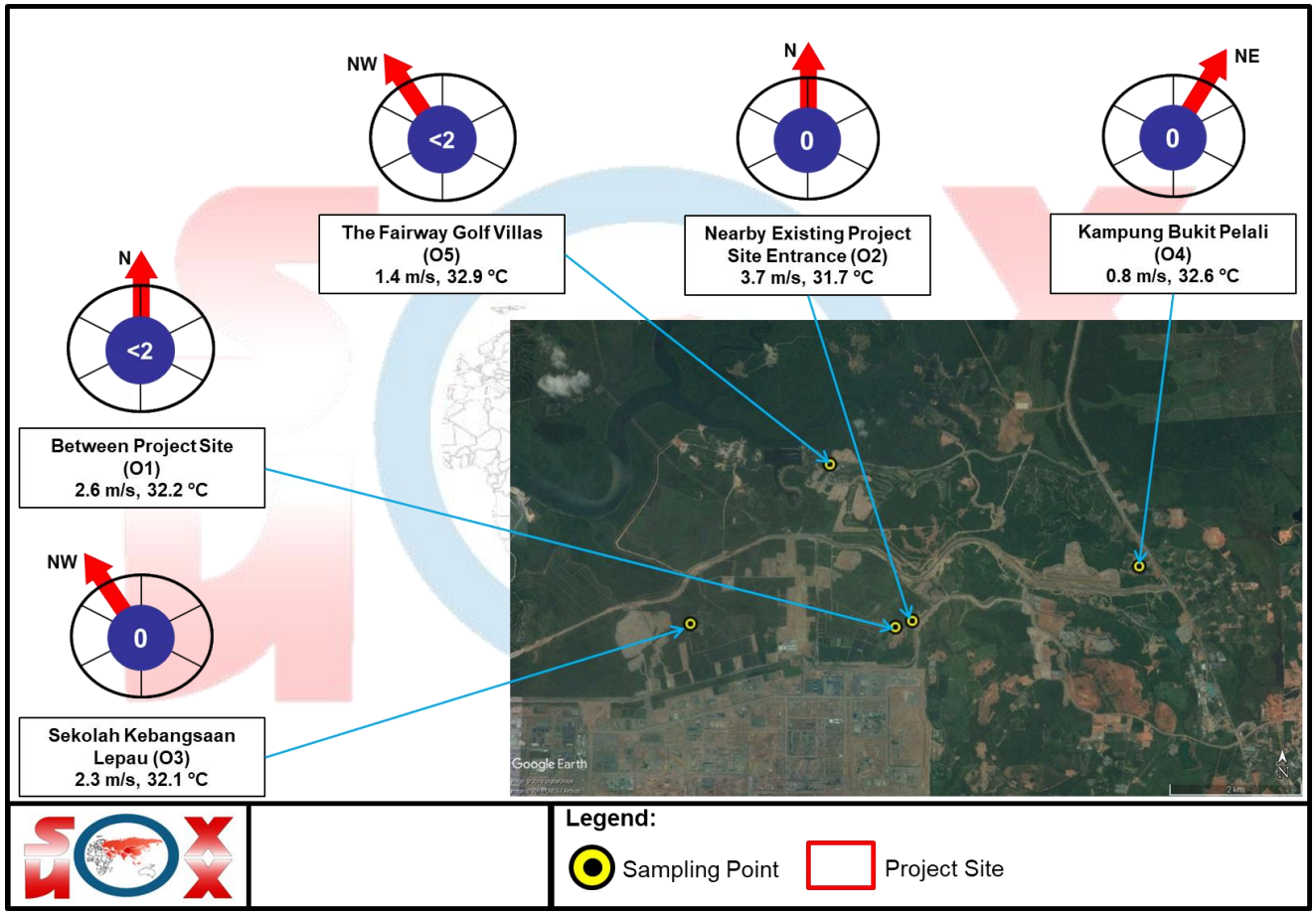
Note:
Hedonic Scale:

Pleasant	Neutral	Unpleasant	Very unpleasant	Unbearable

0 means not detected (no odour perceived) while <2 means very faint odour perceived (above odour threshold)
Calm = less than 0.3 m/s
Wind direction indicates blowing to

SECTION 3: RESULT

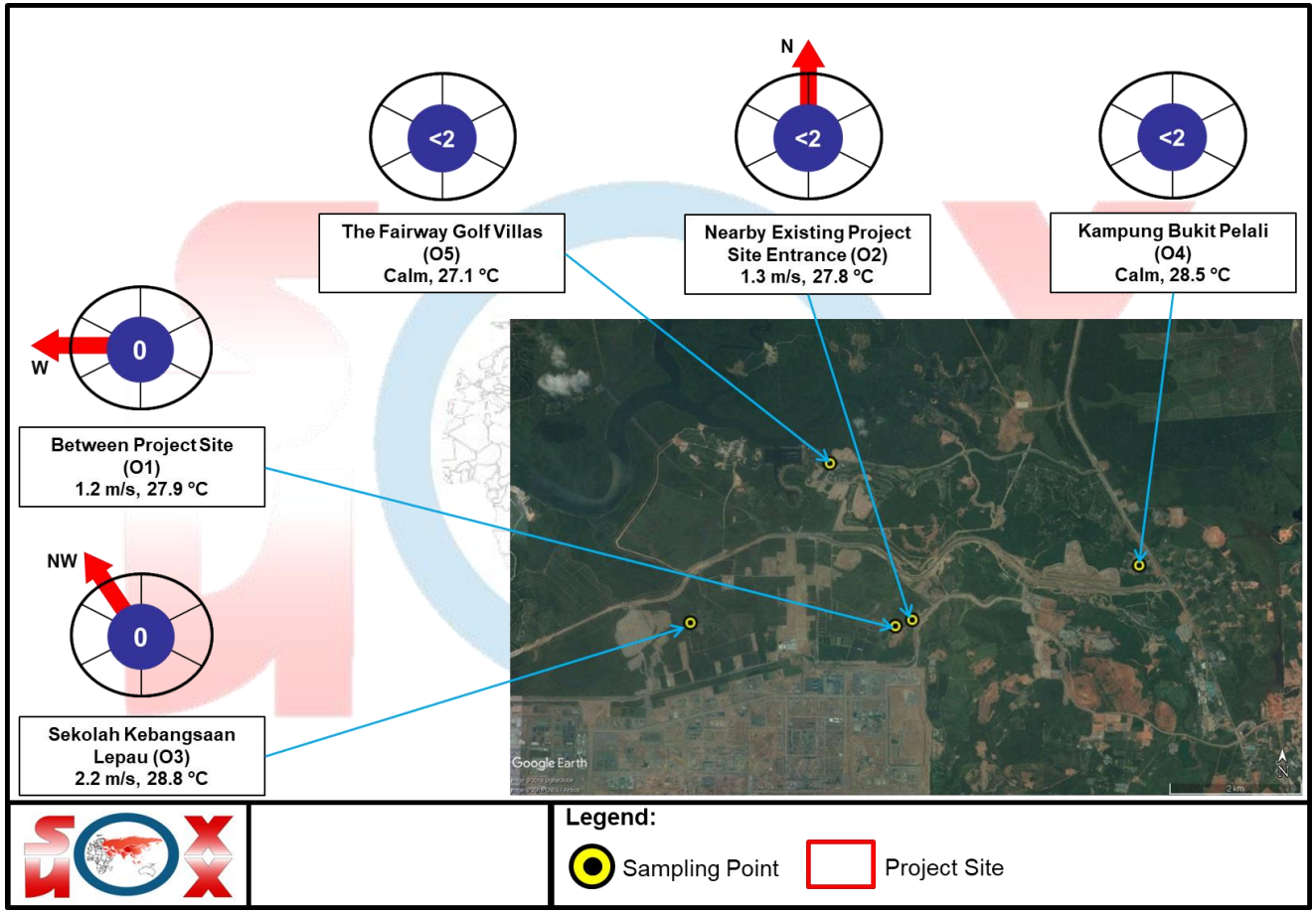
Figure 3-2: Wind Direction, Wind Speed and Temperature during Afternoon Period



*Note: The D/T value shown above is the **highest** D/T perceived.*

SECTION 3: RESULT

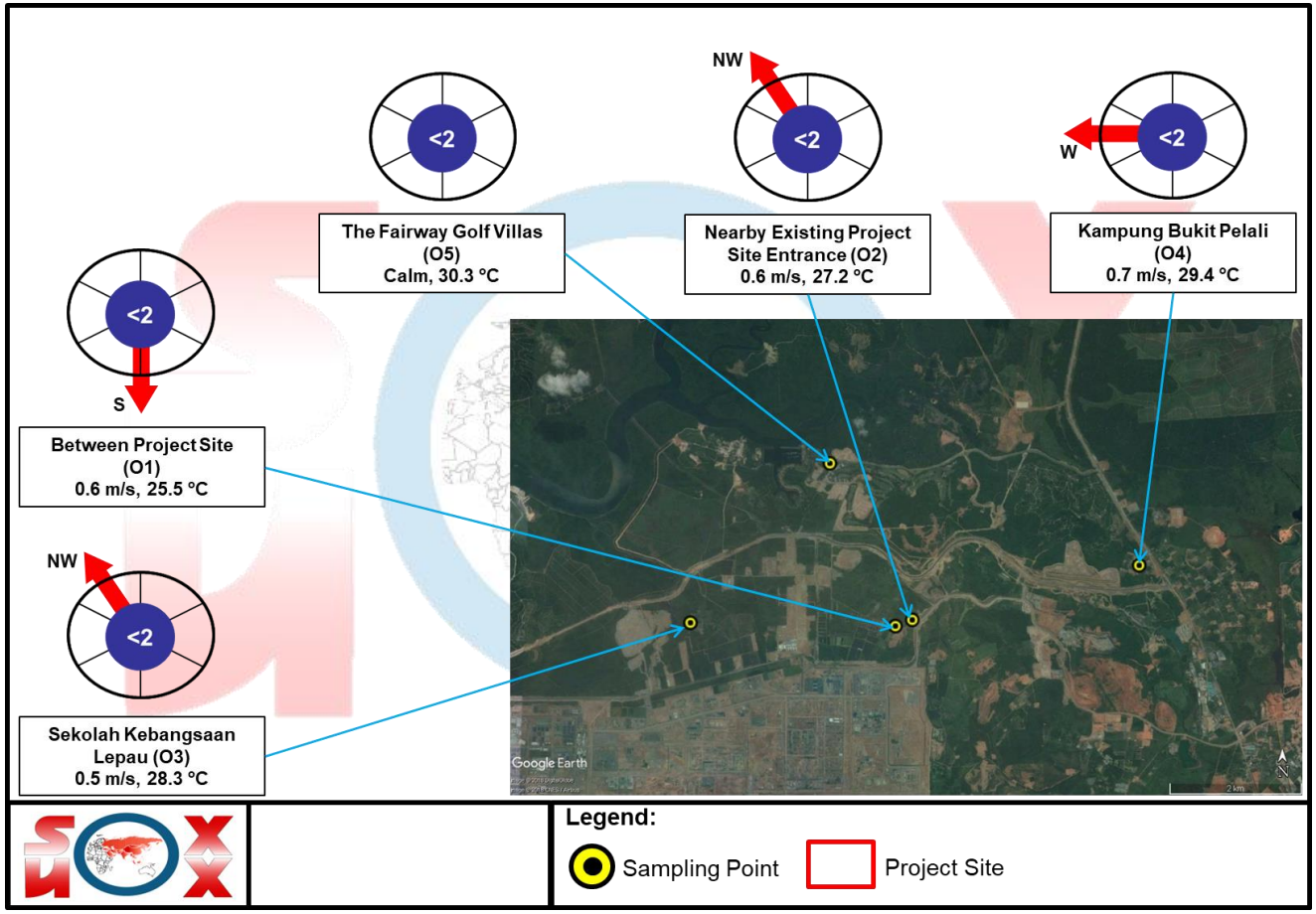
Figure 3-3: Wind Direction, Wind Speed and Temperature during Night-time Period



*Note: The D/T value shown above is the **highest** D/T perceived.*

SECTION 3: RESULT

Figure 3-4: Wind Direction, Wind Speed and Temperature during Morning Period



*Note: The D/T value shown above is the **highest** D/T perceived.*

SECTION 4: CONCLUSION

4.1 CONCLUSION

The results of the perceived odour concentrations obtained from the odour sampling and determination using the Nasal Ranger® Field Olfactometer carried out on 18th and 19th July 2018 are summarized below for the perceived concentration in D/T for unpleasant smell throughout the sampling exercise.

Sampling Location	Dilution to Threshold (D/T)			*Range 1
	Afternoon	Night-time	Morning	
Between Project Site (O1)	<2 *(Combustion)*	0	0	0
Nearby Existing Project Site Entrance (O2)	0	<2 *(Combustion)*	<2 *(Combustion)*	0 - <2
Sekolah Kebangsaan Lepau (O3)	0	0	<2 *(Combustion)*	0 - <2
Kampung Bukit Pelali (O4)	0	0	<2 *(Vehicle combustion)*	0 - <2
The Fairway Golf Villas (O5)	<2 *(Combustion)*	0	<2 *(Tar)*	0 - <2
*Range 2	0 - <2	0 - <2	0 - <2	

Note: 0 means not detected (no odour perceived) while <2 means very faint odour perceived (above odour threshold)
**Range 1 is sampling location based while Range 2 is sampling period based.*

It could be observed that the highest D/T for unpleasant smells perceived through this sampling exercise was only less than 2 D/T which is **below** the objectionable level of 7 D/T at the identified odour sensitive receptors. The perceived low residual smell due to combustion activities is attributed from the on-going construction activity at the nearby petrochemical complex.

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APPENDIX A
Brochure on
Nasal Ranger® Field Olfactometer



Nasal Ranger® Field Olfactometer



Measure odors with precision.



NASAL RANGER®

Nasal Ranger® Field Olfactometer

The Nasal Ranger® is a portable odor-measuring device that allows users to quantify odor strength in nearly any location or circumstance. This essential tool offers an innovative, easy-to-use alternative to guessing at odor strength.

Now, facility operators, community inspectors and neighborhood citizens can conduct complete odor monitoring, regulation, enforcement and documentation in the field. The Nasal Ranger® goes beyond traditional estimation methods, easily measuring odor strength at specific locations surrounding a facility.

In 2003, Central Davis Sewer District (Salt Lake City, UT) implemented odor monitoring with the Nasal Ranger into a comprehensive facility-wide odor management plan at their 10 MGD waste water treatment plant (WWTP). The Nasal Ranger was utilized to assist in identifying odor sources throughout the facility, and, after mitigation actions were taken, the Nasal Ranger was used to quantify the success of these changes through weekly community monitoring. With these changes and a new aggressive complaint response program, the WWTP significantly reduced community odor complaints. CDSD plans to continue use of the Nasal Ranger to maintain their good relationship with the neighboring citizens.

BioCycle, Journal of Composting & Organics Recycling, September 2004







Field Olfactometry is a Necessity

Measuring odor strength is crucial for determining specific odor sources, verifying complaints, monitoring daily industrial operations and documenting specific odor episodes. Its applications are endless: industrial, agricultural, and municipal operations including wastewater treatment, landfills, composting, manufacturing and much more.

With the Nasal Ranger® you can:

- *Monitor daily industrial operations*
- *Evaluate odor mitigation methods*
- *Create credible, defensible evidence*
- *Determine and monitor compliance*
- *Investigate odor control effectiveness*
- *Verify odor dispersion modeling*
- *Determine specific odor sources*
- *Verify odor complaints*



How the Nasal Ranger® Works

The Nasal Ranger® provides a precise odor strength measurement that is consistent from place to place, facility to facility and user to user. It takes the subjectivity out of odor measurement and provides a universal standard for personnel to document odor strength in the field. The Nasal Ranger® provides a cost-effective method to confidently measure odors.

Dilution-to-Threshold

Using the Nasal Ranger® is a reliable way to quantify odor strength in terms of "Dilution-to-Threshold" (D/T) ratios. The D/T measurement is the most common method of measuring odors. This allows experts to quantify odors on a commonly recognized scale.

To make a D/T measurement, carbon-filtered air is mixed with specific volumes of odorous ambient air. The D/T ratio is a measure of the number of dilutions needed to take the odorous air to its threshold.

Calibrated for Accuracy

Because sniff rates vary from user to user, the Nasal Ranger® includes a calibrated flow sensor to increase measurement consistency. When in use, the flow sensor assures users that their "sniff rate reading" is at the inhalation target. Each Nasal Ranger® comes with a calibration certificate to guarantee accuracy.





Nasal Ranger® Training

A focused Nasal Ranger® training course is available through the St. Croix Sensory "ODOR SCHOOL®". This complete training program gives Nasal Ranger® users extensive knowledge and experience with its various monitoring and measuring capabilities.

"The portability and ease of use of the Nasal Ranger allowed the County to quantify odors around a municipal waste handling facility before and after odor mitigation efforts were introduced. The data gave us the confidence that our mitigation efforts were successful and odors from the facility would not impact the neighborhood."

Jake Smith
Senior Environmentalist
Hennepin County, Minnesota

"We have successfully used the Nasal Ranger to determine odor thresholds at animal feeding operations and other odorous industries in the Southern United States."

Susan Schiffman, Ph.D.,
Durham, NC
Researcher in the area of taste and smell and their relation to mood and well-being. She is recognized in the sensory field and specifically in the area of agricultural odors research.

Accessories



The Nasal Ranger® comes complete with Odor Filter Cartridges (4), Nasal Mask with Check Valves, Comfort Seal and storage pouch, Additional Comfort Seals (5), Isopropyl Alcohol Mask Wipes (10), Barrel Cleaning Brush, 9-Volt Battery, Shoulder Strap and Carrying Case.

[Nasal Mask]

Teflon coated, replaceable Nasal Mask is ergonomically designed to fit your nose comfortably. Check valves allow comfortable breathing through the mask.

[Comfort Seal]

The Comfort Seal is a disposable foam seal designed to ensure comfort of the Nasal Mask.

[Mask Wipes]

Individual isopropyl alcohol wipes are used to clean Nasal Masks between uses.

[Universal Odor-Filter Cartridges]

The replaceable odor-filter cartridges contain a proprietary blend of granular activated carbon, which is designed to remove odors from the ambient air to create the odor-free dilution air. Individually wrapped pairs of replacement cartridges attach easily to the Nasal Ranger®.

[High D/T Dial]

An alternate orifice dial allows you to expand your measurement capabilities with D/T's of 60, 100, 200, 300, 400 and 500

[Odor Sensitivity Kit]

Originally designed for physicians to measure the sense of smell, this kit has been adapted for use in the olfactometry field to measure a user's sensitivity and to provide measurable proof of a user's appropriateness for odor detection tasks.



Call today to learn more about the Nasal Ranger® 1-800-879-9231 or visit www.nasal-ranger.com

St. Croix Sensory, Inc.

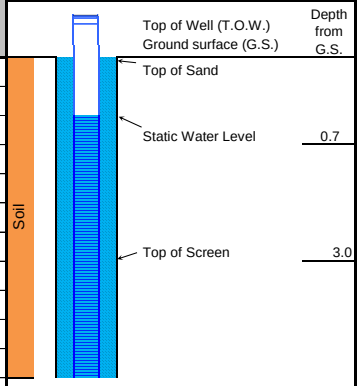
PO Box 313 | 3549 Lake Elmo Avenue
Lake Elmo, MN 55042
1.800.879.9231
[P] 651.439.0177
[F] 651.439.1065
[E] info@nasalranger.com
www.nasalranger.com
www.fivesenses.com

Soil Boring Log

Job I.D.:	J18-780B	**Coordinate N: 1.385149°**	**Boring Log No.: BH1**
Location:	PEC	**Coordinate E: 104.175596°**	**Drilling Method: Percussion drill with hollow stem auger**
Start Date:	12/12/2018	**Ground Elevation: 4.660 m**	**Driller: Propocon**
Completed Date	12/12/2018	**Top Of Well Elevation: 4.273 m**	**Logged by:** CLM, HZ

Time	Soil Sample I.D.	Depth (m)	Sample	TVOC (ppm	Description of Material
		0.0			
1120	BH1-0.5	0.5			Reddish white soil with yellow deposits, dry, loose, odourless, silty clay
1125	BH1-1.0	1.0			Ditto, moist
1130	BH1-2.0	2.0	1		Brown soil, moist, loose, odourless, silt
1133	BH1-3.0	3.0			Brown soil, organic materials, saturated, loose, odourless, silt
1148	BH1-4.0	4.0			Dark brown soil, saturated, odourless, silt
1155	BH1-5.0	5.0			Grey soil, saturated, odourless, silt

Well Diagram



Remarks:

The borehole is located nex to a fish pond

Soil sample is taken at 2.0 m depth

Boring Details

Borehole Diameter:

Wet Auger:

Dry Auger:

Total Depth: 5 m

Water First Noticed: 0.7 m bgs

Borehole Converted to: Temporary well

Well Installation Details

Well Diameter:

Screen: 3 m

Sand Pack: 5 m

Bentonite Seal: None

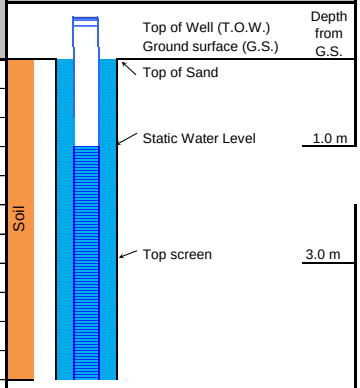
Ground Completion: Stick up

Soil Boring Log

Job I.D.:	J18-780B	**Coordinate N: 1.387703°**	**Boring Log No.: BH2**
Location:	PEC	**Coordinate E: 104.176754°**	**Drilling Method: Percussion drill with hollow stem auger**
Start Date:	12/12/2018	**Ground Elevation: 6.347 m**	**Driller: Propocon**
Completed Date	12/12/2018	**Top Of Well Elevation: 6.567 m**	**Logged by:** CLM, HZ

Time	Soil Sample I.D.	Depth (m)	Sample	TVOC (ppm	Description of Material
		0.0			
1425	BH2-0.5	0.5			Reddish soil with white deposits, gravel, dry, odourless, silty clay
1428	BH2-1.0	1.0	1		Reddish soil, gravel, dry, dense, odourless, silty clay
1438	BH1-2.0	2.0			Grey soil, saturated, loose, gravel, odourless, clayed silt
1442	BH2-3.0	3.0			Grey soil, organic matter (twigs), saturated, loose, odourless, silt
1448	BH2-4.0	4.0			Ditto, less grainy (smooth)
1505	BH2-5.0	5.0	1		Grey soil with reddish deposits, dense, saturated, odourless, silty clay

Well Diagram



Remarks:

Soil samples collected at 1.0 m and 5.0 m depth for above and below groundwater level.

Boring Details

Borehole Diameter:
Wet Auger: -
Dry Auger:
Total Depth: 5 m
Water First Noticed: 1 m bgs
Borehole Converted to: Temporary well

Well Installation Details

Well Diameter:
Screen: 3 m
Sand Pack: 5 m

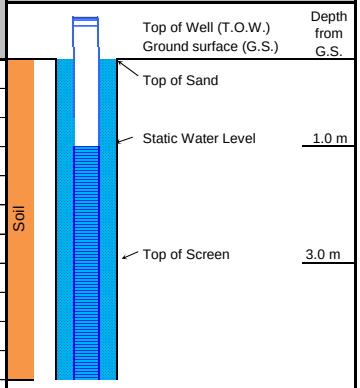
Bentonite Seal: None
Ground Completion: Stick up

Soil Boring Log

Job I.D.:	J18-780B	**Coordinate N: 1.385245°**	**Boring Log No.: BH3**
Location:	PEC	**Coordinate E: 104.173094°**	**Drilling Method: Percussion drill with hollow stem auger**
Start Date:	12/12/2018	**Ground Elevation: 4.183 m**	**Driller: Propocon**
Completed Date	12/12/2018	**Top Of Well Elevation: 4.381 m**	**Logged by:** CLM, HZ

Time	Soil Sample I.D.	Depth (m)	Sample	TVOC (ppm	Description of Material
		0.0			
1639	BH3-0.5	0.5			Brown grey soil, dry, loose, gravel, odourless, silty sand
1645	BH3-1.0	1.0			grey brown, loose, gravel, moist, odourless, silty sand
1651	BH3-2.0	2.0			Grey soil, dense, moist, odourless, clayed sand
1656	BH3-3.0	3.0			Greyish white, dense, dry, odourless, clayed sand
1700	BH3-4.0	4.0	1		White with red deposits, dry, odourless, sandy clay
1719	BH3-5.0	5.0			Redish white soil, moist, dense, odourless, silty clay

Well Diagram



Remarks:

The borehole is located in the orchid farm

Soil sample is collected at 4 m depth

Duplicate soil sample is also taje at 4 m depth

Boring Details

Borehole Diameter:

Wet Auger: -

Dry Auger:

Total Depth: 5 m

Water First Noticed: 1 m bgs

Borehole Converted to: Temporary well

Well Installation Details

Well Diameter:

Screen: 3 m

Sand Pack: 5 m

Bentonite Seal: None

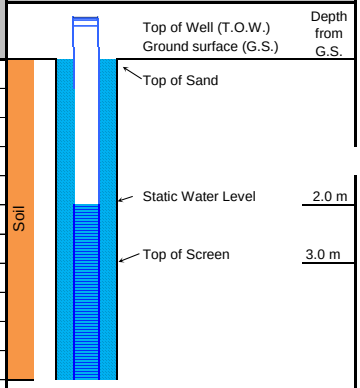
Ground Completion: Stick up

Soil Boring Log

Job I.D.:	J18-780B	**Coordinate N: 1.387939°**	**Boring Log No.: BH4**
Location:	PEC	**Coordinate E: 104.172294°**	**Drilling Method: Percussion drill with hollow stem auger**
Start Date:	13/12/2018	**Ground Elevation: 4.638 m**	**Driller: Propocon**
Completed Date	13/12/2018	**Top Of Well Elevation: 3.893 m**	**Logged by:** CLM, HZ

Time	Soil Sample I.D.	Depth (m)	Sample	TVOC (ppm)	Description of Material
		0.0			
0920	BH4-0.5	0.5			Red soil, dry, loose, peat odour, silty clay
0930	BH4-1.0	1.0			Ditto, moist
0940	BH4-2.0	2.0			Reddish with grey and yellow deposits, loose, moist, peat odour, silty clay
0945	BH4-3.0	3.0	1		Brown soil, organic materials, saturated, loose, odourless, silt
1002	BH4-4.0	4.0			Dark-brown peat soil, loose, moist, slight peat odour, silt
1005	BH4-5.0	5.0			Dark-brown peat soil, loose, saturated, odourless, silt

Well Diagram



Remarks:

The borehole is located at the road side next to the west boundary

Soil sample taken from 3.0 m depth

Boring Details

Borehole Diameter:

Wet Auger: -

Dry Auger:

Total Depth: 5 m

Water First Noticed: 2 m bgs

Borehole Converted to: Temporary well

Well Installation Details

Well Diameter:

Screen: 3 m

Sand Pack: 5 m

Bentonite Seal: None

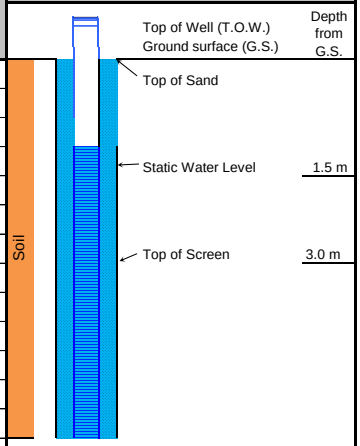
Ground Completion: Stick up

Soil Boring Log

Job I.D.:	J18-780B	**Coordinate N: 1.390000°**	**Boring Log No.: BH5**
Location:	PEC	**Coordinate E: 104.172993°**	**Drilling Method: Percussion drill with hollow stem auger**
Start Date:	13/12/2018	**Ground Elevation: 6.236 m**	**Driller: Propocon**
Completed Date	13/12/2018	**Top Of Well Elevation: 6.443 m**	**Logged by:** CLM, HZ

Time	Soil Sample I.D.	Depth (m)	Sample	TVOC (ppm	Description of Material
		0.0			
1110	BH5-0.5	0.5			Red soil, gravel, dry, odourless, silty clay
1122	BH5-1.0	1.0			Red soil with whie deposits, dry, odourless, silty clay
1130	BH5-2.0	2.0			Ditto
1140	BH5-3.0	3.0			Red soil with white deposits, moist, odourless, silty clay
1145	BH5-4.0	4.0			Red soil with white deposits, moist, odourless, clayed silt
1153	BH5-5.0	5.0	1		Red soil, moist, odourless, clayed silt
1200	BH5-6.0	6.0			Red soil with white & yellow deposits, saturated, odourless, clayed silt

Well Diagram



Remarks:

The borehole is located at the junction road

Soil sample is taken from 5.0 m depth

Boring Details

Borehole Diameter:

Wet Auger:

Dry Auger:

Total Depth: 6 m

Water First Noticed: 1.5 m bgs

Borehole Converted to: Temporary well

Well Installation Details

Well Diameter:

Screen: 3 m

Sand Pack: 5 m

Bentonite Seal: None

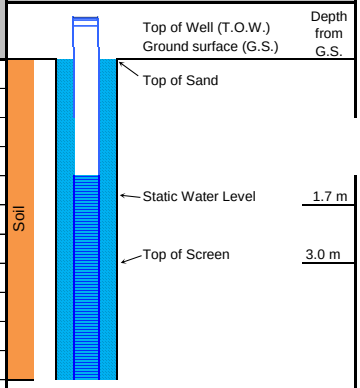
Ground Completion: Stick up

Soil Boring Log

Job I.D.:	J18-780B	**Coordinate N: 1.385013°**	**Boring Log No.: BH6**
Location:	PEC	**Coordinate E: 104.179684°**	**Drilling Method: Percussion drill with hollow stem auger**
Start Date:	13/12/2018	**Ground Elevation: 6.738 m**	**Driller: Propocon**
Completed Date	13/12/2018	**Top Of Well Elevation: 7.283 m**	**Logged by:** CLM, HZ

Time	Soil Sample I.D.	Depth (m)	Sample	TVOC (ppm	Description of Material
		0.0			
1452	BH1-0.5	0.5			Light brown with white deposits, loose, odourless, clayed silt
1455	BH1-1.0	1.0			Dark brown, organinc materials, loose, odourless, silt
1507	BH1-2.0	2.0			Light brown with red deposits, loose, gravel, moist, peat odour, clayed silt
1512	BH1-3.0	3.0	1		Dark grey, organic matters, loose, moist, peat odour, silt
1524	BH1-4.0	4.0			Dark grey, loose, organic matters, saturated, peat odour, silt
1535	BH1-5.0	5.0			Dark grey, saturated, loose, organic matters, odourless, silt

Well Diagram



Remarks:

The borehole is located next to the new road before gate 2 RAPID entrance.

Soil sample from 3 m depth.

Boring Details

Borehole Diameter:

Wet Auger: -

Dry Auger:

Total Depth: 5 m

Water First Noticed: 1.7 m bgs

Borehole Converted to: Temporary well

Well Installation Details

Well Diameter:

Screen: 3 m

Sand Pack: 5 m

Bentonite Seal: None

Ground Completion: Stick up

APPENDIX E

QUANTITATIVE RISK ASSESSMENT OF PENGERANG ENERGY COMPLEX SDN BHD

EXECUTIVE SUMMARY

Introduction

The proposed Pengerang Energy Complex is planned as a world-scale condensate splitter and aromatics complex, on a 250 acre site in the Pengerang Industrial Park (PIP) that is situated within the Pengerang Integrated Petroleum Complex (PIPC). The production capacity of the PEC is about 5.844 Million metric tonnes per annum (MMtpa), or 16.697 kilometric tonnes per day (KMTpd), of aromatic petrochemicals and oil products, which will be processed from 6.324 MMtpa of condensate feedstock. The 'Project Proponent', or project owner, is Pengerang Energy Complex Sdn. Bhd. (PEC).

Under the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order, 2015 (EIA Order 2015), the construction of the PEC is a Prescribed Activity under the Second Schedule and requires a detailed Environmental Impact Assessment (EIA) be submitted to the Department of Environment (DoE) for approval prior to project implementation.

As part of the Environmental Impact Assessment, a Quantitative Risk Assessment (QRA) needs to be prepared to provide a demonstration that the measures for prevention and mitigation employed by the hazardous installation result in a level of risk that is 'as low as reasonably practicable' (ALARP). The QRA is carried out in accordance with *DoE's EIA Guidelines for Risk Assessment.*

Background to the PEC Project

The proposed 250 acre (about 101 hectare (ha)) PEC site is located in Pengerang Sub-district, Kota Tinggi District, Johor State, in a designated industrial area; the 788 acre, Pengerang Industrial Park (PIP) within the Pengerang Integrated Petroleum Complex (PIPC). The PEC site is situated 7.5 km northeast of Pengerang and 6km northwest of Sungai Rengit. Singapore's Pulau Tekong and Changi Airport lie 9 km and 17 km east of the site. Highways connect the PIPC to Johor Bahru, the state capital, and its airport, Senai. The direct distance between PEC and Johor Bahru, and PEC and Senai Airport is approximately 50 and 67 km, respectively, and it is also accessible by scheduled ferry from Singapore to Pengerang and to larger vessels via the PIPC's Pengerang Deepwater Terminal (PDT).

The site is in the Pengerang Local Authority (Pihak Berkuasa Tempatan Pengerang) area which covers the five south-eastern sub-districts of Kota Tinggi District.

The proposed PEC condensate splitter and aromatics complex will process 6.324 MMtpa of condensate with a production capacity of 5.844 MMtpa, comprising 2.161 MMtpa of aromatic products, mainly two 'primary products'; paraxylene and benzene and 3.683 MMtpa of oil products, subdivided into high value 'co-products'; Liquefied Petroleum Gas (C3 and C4 LPG), Kerosene/ jet fuel (Jet A1), ultra-low sulphur diesel (ULSD) and low sulphur fuel oils (LSFOs)) and lower value 'by-products'; including light naphtha, hydrogen rich gas, fuel gas and light ends, together with solid sulphur. PEC will retain options to utilise naphtha feedstock, depending on market conditions.

On completion, the PEC will be one of the largest capacity aromatics complexes in the world, with the major end users for its aromatic products being in synthetic fibres and plastics production (e.g. polyester, PET, and styrene), chemicals, detergents, pharmaceuticals and insecticides.

QRA Objectives and Scope

Purpose of the QRA

The results of this QRA study will be valuable in providing the Malaysian Authorities with relevant information to decide on the acceptability of project on risk grounds. The QRA Report will also provide a demonstration that the measures for prevention and mitigation employed by the hazardous installation result in a level of risk that is 'as low as reasonably practicable' (ALARP). The QRA is carried out in accordance with *DoE's EIA Guidelines for Risk Assessment.*

Scope of Work

The scope of work of the QRA comprises the following:

- **Hazard identification** – a qualitative review of possible accidents that may occur (based on industrial accident records or, as necessary, professional judgement) involving the hazardous substances stored and/or utilised by the project;
- **Scenario identification** – definition of the specific scenarios to be studied in this QRA, with each scenario assigned a unique identification code or isolatable section number;
- **Event tree and frequency analysis** – determination of the frequency or likelihood of occurrence of all identified scenarios;
- **Consequence modelling** – determination of the consequence distances (hazard zones) that would result from realisation of each scenario identified by outcome, e.g. pool fire, jet fire, flash fire, vapour cloud explosion (VCE) and toxic release;
- **Risk Summation**– the summation of consequences and frequencies of all isolatable sections to determine the Individual Risk (IR) and Societal Risk (SR); and
- **Evaluation against Risk Acceptance Criteria** – to determine acceptability of the projects risks to the site surroundings with regards to DoE Individual Risk Acceptance Criteria and, as necessary, to recommend mitigation measures to ensure compliance and that risks are *as low as reasonably practical (ALARP)*.

Salient Findings of the QRA

Hazardous Substances & Scenarios Assessed

The general groups of hazardous substances assessed at the Site are summarised in *Table S1*.

Table S1: Potential Hazards

No.	Substance	Potential Major Hazards
1	Condensate	Fire
2	Naphtha	Fire, Explosion
3	Sour Naphtha	Fire
4	Sweet Naphtha	Fire
5	Pentane	Fire, Explosion
6	Dodecene	Fire
7	LPG	Fire, Explosion
8	Methane	Fire, Explosion
9	Butane	Fire, Explosion
10	Kerosene	Fire, Explosion
11	Propane	Fire, Explosion
12	Ethane	Fire, Explosion
13	Hydrogen	Fire, Explosion
14	Diesel	Fire
15	Heptane	Fire
16	Sulfolane	Fire
17	Hydrogen Sulfide	Fire, Explosion, Toxic
18	Toluene	Fire, Explosion
19	Xylene	Fire, Explosion
20	Para-xylene	Fire
21	Hexane	Fire, Explosion
22	Aromatics	Fire
23	Benzene	Fire, Explosion
24	Tetramethylbenzene	Fire, Explosion
25	Diethylbenzene	Fire, Explosion

No.	Substance	Potential Major Hazards
26	Trimethylbenzene	Fire, Explosion

Frequency Analysis and Consequence Results

The QRA conservatively addresses the failure frequencies of all the facilities at the Site and determines the consequences of the hazards identified before performing risk summation and evaluation.

Conservatisms ensure risks are not underestimated and, in this case, include usage of maximum inventories of hazardous substances in vessels and modelling releases based on the worst case situation, i.e. the isolatable sections are modelled without quantitatively considering the benefits of all safety systems (excepting the tank bunds), procedural or firefighting safety measures onsite.

The identified worst case scenarios at the Site by event are summarised in *Table S2*.

Risk Summation and Evaluation against Risk Acceptance Criteria

Individual Risk

The QRA quantifies its Individual Risk (IR) and found that while the 1 x 10^{-6} per year IR contour extends offsite (see *Figure S1(i)),* it remains confined within the Industrial Area. Hence the risks comply with *DoE Risk Acceptance Criteria*. The QRA found the major offsite risk contributors from the PEC plant resulted from failures of the Butane Storage Tank (842TK1) and Area A2 (Xylene Splitter Area).

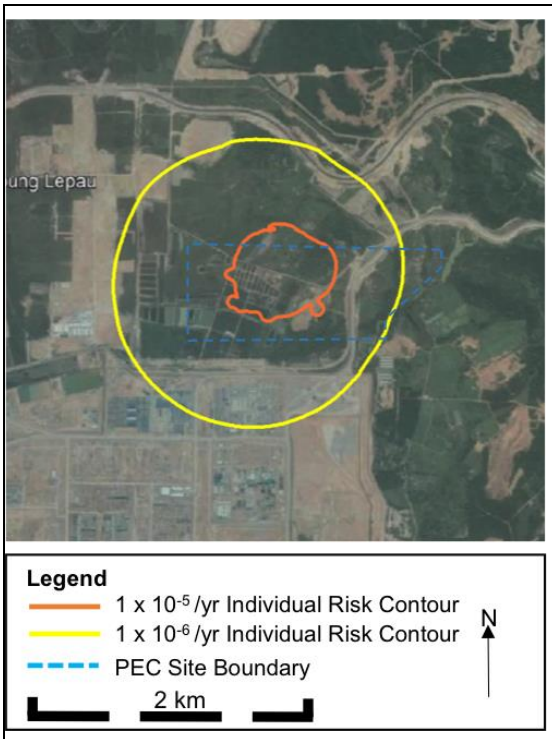
Societal Risks

The Societal Risk (SR) (see *Figures S1(ii))* is within the 'Tolerable' region of the adopted Societal Risk Tolerability Criteria, adopted as provided in *RIVM Reference Manual Bevi Risk Assessments*. The maximum number of offsite fatalities associated with major accidents events (MAEs) arising from within the PEC site was assessed at 22 with a frequency of 7.85 x 10^{-8}/year, which is found to be within the "Tolerable" region. Hence no additional mitigation measures are required to be implemented in accordance with the ALARP (*as low as reasonablly practical*) principle.

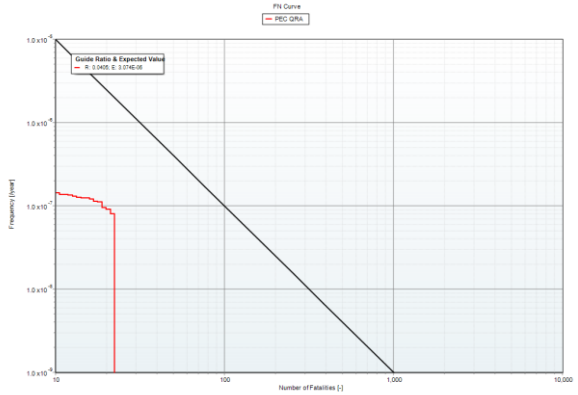
Table S2: Identified Worst Case Scenarios

Isolatable Section	Hazard Type	Fatality Levels- Harm Footprint	Maximum Hazard Zone [m]
003_100V018_C (catastrophic rupture of feed surge drum under weather condition C3)	Pool Fire (Pentane)	90% fatality	170
		50% fatality	205
		3% fatality	258
130_Xylene_pipe_B (large leak of xylene pipeline under weather condition F1)	Jet Fire (Xylene)	90% fatality	181
		50% fatality	190
		3% fatality	206
200_842T001_C (catastrophic rupture of Butane LPG tanks under weather condition F1)	Fireball (BLEVE) (Butane LPG Tanks)	90% fatality	825
		50% fatality	1,083
		3% fatality	1,502
199_840T001_C (catastrophic rupture of propane tank under weather condition F1)	Flash Fire (Propane)	LFL	1,686
201_841T001_C (catastrophic rupture of LPG tank under weather condition F1)	Explosion (LPG)	90% fatality	Not Attained
		50% fatality	560
		3% fatality	561
189_650V003_C (catastrophic rupture of	Toxic Dispersion (H_2S)	90% fatality	1
		50% fatality	2

Isolatable Section	Hazard Type	Fatality Levels- Harm Footprint	Maximum Hazard Zone [m]
sour water stipper under weather condition F1)		3% fatality	100
Notes: 1. N/A – not attainable 2. LFL – Lower Flammable Limit			



(i) IR Contours (satellite)



(ii) Societal Risk FN Curve

Figure S1 – Individual Risk and Societal Risk Results – *PEC QRA*

Conclusions of the QRA

Based on the QRA results summarised above, it is concluded that the PEC Plant satisfy the *DoE Risk Acceptance Criteria* for Individual Risk as:

- The 1 x 10^{-5} fatalities per year contour remains within the industrial development; and
- The 1 x 10^{-6} fatalities per year contour does not encroach to any public areas, such as residential areas, schools, hospitals.

Therefore, no additional mitigation measures are deemed to be mandatory to further reduce the risks associated with the PEC operations.

The Societal Risk associated with the PEC Plant is found to be within the tolerable region of the adopted Societal Risk Tolerability Criteria (Dutch Guidance Value). Therefore, it can be concluded that risks are acceptable and no additional mitigation measures are required to reduce risks to a level *as low as reasonably practical (ALARP)*.

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Acronyms

ALARP	As Low As Reasonably Practicable
BAT	Best Available Techniques Economically Achievable/ Best Available Technology
CAR	Clean Air Regulations
CIMAH	Control of Industrial Major Accident Hazards
CoA	DoE EIA Conditions of Approval
COD	Chemical Oxygen Demand
DCS	Distributive Control System
DED	Detailed Engineering Design
DoE	Department of Environment
DOSH	Department of Occupational Safety and Health
EF	Emission Factor
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPCM	Engineering Procurement & Construction Management
EQA	Environmental Quality Act 1974/ Amendment 2012
ERP	Emergency Response Plan
ESC	EnviroSolutions & Consulting Sdn Bhd
ESH	Environmental, Safety and Health
ETA	Event Tree Analysis
FB	Fire Ball
FF	Flash Fire
Ha	Hectare
HMB	Heat and Material Balance
HSE	Health and Safety Executive
HSES	Health, Safety Environment & Security
ILP	Institut Latihan Perindustrian
IPT	Intermodal Portable Tanks
IR	Individual Risk
ITCZ	Inter Tropical Convergence Zone
IWTP	Industrial Wastewater Treatment Plant
JF	Jet Fire
LEL	Lower Explosion Limit
LFL	Lower Flammability Limit
LSIR	Location Specific Individual Risk
MAIC	Maximum Average Incremental Concentrations
MMD	Malaysian Meteorological Department
MMS	Malaysian Meteorological Services

MS	Management System
MSDS	Material Safety Data Sheet
MT	Metric Ton
NASA	National Aeronautics and Space Administration
NIOSH	National Institute for Occupational Safety and Health
NWQSM	National Water Quality Standards for Malaysia ORP Oxidation-Reduction Potential
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Act, 1994
P2M2	Pollution Prevention and Mitigation Measures
P&ID	Piping & Instrumentation Diagrams
PCP	Pollution Control Permit
PEIA	Preliminary EIA
PF	Pool Fire
PFD	Process Flow Diagram
PLC	Process Logic Control
PM_{10}	Particulate Matter less than 10 microns
PMP	Performance Monitoring Programme
PPE	Personal Protective Equipment
PPMV	Parts per million volume
PSV	Pressure Safety Valve
QRA	Quantitative Risk Assessment
RA	Risk Assessment
REL	Recommended Exposure Limit
RMAQG	Recommended Malaysian Air Quality Guidelines
UN	Unignited Release
UPS	Un-interruptible Power Supply
USEPA	US Environmental Protection Agency
VCE	Vapour Cloud Explosion
VOC	Volatile Organic Compound
WQI	Water Quality Index

1 INTRODUCTION

1.1 Project Title & Proponent

The subject project is *PEC Quantitative Risk Assessment* and the Project Proponent, or project owner, is Pengerang Energy Complex Sdn. Bhd. (PEC).

1.2 Project Background

The proposed Pengerang Energy Complex is planned as a world-scale condensate splitter and aromatics complex, on a 250 acre site in the Pengerang Industrial Park (PIP) that is situated within the Pengerang Integrated Petroleum Complex (PIPC). The production capacity of the PEC is about 5.844 Million metric tonnes per annum (MMtpa), or 16.697 kilometric tonnes per day (KMTpd), of aromatic petrochemicals and oil products, which will be processed from 6.324 MMtpa of condensate feedstock. The 'Project Proponent', or project owner, is Pengerang Energy Complex Sdn. Bhd. (PEC).

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1.3 Brief Project Description

The proposed 250 acre (about 101 hectare (ha)) PEC site is located in Pengerang Sub-district, Kota Tinggi District, Johor State, in a designated industrial area; the 788 acre, Pengerang Industrial Park (PIP) within the Pengerang Integrated Petroleum Complex (PIPC). The PEC site is situated 7.5 km northeast of Pengerang and 6km northwest of Sungai Rengit. Singapore's Pulau Tekong and Changi Airport lie 9 km and 17 km east of the site. Highways connect the PIPC to Johor Bahru, the state capital, and its airport, Senai. The direct distance between PEC and Johor Bahru, and PEC and Senai Airport is approximately 50 and 67 km, respectively, and it is also accessible by scheduled ferry from Singapore to Pengerang and to larger vessels via the PIPC's Pengerang Deepwater Terminal (PDT).

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The main process areas of the PEC facility are:

- Condensate Splitter Section
    - Sour Water Stripping / Sulphur Recovery / Amine Regeneration / Spent Caustic Treatment (C2 AREA); and
    - Prefractionation (C1 AREA).

- Aromatics Plant
    - Naphtha Hydrotreating unit; / CCR Platforming and Regeneration unit / Olefin Reduction Process unit (R1 AREA);
    - Sulfolane unit / BT/ Tatoray unit (A1 AREA);
    - Xylene / Parex (A2 & A3 AREA); and
    - Isomar unit (A2 & A3 AREA).

Figure 1 shows the location of PEC, whilst *Figure 2* provides the saite lay-out.



Figure 1 – PEC Development Footprint of ~179 acres within the PEC site
Source: ChemOne with Google Earth Image, 2016

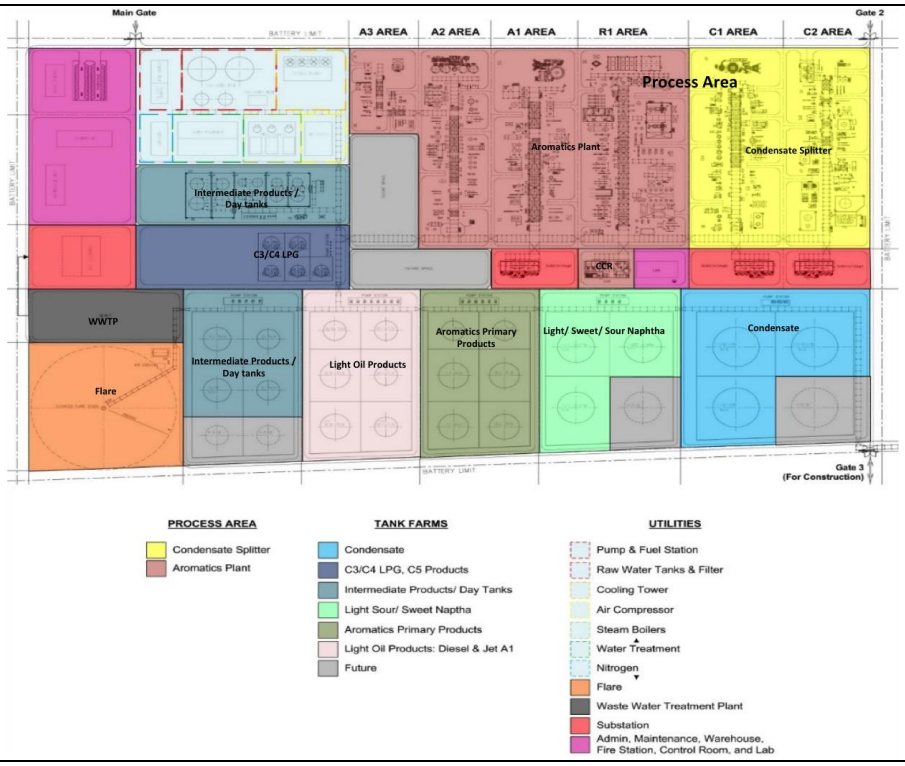


Figure 2 – PEC Layout Plan

1.4 Objectives of the QRA

The results of this QRA study will be valuable in providing the Malaysian Authorities with relevant information to decide on the acceptability of project on risk grounds. The QRA Report will also provide a demonstration that the measures for prevention and mitigation employed by the hazardous installation result in a level of risk that is 'as low as reasonably practicable' (ALARP). The QRA is carried out in accordance with *DoE's EIA Guidelines for Risk Assessment.*

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1.6 Organisation of the Report

The remainder of this report is organised as follows:

- *Section 2* details the project descriptions;
- *Section 3* details the hazard identification process and selection of scenario's for the QRA;
- *Section 4* provides the frequency analysis;
- *Section 5* gives an overview of the consequence analysis;
- *Section 6* summarises the Risk Acceptance Criteria and provides the Risk Summation and Evaluation for the scenarios and the cumulative site risks; and
- *Section 7* summarises the QRA conclusions.

2 PROJECT BACKGROUND AND PROJECT DESCRIPTION

2.1 Project Capacity, Feedstocks and Products

The proposed PEC condensate splitter and aromatics complex will process 6.324 MMtpa of condensate with a production capacity of 5.844 MMtpa, comprising 2,161 MMtpa of aromatic products, mainly two 'primary products'; paraxylene and benzene and 3.683 MMtpa of oil products, subdivided into high value 'co-products'; Liquefied Petroleum Gas (C3 and C4 LPG), Kerosene/ jet fuel (Jet A1), ultra-low sulphur diesel (ULSD) and low sulphur fuel oils (LSFOs)) and lower value 'by-products'; including light naphtha, hydrogen rich gas, fuel gas and light ends, together with solid sulphur. PEC will retain options to utilise naphtha feedstock, depending on market conditions. On completion, the PEC will be one of the largest capacity aromatics complexes in the world, with the major end users for its aromatic products being in synthetic fibres and plastics production (e.g. polyester, PET, and styrene), chemicals, detergents, pharmaceuticals and insecticides.

Figure 3 provides a schematic overview of the PEC feedstock and product sales.

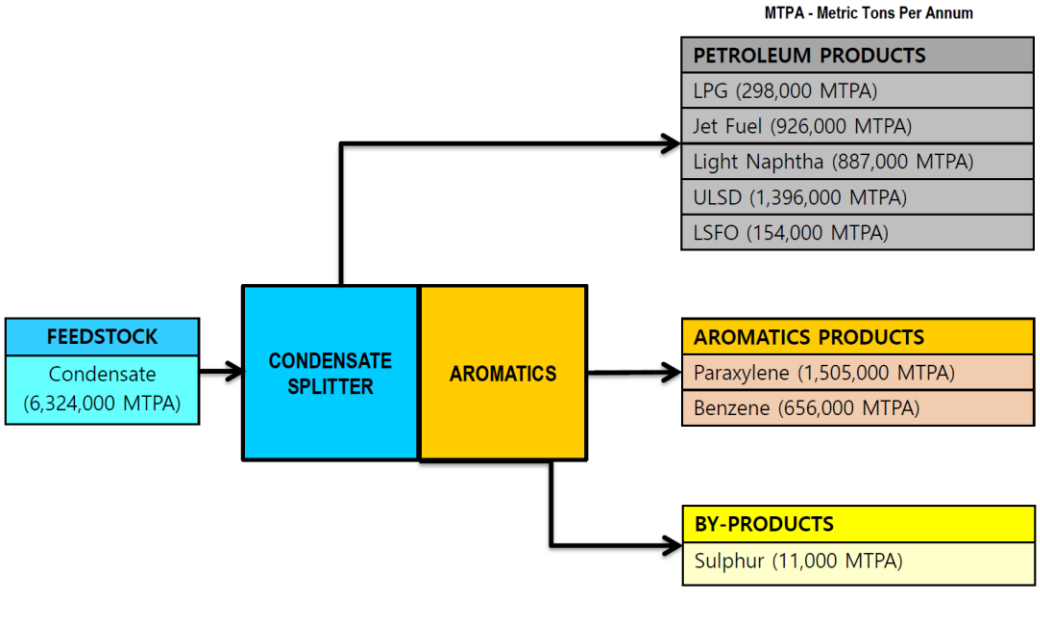


Figure 3 – PEC Feedstock and Product Slates
Source: PEC

2.1.1 Plant Layout and Facilities

Figure 1 above shows the plant development footprint within the 250 acre PEC site overlain on the site's satellite image. The process plant, inclusive of onsite facilities, is to be located in the western part of the site and will occupy an area measuring roughly 1,065m by 645m, or ~69 ha/ ~170 acres (68% of site area). *Figure 2* shows the PEC's conceptual plant layout in more detail, showing:

- **Tank Farms:** One week capacity bulk storage tanks are located to the east and south of the plot. There are seven (7) separate tank farms for condensate (1); 129,000 Mt in 3 tanks; intermediate products (2); raw diesel, raw kerosene, FBR naphtha and primary product day tanks; Liquefied gases (1); ~8,600 Mt of C3/C4 LPG in sphere tanks; and products (3); blended light naphtha, aromatic primary products and oil co-/ by-products (fuel oil, kerosene, diesel). Maximum total storage capacity on-site is about 500,000 Mt. Tank farms will meet Malaysian standards for containment (i.e. bund capacity ≥110% of largest tank) and design.

- **Process Areas:** The main process areas are situated along the site's northern boundary, from east to west:
- Condensate Splitter Section:
    - Condensate fractionation unit comprising of the feed fractionator and stabiliser (C2 AREA);
    - LPG Merox unit, distillate unionfining (KHT) Unit and distillate unionfining (DHT) Unit; and
    - Sour water stripper, sulphur recovery, amine regeneration, and spent caustic treatment units (C1 AREA).
    - Aromatics Plant:
        - Naphtha hydrotreating unit (NHT), naphtha splitter, CCR platforming and regeneration unit, reformate splitter (R1 AREA);
        - Sulfolane unit, benzene/ toluene column, Tatoray unit (A1 AREA);
        - Xylene / Parex unit (A2 & A3 AREA); and
        - Isomar unit (A2 & A3 AREA).
- **Utility Areas:** The flare system will be located on the southwest corner of the plot, while substations (3) are situated south of process units in the centre of the site together with the laboratory and main control building. An admin building with a canteen and car park, and the site fire station will be centrally located, at the southern end of the developed part of the site. West of the admin building is the maintenance shop and warehouse (which will be used for chemical and catalyst storage), with the wastewater treatment plant (WWTP) in the southwest corner. The northwest corner of the built area will house on-site utilities including raw water and firewater tanks, raw water treatment and demineralised water system, the sites steam boilers, cooling water system/ towers and air compressors, together with third party nitrogen system and the main site electrical switchboard.
- **Pipelines:** Incoming pipelines to the site include condensate from the third party bulk storage terminal, raw water and natural gas (from external suppliers). Outgoing pipelines from PEC may supply other users in the PIPC with light naphtha, C4 LPG and hydrogen. The remaining product export is via the same pipelines as condensate

2.1.2 Process Overview

Principle operations at the proposed PEC are planned as follows:

- **Feedstock, import and storage:** The condensate feedstock is a blended low density mixture of hydrocarbon liquids derived from raw natural gas extracted from oil and gas fields. Plant design is flexible enough to take various blends of condensate and/or imported naphtha as feedstock, including potentially from other oil refineries in the PIPC. Shipments of incoming condensate feedstock shipments to the PDT will be off-loaded at a third-party operated jetty and sent to storage an adjacent, third-party bulk terminal within the PDT Central Tank Facility (CTF) area.
- **Other raw materials** mostly comprise solid or liquid catalysts, in relatively small quantities, that will be delivered to the PEC site and stored in the warehouse.
- **Processing:** As and when needed, condensate is pumped via ~5.3km pipelines from the PDT to the PEC site's limited capacity (one week), on-site bunded bulk storage tank farm prior to processing. The proposed PEC comprises of two main processing sections; a condensate splitting plant, which produces the oil products and the full boiling range (FBR) naphtha that is the feedstock to the aromatics plant, the second main section.
- **Supporting facilities and utilities** on site will include the tank farms for condensate, intermediate products and products, steam boilers, raw and wastewater treatment plants, pipelines and the on-site utilities/ buildings (see *Figure 4*). A flare system for emergency flaring of raw materials (i.e.

Condensate, semi-finished and finished product) will be located in the southwest corner of the site. Third parties will supply the PEC with raw water, nitrogen gas, electrical power and natural gas.

- **Products:** *Table 1* provides the full list of products, co products and by-products. By-product hydrogen rich gas, fuel gas and light ends are used directly on-site in the process or as fuel for its fired heaters. All other products are stored in limited quantities in the onsite tank farms prior to transfer via pipeline to the PDT third party bulk storage terminal and its jetty.

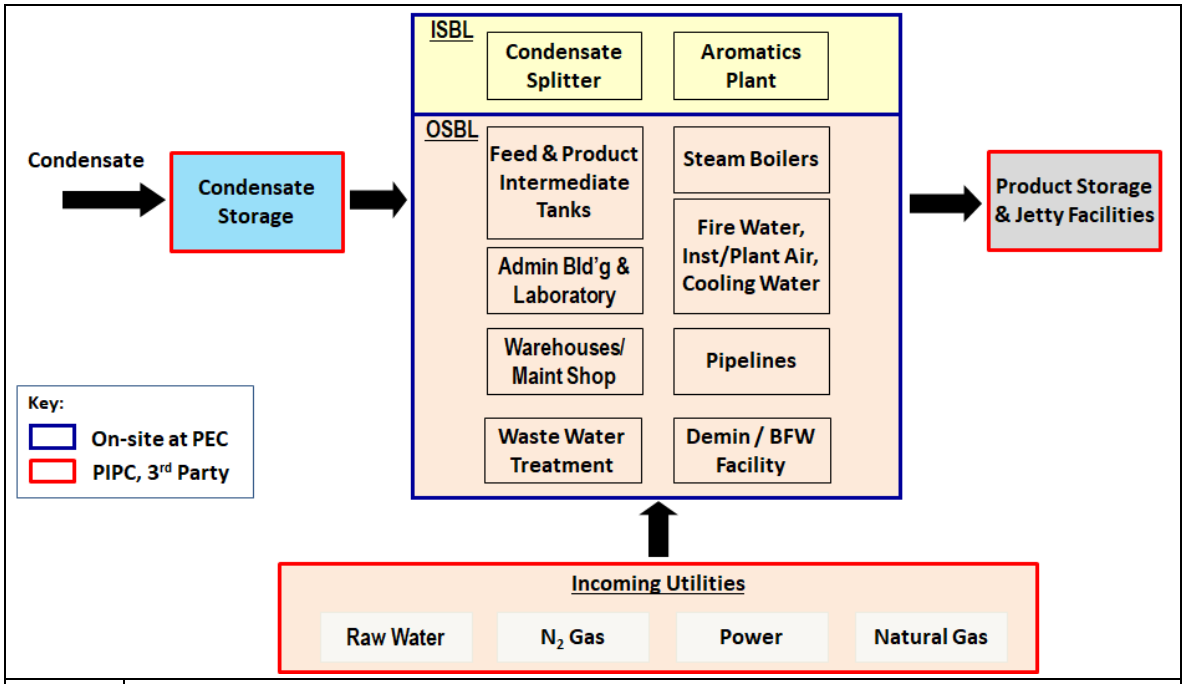


Figure 4 – PEC Processing Sections and Supporting Facilities Schematic
Source: PEC

Table 1: PEC Facility Production Capacities of Products, Co-Products and By-Products

Primary Products	Capacity (metric tonnes per annum)
Benzene	656,000
Paraxylene	1,505,000
Sub-total aromatics	**2,161,000**
Co-Products	Capacity (metric tonnes per annum)
Jet Fuel	926,000
Diesel (ULSD)	1,396,000
C3/C4 LPG	298,000
Fuel Oils (LSFO)	154,000
Light Naphtha	887,000
By-Products	Capacity (metric tonnes per annum)
Sulphur	11,000
Hydrogen Rich Gas	11,000
Sub-total oil products	**3,683,000**
TOTAL PRODUCTION CAPACITY	5,844,000
Hydrogen Rich Gas	254,000
Fuel gas (DC2 Off gas)/ Light Ends	226,000
Sub-total utilised on-site	**480,000**

Note:
1. Primary and oil products exported for sale, together with sulphur by-product, other by-products used on site in process or as fuel

2.2 Process Description

The PEC will utilise the refining and aromatics technologies of Honeywell UOP, the globally leading vendor. *Figure 5* provides an overview of the processes in the form of a simplified process flow diagram (PFD) for the PEC with the main operations broadly as follows:

- The **condensate splitting section** produces the intermediate naphtha that feeds the aromatics plant. Feedstock condensate is processed using standard oil refining 'unit operations' that utilise heating, cooling, fractionation, reforming and distillation processes. Condensate is desalted and processed in the feed fractionator, which splits the condensate into heavy naphtha and kerosene (jet fuel). This unit boils the condensate via steam and direct heating from a fuel burner.

The naphtha is sent to the stabilizer, where a similar process splits this flow into gaseous LPG and the full boiling range (FBR) naphtha that is the feedstock for the aromatics complex. The remaining split hydrocarbon fractions are sent to the LPG Merox or hydrotreating units (KHT & DHT), where the gas and oil products undergo amine treating, hydrogenation, desulphurisation and processing to the various petroleum co- and by-products including light ends, C3 Liquefied Petroleum Gas (LPG) (propane), C4 LPG (butane and iso-butane), Ultra Low Sulphur Diesel (ULSD), Low Sulphur Fuel Oil (LSFO) and Jet Fuel (Jet-A1), that are sent to storage.

- In the **aromatics treatment complex** the intermediate naphtha feedstock is first hydrotreated in the naphtha hydrotreating unit (NHT) to remove sulphur, nitrogen and other contaminants and light naphtha separated in the naphtha splitter. The remaining heavy naphtha is then processed in the continuous catalytic reforming (CCR) platforming and regeneration unit via catalytic reforming, or dehydrogenation in the presence of a catalyst at elevated temperature and pressure. Under these conditions, aliphatic/straight chain hydrocarbons form rings and lose hydrogen (by-product) to become aromatic/ring chain hydrocarbons (or BTX; Benzene-Toluene-Xylenes).
- The aromatic products of the reaction are then separated from the reaction mixture (or reformate) by Sulfolane solvent extraction and distillation. The Tatoray unit then converts toluene, the lower value aromatic-product, to xylene and benzene using the toluene disproportionation (TDP) process that reacts two toluene molecules together and rearranges the methyl groups from one toluene molecule to the other, a process that yields one benzene molecule and one xylene molecule, with molten sulphur as by product. Primary product benzene is separated and sent to storage. Xylenes are further processed in the Parex and Isomar units, via absorption and isomerisation to maximise production the other high value primary product, paraxylene.

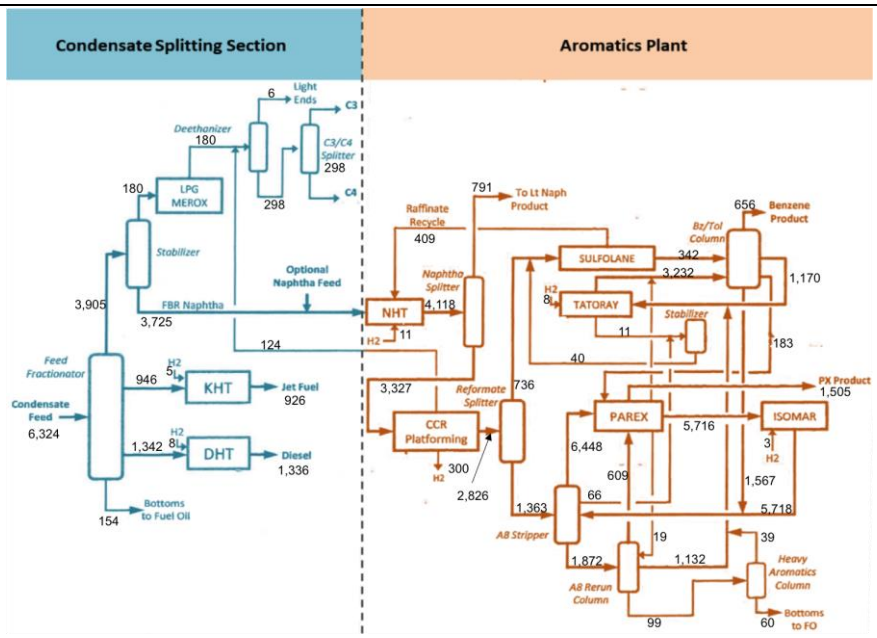


Figure 5 – PEC Simplified Process Flow Diagram

2.2.1 Condensate Splitting Complex

The condensate splitting complex will consist of the following major units:

- Condensate Fractionation Unit (AREA C1)
- LPG Merox Unit (AREA C1)
- Distillate Unionfining (KHT) Unit (AREA C1)
- Distillate Unionfining (DHT) Unit (AREA C2)

Detail descriptions of each unit in condensate splitting complex are as follows:

2.2.1.1 Condensate Fractionation Unit (AREA C1)

Condensate is initially passed through a desalting unit. Removed salt is sent as brine to the refinery waste water treatment plant (WWTP). The condensate is then processed in the fractionation unit. Fractionation has three major processes, a feed fractionator, a product fractionator, and a stabiliser.

The condensate first enters the **feed fractionator**. Feed fractionator splits the heavy naphtha and kerosene (jet fuel). The basis for this split is the retention of approximately 66% of the C10s into the heavy naphtha for aromatic production while meeting the specification for the jet fuel. This unit boils the condensate via steam and direct heating from a fuel burner in the reboiler. Ammonia and Unicor (corrosion inhibitor) are added to assist the process of splitting the condensate into two fractions, called overheads and bottoms. The process also produces sour water, which is sent to the sour water stripper. Point source emissions are generated from the reboiler and any other gases and air displaced from the equipment is channelled into the air treatment system, described later. Gaseous emissions are collected in the same manner as above.

The overheads are sent to the **stabilizer** at a rate of 3,905 KMTA**.** A similar process splits this flow into two further fractions. The stabilizer overheads are gaseous LPG, which is routed to the LPG Merox unit. The stabilizer bottom product is full boiling range (FBR) naphtha, the feedstock for the aromatics complex and sent to the naphtha hydrotreating unit. This unit may produce sour water, which is channelled to the sour water stripper.

The bottoms from the feed fractionator are sent to the **product fractionator** at a rate of 2,288 KMTA, where it is split into three fractions, the condensate is heated via a fuel fired boiler and steam. The overheads are routed to the KHT and DHT units and is stored onsite. The bottoms are sent directly to fuel oil storage. The product fractionator also has a side-cut which is routed to the distillate unionfining unit.

2.2.1.2 LPG Merox Unit (AREA C1)

An LPG Extraction Merox Unit is designed to remove H_2S, COS and Mercaptans from the LPG required when further processing of C3 and C4 olefins in alkylation, polymerization or petrochemical synthesis is required. The capital-efficient Extractor Plus design is typically used in this service.

The Extractor Plus design incorporates caustic pre-treatment, mercaptan extraction and post-treatment into a single vessel, thereby offering a low capital cost alternative to other extraction processes.

The LPG from the condensate fractionation unit is processed in the caustic merox (LPG extraction) unit to reduce sulphur which occurs as mercaptans and hydrogen sulphide (H_2S). The pressure of LPG will be ~13.7 barg after flow record and control (FRC) and at a temperature of 40°C. The process uses steam. Normal feed rate to the unit would be 180 KMTA (6,091 barrels per stream day BPSD). The first stage of the unit (not shown) is **an amine absorber** for H_2S removal.

The feed (after being treated in the amine absorber) flows to a caustic pre-wash prior to being charged to the **extractor**, with caustic (sodium hydroxide) solution, containing merox catalyst (cobalt phthalocyanine sulfolane compounds). Treated product is sent to storage.

Mercaptan rich caustic solution containing merox catalyst is injected with air and the mixture flows into the **oxidizer** where the dissolved mercaptans are catalytically oxidized to water insoluble disulphide oil. The oxidizer effluent flows to the **disulphide separator** where disulphide is removed. The disulphide oil is

decanted in a disulphide sand filter and is sent to unionfining unit. Lean caustic is circulated from the disulphide separator to the extractor.

The unit has several over pressure vents to the flare stack, which may be activated in the event of over pressure, air emissions are reprocessed in various subsequent units.

2.2.1.3 Distillate Unionfining (KHT) Unit (AREA C1)

KHT Distillate Unionfining Process Unit is divided into reactor and stripper sections. The unit consists of one reactor section with separate stripper section.

Reactor Section

Cold feed from storage is sent to the unit via a Coalescer to remove any free water, and is filtered to remove any particulate matter which could plug the reactor catalyst beds. For this type of feed the Filter is likely to be a cartridge type. The filtered feed is then routed to the Feed Surge Drum.

The unit feed is pumped from the Feed surge Drum via the high head multistage charge pump to the reactor system pressure. The feed is mixed with recycle gas and the combined feed is heated by the reactor effluent stream and then in the charge heater to the required reaction temperature before entering the reactor.

The reactor effluent is cooled against the combined feed stream and enters the Separator. The liquid from the Separator is routed to the Stripper column.

Prior to cooling in the product condenser wash water is injected into the reactor effluent stream to remove any ammonium salts that may deposit within the tubes of the air cooler.

The vapour from the Separator vessel is the recycle gas which is routed to the recycle gas compressor, mixed with the fresh feed and returned to the reactor system.

Improving the purity of the make-up H_2 will have impact on the catalyst quantity, reactor size and compression costs.

Makeup hydrogen is added to the reactor system via the makeup Gas Compressors. To minimise the capacity of the Recycle Gas Compressor the makeup gas is routed to the discharge of this compressor.

To avoid the formation of an emulsion, the liquid hydrocarbon and water phases in the Separator vessel are separated before being let down in pressure.

Stripper Section

The Stripper column is designed to remove the H_2S from the product. The column is fed from the separator. The separator liquid is heated against the Stripper bottoms stream prior to entry into the column.

The Stripper column overhead vapour is condensed and collected in the Stripper Receiver. The hydrocarbon liquid from the Stripper Receiver is the sour wild naphtha product which is sent to the refinery for further processing. Normally there is no liquid from the stripper receiver.

The Stripper column bottoms stream is the desulfurized product and is cooled against the cold Stripper feed. To produce a dry product the bottoms stream is further cooled before being sent to storage.

2.2.1.4 Distillate Unionfining (DHT) (AREA C2)

The unit processes the diesel fraction, from the condensate fractionation unit. The objective of the unit is to reduce the sulphur in the diesel to meet the Euro-V fuel specification. The nominal feed rate is 1,342 KMTA (28,699 BPSD). This unit will produce a sweet fuel gas stream and an un-stabilised naphtha stream which is recycled in the condensate fractionation unit.

The unit comprises the reactor, separator, compressor, stripper, and diesel product section. The Feed enters the reactor pressurised and is combined with recycled gas and heated via a fuel boiler together with reactor effluent. The proposed design has only a single reactor with two catalyst beds and hydrogen quench. The two catalyst beds filter out fine particles such as corrosion products to avoid high-pressure drop across the catalyst bed during operation, followed by the desulphurisation catalyst. Subsequently the gas and liquid mixture is separated in the high-pressure separator unit. Water is injected into the reactor effluent ahead of

the effluent air cooler to prevent the deposition of ammonium disulphide. Sour water is coalesced and removed from the boot of the separator, and sent to the flash drum.

High-purity (90%) make-up hydrogen, from the make-up gas compressor discharge, is mixed with the recycled gas at the suction of the recycle compressor and the combined recycle and make up gas stream is sent to the reactor system. The separator liquid is sent to the flash drum (low pressure separator) where the hydrocarbon liquid, flash gas and sour water are separated. The flash gas is sent to the amine absorber for H_2S removal. The flash drum liquid requires stripping to remove residual hydrogen sulphide, ammonia and light hydrocarbons. The steam stripper will generate off-gas, sour water and the diesel product. Diesel product with a moisture content less than 200 wppm will be achieved, by routing the diesel product through a product coalescer and salt dryer to remove the free water. The product is then sent to storage.

2.2.2 Aromatics Treatment Complex

The Aromatic treatment complex will consist of the following major units:

- Naphtha Hydro-treating Unit (NHT);
- Contaminant Removal Process Unit;
- Continuous Catalytic Reforming (CCR) Platforming and Regeneration Unit;
- Pressure Swing Adsorption (PSA) Unit;
- Olefin Reduction Process Unit;
- Sulfolane Unit;
- Tatoray Unit;
- Aromatic Fractionation Unit;
- Parex Unit; and
- Isomar Unit.

2.2.2.1 Naphtha Hydrotreating Unit (NHT) (Area 200)

FBR naphtha produced from the condensate splitting section is further treated in the NHT unit. NHT uses a selective catalyst HYT 1119 (Aluminum Oxide) and GB-346 to hydrotreat with hydrogen rich gas to decompose organic sulphur, nitrogen and oxygen compounds in the naphtha prior to further processing in the CCR platforming unit. In addition, hydrotreating removes organometallic compounds (including mercury – see contaminant removal process below) and saturates olefinic compounds.

The unit comprises the following sections:

- Reaction Section – consists of a heat exchanger, fuel fired heater, reactor, separator, recycled gas compressor and ancillary equipment
- Stripper Section – comprises a stripper column, fuel fired reboiler, amine treater and ancillary equipment

The naphtha hydrotreating unit uses a mixture of 50% condensate and 50% stripped water from the sour water stripping unit as wash water. The stripper net overhead gas is amine treated prior to being sent to fuel gas system.

2.2.2.2 Contaminant Removal Process (CRP) Unit (part of NHT) (Area 230)

The Contaminant Removal Process removes mercury and arsenic from the feedstocks through an adsorber. Mercury is a catalyst and adsorbent poison and is known to corrosively attack equipment made with aluminum, such as heat exchangers in gas processing plants or olefin complexes. Arsenic compounds are also catalyst poisons in many petrochemical processes.

The CRP is designed to reduce the mercury content of certain feeds to 5 ppb or less, and to remove the arsenic compounds typically present in light and heavy naphtha streams to less than 5 ppb. In addition to protecting equipment, catalyst and adsorbents, the CRP provides a means to control emissions of mercury and arsenic.

The regenerable adsorbent has a long useful life and when ultimately spent, has no detectable mercury level. Arsenic generally occurs only in combined forms. The various species of arsenic will be adsorbed by the non-regenerable material depending on the boiling points of the arsenic compounds present.

2.2.2.3 Continuous Catalytic Reforming (CCR) Platforming and Regeneration Unit (Areas 300 and 312)

The CCR platforming process produces aromatics and hydrogen from napthenes and paraffin at high severity, it is the only in the complex that creates aromatic rings. The rest of the complex is used to separate the various aromatic components into individual products and to convert undesired aromatics into additional high value products. Feed for the CCR platforming unit is the naphtha splitter bottoms from the NHT. This unit upgrades mercury depleted low octane hydrotreated heavy naphtha to produce 105 RONC reformate. Hydrogen, LPG and light ends are also produced in this process.

The unit comprises a reaction section, recontact section and debutaniser section. The unit produces the following product streams:

- A hydrogen rich gas stream, which is routed to the NHT unit, isomar unit, tatoray unit and olefin reduction unit.
- An unstabilised LPG stream, which is routed to condensate splitting for combined treatment (de-ethaniser followed by C_3/ C_4 splitter)
- A reformate intermediate, which is sent to the reformate splitter.

The reaction section consists of four stacked radial flow reactors, fuel fired charge heater and inter-heaters, combined feed exchanger, separators, recycle gas compressor and their ancillary equipment. Four major reactions occur in the reactors including dehydrocyclisation, isomerisation, dehydrogenation, hydrocracking of large hydrocarbons to smaller hydrocarbons.

Vapor from the product separator is split into two streams: recycle gas and hydrogen rich net gas. The recycle compressor compresses the recycle gas while the net gas is sent to the product recovery section. The product recovery section consists of recontacting and net gas compression. The net gas from product recovery section flows to a Recovery Plus system to further improve the recovery of C_5+ material and LPG.

Recontact section consists of a two-stage counter-current recontacting and net gas compression scheme plus a third stage of net gas compression. The recontact pressure is 31 barg. The hydrogen gas from the second stage compression and recontacting scheme is treated to remove chlorides and is sent to the NHT unit and isomar unit. The gas from the third stage compression goes to the tatoray and olefin reduction unit. The light ends from the second stage of the compression and recontacting scheme is sent to the de-ethaniser and C_3/ C_4 splitter, after chloride removal. As a result of chloride removal, chlorinated water from CCR platforming process will be collected and treated in waste water treatment plant on site.

2.2.2.4 CCR Catalyst Regeneration

The CCR platformer uses a movable bed of R-334 catalyst. Over time, coke will build up on the catalyst surface, reducing catalyst activity. Hence, the catalyst requires regeneration. During the regeneration process, the refinery will suffer production loss, which is the reason why UOP developed a major process enhancement by making the regeneration possible continuously, while the process is also taking place.

In UOP design, the catalyst is able to flows by gravity between reactors and is continuously regenerated. Catalyst regeneration will generate particulate which will be filtered prior venting. Catalyst regeneration consists of four steps. The first three steps of coke burning, oxychlorination, and drying occur in the CCR Cyclemax® regeneration unit. The fourth step, reduction, occurs in the reduction zone on top of the reactor stack. The CCR Cyclemax® regeneration unit uses a pressurized regenerator design. The Chlorosorb® system, which recovers upto 99% of chlorides from the vent gas stream and recycles the chlorides back to the process, is also applied. Spent catalyst is used as chlorides adsorbent.

2.2.2.5 Reformate Splitter

The reformate splitter reboils the intermediate product, bottoms from the debutanizer at the CCR. The bottoms are passed through the Olefin Reduction Process (ORP) prior to being sent to the xylene splitter. The top fraction is condensed and sent to the sulfolane unit,. Vent gases are sent to the sulfolane vent tank and subsequently to the flare stack. The unit will produce solid waste when clay beds are changed and will be sent for off-site disposal by a licensed waste collector.

2.2.2.6 Olefin Reduction Process (ORP) Unit (Area 322)

ORP Unit uses a simple, fixed-bed reactor system where olefins in the reformate are selectively hydrogenated to their corresponding alkane or cycloalkane using hydrogen rich gas from the third compression stage of the CCR platforming unit. The unit includes a heat exchanger train and two swing-bed reactors. The unit product will be routed to the sulfolane unit.

2.2.2.7 Sulfolane Unit (Area 541)

The sulofane process combines liquid-liquid extraction with extractive distillation to recover high purity aromatics. The unit extracts a benzene-toluene fraction, which is sent for further fractionation, where it is heated to produce the fractions for finished product and subsequently stored on-site. The unit also produces a raffinate product.

The feed to the sulfolane unit is the reformate splitter overhead liquid from the xylenes fractionation unit and the stripper column bottoms from the isomar unit.

Sulfolane unit consists of, a feed surge drum, lean solvent section, extractive distillation (ED) column, recovery column, solvent separator, clay treaters, benzene column and their ancillary equipment. A plant inventory tank and sulfolane sump tank are also included.

The feed is routed to the ED Column via the Feed Surge Drum. The maximum temperature of the ED Column is 89°C and the maximum pressure is 1.1 barg. The lean solvent is added to the column above the feed inlet. Mono-ethanol amine (MEA), a gas washing solvent and an anti-foaming agent are also injected into the process. As the feed flows through the ED Column, aromatics are selectively dissolved in the solvent. A raffinate stream, very low in aromatics content, is withdrawn from the top of the ED Column.

The target recovery of benzene is 99.5% across the ED Column. Extracted aromatics are separated from the solvent in the recovery column as an overhead stream, and are clay treated in order to remove trace amounts of olefins and other impurities. The treated extract is sent to the benzene column. The bottoms stream from the recovery column is toluene, which is recycled to the ED column. Final product is sent to product storage tanks.

2.2.2.8 Tatoray Unit (Area 380)

The tatoray unit is used to selectively convert toluene C_9 – C_{10} to more valuable benzene and xylenes, over the TA-32 catalyst. The unit consists of a reaction section and a stripper section. A feed storage tank will feed the coolers and a feed pump.

The toluene xylene columns in the aromatic fractionation unit provide the feed to the reaction section. Hydrogen rich gas is also supplied from the CCR platforming unit. The two major reactions in the process are disproportionation and transkylation. Disproportionation converts toluene into benzene and xylene; and transkylation converts a mixture of toluene and C_9 – C_{10} aromatics into xylenes and benzene.

The reactor section consists of a feed surge drum, charge heater, reactor, combined feed exchanger, products condenser, products separator, recycle gas compressor and their ancillary equipment. The reaction will take place at a temperature of 368/ 500°C and a pressure of 29 barg.

The stripper section is designed to separate benzene cut from heavier hydrocarbons. The stripper section is fed by:

- Reaction section liquid product

- The isomar stabilizer overhead liquid
- Crude toluene from the parex finishing column
- The reformate from the ORP unit

Overheads from the stripper is cooled and separated into gas and liquid products. The stripper overhead gas is exported to the fuel gas system. The overhead liquid is sent to the stripper at the isomar unit.

2.2.2.9 Aromatic Fractionation Unit (Area 431)

The aromatic fractionation unit prepares feed for the parex and tatoray units. It also produces a toluene stream, which is fed to the sulfolane unit and the heavy aromatics product stream.

The unit consists of several columns, one each for toluene, xylene and heavy aromatics. Feed to the unit is the tatoray stripper bottoms and the isomar deheptaniser bottoms which is fed to the xylene column together with toluene column bottoms.

Products / Intermediates from the aromatic fractionation unit are:

- Xylene stripper overheads to the parex unit,
- Xylene Rerun Column
- Heavy aromatics column overhead contains C_9 and C_{10} aromatics & is sent to the tatoray unit
- Heavy aromatics column bottoms are the heavy aromatics to be blended with diesel.

The stabilized reformate from the Depentanizer Column is sent to the Reformate Splitter section where the reformate is split into a light reformate stream, predominantly a C_6/C_7 cut, and C_8+ heavy reformate.

The light reformate stream from the Reformate Slitter is taken overhead and sent to the ED Sulfolane Unit where the aromatics in the ED Sulfolane feed are recovered as an extract stream. The non-aromatics are rejected as raffinate stream; this stream is run down to by-product storage and is typically sold as isomerization unit feed, stream cracker feed or bending component. The aromatics-rich extract stream is clay treated and sent to the Benzene-Toluene Column, which also processes the Tatoray Stripper bottoms. The Benzene-Toluene Column is a dividing-wall column that provides the finished benzene product as an upper sidedraw, a toluene-rich stream as a lower sidedraw and a bottoms stream that is reach in A_{8+}. The toluene produced in the Benzene-Toluene Column is combined with A_9/A_{10} recycle-comprised of the A8 Rerun Column sidedraw stream and the Heavy Aromatics Rectifier overhead- and is charged to the Tatoray Unit. Toluene desorbent make-up to the Parex unit is also provided by the Benzene-Toluene Column lower sidedraw when needed. The Benzene-Toluene Column bottoms stream is sent to the A8 Stripper.

The tatoray unit processes toluene from the Benzene-Toluene (B-T) column and A_9/A_{10} from the A_8 Rerun Column and Heavy Aromatics Rectifier to produce mixed xylenes and benzene. The tatoray unit reactor effluent is sent to the Tatoray Stripper Column, which removes hydrogen and light ends in the overhead vapor and some of the benzene in the overhead liquid. The A_{6+} Tatoray Stripper bottoms stream is sent to the Benzene-Toluene Column for fractionation of aromatics. The Tatoray Stripper overhead liquid combines with the A_8 Stripper overhead, and the combined stream is sent to stabilizer. The Tatoray Stripper vapor stream is sent to fuel gas.

The A_8 Stripper processes the clay-treated heavy reformate from the Reformate Splitter bottoms, the B-T Column Bottoms, and the Isomar Hot and Cold Separator liquid streams. The A_8 Stripper produces a mixed xylenes sidedraw that is sent to the Parex Unit and an A_{9+} bottoms stream that is sent to the A_8 Rerun Column. The C_{7-} overhead from the A_8 Stripper is sent to the Stabilizer for recovery of benzene, toluene and fuel gas. The Stabilizer bottoms stream contains benzene and toluene and is sent to the ED Sulfolane Unit for aromatics recovery.

The A_8 Rerun Column is fed by the A_8 Stripper bottoms and the A_{9+} bottoms from the Paraxylene Column. The A_8 Rerun Column recovers mixed xylenes from the A_8 Stripper bottoms as overhead, and it produces an A_9/A_{10} vapor sidedraw that is sent to the Tatoray Unit and an A_{11+} bottoms astream that is sent to the Heavy Aromatics Rectifier.

The overhead from the Heavy Aromatics Rectifier, mainly A_{10}, is combined with the A_8 Rerun Column A_9/A_{10} sidedraw as feed to the Tatoray. The A_{11+} bottoms stream from the Heavy Aromatics Rectifier is sent to diesel pool, or alternative uses as required.

The mixed xylenes from the sidedraw of the A_8 Stripper are combined with the A_8 Rerun Column overhead and set to the Parex Unit. In the Parex Unit, very high purity paraxylene (PX) product is recovered in the extract and paraxylene columns. The extract column is fed by the Parex extract stream, which contains PX and toluene desorbent. The bottoms stream rom the Extract Column is sent to the Paraxylene Column; Paraxylene Column overhead is the finished PX product. The Paraxylene Column bottoms stream contains A_{9+} with some xylene and is, therefore, returned to the A_8 Rerun Column for fractionation of xylenes and A_9/A_{10} from $A1_{1+}$.

The Parex Rafffinate Column is fed by the Parex raffinate stream, which is depleted of PX and contains ethylbenzene (EB), metaxylene (MX), orthoxylene (OX) and toluene desorbent. The Raffinate Column bottoms stream, which contains the PX-depleted xylenes, is sent to the Isomar Unit where xylene equilibrium is re-established and ethylbenzene is dealkylated to benzene. The Isomar Hot and Cold Seperator liquids are fed to the A8 stripper for separation of dissolved light ends, benzene, toluene, mixed xylenes and A_{9+}.

The overhead streams from the Parex Extract and Raffinate Columns recycle the toluene desorbent to the Parex unit. A small desorbent drag stream is taken to the B-T Column, and make-up desorbent is recycled from the B-T Column to the Parex Unit.

2.2.2.10 Parex Unit (Area 500)

The parex unit recovers para-xylene from mixed xylenes, producing 800 kMTA of paraxylene at a minimum purity of 99.8%. The feed is the overhead liquid from the Xylene Column. The Unit extracts paraxylene from the feed using the ADS-50/ ADS-50L molecular sieve adsorbent and the toluene desorbent (low density Parex). The unit consists of a continuous adsorption and extract sections, raffiante and desorbent fractionation. Desorbent and plant inventory tanks are also included. The adsorption section consists of two adsorbent chambers.

Paraxylene extract is separated from the desorbent in the extract column. The paraxylene is further purified in the finishing column to final product specifications and initially sent to one of the two day tanks and then storage. The finishing column overhead liquid is sent to the stripper column in the tatoray unit. Desorbent is recycled to the adsorption section.

The raffinate is separated from the desorbent in the raffinate column and is then routed to the isomar unit. Desorbent is recycled to the adsorption section. The desorbent rerun column bottoms are routed to the heavy aromatics tank via the heavy aromatics product cooler in the aromatic fractionation unit.

2.2.2.11 Isomar Unit (Area 320)

The isomar unit increases the efficiency and reduces waste from the PEC facility by converting the raffinate feed from parex unit to a mixed xylene stream for further processing into product in the xylene column. The isomar unit consists of a reactor section and a fractionation section.

The reactor section consists of a catalytic reactor, combined feed exchanger, charge heater, product condenser, products separator, recycle gas compressor, and their ancillary equipment. Makeup hydrogen to the unit is supplied from the tatoray unit and from CCR platforming unit. The feed to the isomar unit is first combined with hydrogen-rich recycle gas and makeup gas to replace the small amount of hydrogen consumed in the isomar reactor. The combined feed is then pre-heated and vaporised by exchange with reactor effluent, and raised to reactor operating temperature (301°C) in a charge heater. The hot feed vapour is sent to the reactor, where it is passed through the catalyst. The reactor effluent is cooled by exchange with the combined feed and is then sent to the product separator.

The fractionation section consists of a deheptaniser column, clay treater, surge drum and their ancillary equipment. The maximum temperature of the deheptaniser column is 146°C and the maximum pressure is 3.4 barg. The liquid hydrocarbons from the product separator are mixed with the mixed xylene and are fed

to the deheptaniser column. The deheptaniser removes the C7 minus material to allow the column bottoms material to be charged directly to the xylene column in the aromatic fractionation unit after clay treating.

The deheptaniser overhead liquid is routed to the stabiliser column in the tatoray unit. The deheptaniser column net overhead gas and product separator net gas from the unit is routed to fuel gas. Stripper column net bottoms will be routed to the sulfolane unit.

2.3 Safety Features

The following safety features shall be made available at the site. These features are taken into consideration in this study. The safety features for the proposed facility are categorised into mainly procedural safety precautions and safety systems as shown below.

2.3.1 Procedural Safety Precautions

- Personnel Protective Equipment (PPE) i.e. safety shoes, safety helmet to be worn within the site premises
- Trained first aid personnel will be available on site at all times
- Appropriate numbers of staff will be on site on a full-time basis depending on the need to assure the safety of the staff and the availability of any emergency equipment, if required
- The Site will establish and maintain an emergency preparedness and response plan designed to response and manage the occurrence of an incident

2.3.2 Plant and Equipment Protection

The new plant will be designed with consideration for the highest levels of plant safety and equipment protection systems; provided Instrumented Protective Function systems will include:

- Emergency Shut Down (ESD) and/or Emergency Depressurizing (EDP) systems to protect process units and their related facilities;
- Fire and Gas Detection Systems for early detection and protection from developing hazardous conditions; and
- Fire protection and Alarm Management Systems.

2.3.3 Safety Systems

Both passive and active safety systems will be provided in the plants, including the following:

- In-place safety management systems (standard operating procedure, permits to work etc.)
- Fire detection, alarms and firefighting systems;
- Automatic sprinkler;
- Fireproofing of critical structures and equipment;
- Fixed and portable gas detectors and smoke/flame detectors;
- Lighting protection;
- Electrical grounding;
- Safety shower and eye bath systems;
- Personal Protective Equipment (PPE);
- Inert gas blanketing; and
- Flare System.

2.3.4 Fire Detection and Protection System

The basic features of fire detection and protection systems are outlined below:

- The plant will be covered by a fire water ring main. Water from the fire water reservoir will be charged and pressurised in the ring main using a combination of motor and diesel driven fire water pumps. Hydrant stand post, water monitors and other appropriate firefighting accessories will be placed in the fire water network as per NFPA design guidelines.
- Storage tanks will be provided with appropriate fire protection measure (e.g. foam, deluge etc.) as per design codes and standards.
- Control room and sub stations will be protected with clean agent flooding systems such as FM 200 etc.
- Automatic sprinkler system and fire hose reel system will be provided for admin building. Fire extinguishers will be placed in strategic location of the buildings as necessary.
- Design scheme for Automatic fire alarm system and Manual call point system will be provided in the storage tank areas and in the buildings as necessary.

The establishment shall be provided with an Automatic Fire Alarm System conforming to Malaysian Standards for Fire safety and Protection, and *Uniform Building By-Laws 1984* requirements.

The Fire Alarm System shall comprise but not be limited to the following:

For safe storage of flammable liquids, fire protection measures will be provided according to the MSDS of the storage liquid. Such systems include but are not limited to:

- Foam protection system
- Deluge System
- Fire hydrant with monitor

The storage tank will be equipped with heat detectors connected to automatic fire alarm system. The storage area will include manual call points.

Fire extinguishers will be placed in strategic locations for adequate fire protection as per code requirement of the *Uniform Building By-Laws 1984*.

2.4 Land Use Planning, Population and Meteorological Data

Landuse planning, population figures for the surrounding and meteorological data were based are presented in *Appendix A*.

3 HAZARD IDENTIFICATION AND SELECTION OF SCENARIOS

3.1 Introduction

A hazard in this context is defined as a loss of containment (LoC) that has the potential to cause offsite damage to people, property or the surrounding environment. The following section identifies and selects the specific hazardous scenarios to be address in this QRA.

3.2 Chemical Inventory and Properties of Hazardous Substances

The substances that will be stored and are subject to a QRA are Condensate, Naphtha, Sour Naphtha, Sweet Naphtha, Pentane, Dodecene, LPG, Butane, Kerosene, Propane, Ethane, Hydrogen, Diesel, Heptane, Sulfolane, Hydrogen Sulfide, Toluene, Xylene, Para-xylene, Hexane, Aromatics, Benzene, Tetramethylbenzene (TTMBZ), Diethylbenzene (DEBZ), and Trimethylbenzene (TMBZ).

The materials are chosen based on high mass percentage in each unit (equipment and pipeline).

Information on the location, hazards, physical properties, physical condition and storage/processing vessels for each hazardous substance is summarised in the tables below. It should be noted that maximum quantities/ inventories and worst case operating/ processing conditions are used in the QRA to ensure conservatism. In particular the QRA was based on preliminary design data whereby inventories in key process vessels were estimated based on the empty volume of the vessels.

Please refer to *Appendix B* for the Safety Data Sheets.

Table 2 – Chemical Inventory On-Site

No.	Chemical	Handling Location	Major Hazards	Physical Form at Operating Condition	Type of Container	Unit Capacity of Container (m^3)
1	Condensate UN ID: 1267	Condensate Tank (800-TK1A~C)	Flammable	Liquid (40˚C @ 0.00barg)	Tank	57,900
2	Naphtha UN ID: 1256	Stripper Receiver (130-V8)	Flammable	Liquid (46˚C @ 6.18barg)	Pressurized vessel	10
		Reactor (200-R1)	Flammable	Liquid (343˚C @ 27.65barg)	Pressurized vessel	100
		Separator (200-V3)	Flammable	Liquid (46°C @ 24.12barg)	Pressurized vessel	300
		Naphtha Splitter (200-V7)	Flammable	Vapour (71°C @ 1.57barg)	Pressurized vessel	600
		Separator (300-V1)	Flammable	Liquid (46°C @ 2.45barg)	Pressurized vessel	85
		Light Naphtha Tank (830-TK1A/B)	Flammable	Liquid (40°C @ 0.00barg)	Tank	15,800
3	Sour Naphtha UN ID: 1255	Sour Naphtha Tank (850-TK1)	Flammable	Liquid (40°C @ 12.672barg)	Tank	31,400
4	Sweet Naphtha UN code: 1268	Sweet Naphtha Tank (851-TK1)	Flammable	Liquid (40°C @ 0.00barg)	Tank	31,400
5	Pentane	Feed Surge Drum	Flammable	Liquid (30°C @ 1.18barg)		210

No.	Chemical	Handling Location	Major Hazards	Physical Form at Operating Condition	Type of Container	Unit Capacity of Container (m^3)
	UN ID: 1265	(100-V18)			Pressurized vessel	
		Feed Fractionator Receiver (100-V5)	Flammable	Liquid (46°C @ 0.49barg)	Pressurized vessel	275
		Feed Fractionator Reflux Coalescer (100-V10)	Flammable	Liquid (47°C @ 12.26barg)	Pressurized vessel	45
		Stabilizer (100-V4)	Flammable	Liquid (56°C @ 6.37barg)	Pressurized vessel	1,100
		Stripper (200-V5)	Flammable	Liquid (99°C @ 11.57barg)	Pressurized vessel	330
		Stripper Receiver (200-V6)	Flammable	Liquid (40°C @ 10.4barg)	Pressurized vessel	20
		Naphtha Splitter (200-V7)	Flammable	Liquid (71°C @ 1.57barg)	Pressurized vessel	600
		Naphtha Splitter Receiver (200-V8)	Flammable	Liquid (58°C @ 1.18barg)	Pressurized vessel	50
		Depentanizer (200-V9)	Flammable	Vapour and Liquid (62°C @ 1.57barg)	Pressurized vessel	140
		Depentanizer Receiver (200-V10)	Flammable	Liquid (53°C @ 1.18barg)	Pressurized vessel	25
		Debutanizer Receiver (300-V7)	Flammable	Liquid (40°C @ 10.98barg)	Pressurized vessel	30
		Debutanizer Receiver (320-V6)	Flammable	Liquid (40°C @ 3.92barg)	Pressurized vessel	10
		C5 Gas Knockout Drum (431-V14)	Flammable	Liquid (85.6°C @ 3.63barg)	Pressurized vessel	6
		Pentane Tanks (843-TK1A,B)	Flammable	Vapour (40°C @ 12.67barg)	Ball Tank	2,500
6	Dodecane UN ID: Not regulated	Desalter (100-V9)	Flammable	Liquid (112°C @ 24.01barg)	Pressurized vessel	110
		Feed Fractionators (100-V1)	Flammable	Liquid (143°C @ 1.18barg)	Pressurized vessel	835
		Distillate Fractionator (100-V2)	Flammable	Liquid (243°C @ 1.08barg)	Pressurized vessel	100
		Diesel Stripper (100-V3)	Flammable	Liquid (280°C @ 1.18barg)	Pressurized vessel	40
		Distillate Fractionator Receiver (100-V6)	Flammable	Liquid (108°C @ 0.39barg)	Pressurized vessel	90
		Disulfide Sand Filter (110-V6)	Flammable	Liquid (43°C @ 3.63barg)	Pressurized vessel	1
		Feed Coalescer	Flammable	Liquid (35°C @ 6.17barg)		30

No.	Chemical	Handling Location	Major Hazards	Physical Form at Operating Condition	Type of Container	Unit Capacity of Container (m^3)
		(130-ME1)			Pressurized vessel	
		Feed Surge Drum (130-V1)	Flammable	Liquid (134^{O}C @ 2.53barg)	Pressurized vessel	25
		Stripper (130-V7)	Flammable	Liquid (260^{O}C @ 6.86barg)	Pressurized vessel	50
		Vacuum Dryer (130-V9)	Flammable	Liquid (173^{O}C @ -0.69barg)	Pressurized vessel	25
		Raw Diesel Storage Tank (100-TK1)	Flammable	Liquid (68^{O}C @ 0.0147barg)	Tank	8,200
		Raw Kerosene Storage Tank (100-TK2)	Flammable	Liquid (68^{O}C @ 0.0147barg)	Tank	6,000
		Distillate Fractionators Reflux Coalescer (100-V11)	Flammable	Liquid (108^{O}C @ 20.59barg)	Pressurized vessel	45
7	LPG UN ID: 1075	Feed Fractionator (100-V1)	Flammable	Vapour (143^{O}C @ 1.18barg)	Pressurized vessel	835
		LPG Tank (841-TK1)	Flammable	Vapour (70^{O}C @ 0.00barg)	Ball Tank	4,500
8	Butane UN ID: 1011	Stabilizer (100-V4)	Flammable	Vapour (56^{O}C @ 6.37barg)	Pressurized vessel	1,100
		Stabilizer Receiver (100-V7)	Flammable	Vapour (38^{O}C @ 5.98barg)	Pressurized vessel	45
		Amine Absorber (110-V8)	Flammable	Vapour (38^{O}C @ 10.095barg)	Pressurized vessel	30
		Extractor Plus (110-V1)	Flammable	Vapour (38^{O}C @ 8.83barg)	Pressurized vessel	55
		Deethanizer (115-V1)	Flammable	Liquid (55^{O}C @ 27.95barg)	Pressurized vessel	85
		C3/C4 Splitter (115-V3)	Flammable	Liquid (50^{O}C @ 15.4barg)	Pressurized vessel	75
		Stripper (200-V5)	Flammable	Vapour (99^{O}C @ 11.57barg)	Pressurized vessel	330
		Stripper Receiver (200-V6)	Flammable	Vapour (40^{O}C @ 10.4barg)	Pressurized vessel	20
		Debutanizer (300-V6)	Flammable	Vapour (63^{O}C @ 11.77barg)	Pressurized vessel	270
		Debutanizer Receiver (300-V7)	Flammable	Vapour (40^{O}C @ 10.98barg)	Pressurized vessel	30
		LPG Chloride Treaters (300-V8A/B)	Flammable	Liquid (40^{O}C @ 32.56barg)	Pressurized vessel	7
		Debutanizer	Flammable			80

No.	Chemical	Handling Location	Major Hazards	Physical Form at Operating Condition	Type of Container	Unit Capacity of Container (m^3)
		(320-V5)		Vapour (68^{O}C @ 3.92barg)	Pressurized vessel	
		Debutanizer Receiver (320-V6)	Flammable	Vapour (40^{O}C @ 3.92barg)	Pressurized vessel	10
		Reformate Splitter (431-V1)	Flammable	Vapour (105^{O}C @ 0.49barg)	Pressurized vessel	750
		Butane LPG Tanks (842-TK1A/B/C/D)	Flammable	Vapour (40^{O}C @ 0.00barg)	Ball Tank	2,500
9	Kerosene UN ID: 1223	Distillate Fractionator (100-V2)	Flammable	Vapour (243^{O}C @ 1.05barg)	Pressurized vessel	605
		Diesel Stripper (100-V3)	Flammable	Vapour (280^{O}C @ 1.18barg)	Pressurized vessel	40
		Coalescer (120-V1)	Flammable	Liquid (40^{O}C @ 12.25barg)	Pressurized vessel	5
		Electrostatic Coalescer Prewash (120-V2)	Flammable	Liquid (40^{O}C @ 12.35barg)	Pressurized vessel	45
		Reactor (120-R1)	Flammable	Liquid (40^{O}C @ 11.57barg)	Pressurized vessel	165
		Caustic Settler (120-V3)	Flammable	Liquid (40^{O}C @ 10.59barg)	Pressurized vessel	75
		Water Wash (120-V4)	Flammable	Liquid (40^{O}C @ 10.2barg)	Pressurized vessel	65
		Sand Filter (120-V5A/B)	Flammable	Liquid (40^{O}C @ 9.81barg)	Pressurized vessel	60
		Clay Filter (120-V6A/B)	Flammable	Liquid (40^{O}C @ 8.43barg)	Pressurized vessel	130
		Kerosene Tanks (820-TK1A/B)	Flammable	Liquid (40^{O}C @ 0.00barg)	Tank	12,800
10	Propane UN ID: 1978	C3/C4 Splitter (115-V3)	Flammable	Vapour (50^{O}C @ 15.4barg)	Pressurized vessel	75
		C3/C4 Splitter Receiver (115-V4)	Flammable	Liquid (46^{O}C @ 15.59barg)	Pressurized vessel	20
		Propane LPG Tanks (840-TK1A/B)	Flammable	Vapour (40^{O}C @ 0.00barg)	Ball Tank	2,500
11	Ethane UN ID: 1035	Deethanizer (115-V1)	Flammable	Vapour (55^{O}C @ 27.95barg)	Pressurized vessel	85
		Deethanizer Receiver (115-V2)	Flammable	Vapour and Liquid (38^{O}C @ 27.56barg)	Pressurized vessel	6
		Deheptanizer (320-V2)	Flammable	Vapour (154^{O}C @4.40barg)	Pressurized vessel	640
		Deheptanizer Receiver	Flammable			125

No.	Chemical	Handling Location	Major Hazards	Physical Form at Operating Condition	Type of Container	Unit Capacity of Container (m^3)
		(320-V3)		Vapour (41^{O}C @ 3.70barg)	Pressurized vessel	
		Deheptanizer Vent Drum (320-V4)	Flammable	Vapour (10^{O}C @ 3.43barg)	Pressurized vessel	2
		Stripper Condenser (380-V4)	Flammable	Vapour (40^{O}C @ 5.20barg)	Pressurized vessel	40
12	Hydrogen UN Code: 1049	Reactor 1 (130-R1)	Flammable	Vapour (380^{O}C @ 75.41barg)	Pressurized vessel	80
		Reactor 2 (130-R2)	Flammable	Vapour (380^{O}C @ 72.57barg)	Pressurized vessel	125
		Separator (130-V3)	Flammable	Vapour (54^{O}C @ 60.31barg)	Pressurized vessel	25
		Flash Drum (130-V4)	Flammable	Vapour (57^{O}C @ 17.60barg)	Pressurized vessel	50
		Recycle Gas Compressor Suction drum (130-V5)	Flammable	Vapour (60^{O}C @ 60.31barg)	Pressurized vessel	3
		Make Up Gas Compressor Suction Drum (130-V6)	Flammable	Vapour (40^{O}C @ 31.38barg)	Pressurized vessel	2
		Stripper (130-V7)	Flammable	Vapour (260^{O}C @ 6.86barg)	Pressurized vessel	50
		Off Gas Absorber/Knock Out Drum (130-V11)	Flammable	Vapour (53^{O}C @ 5.88barg)	Pressurized vessel	20
		Treated Off Gas Knock Out Drum (130-V12)	Flammable	Vapour (47^{O}C @ 5.88barg)	Pressurized vessel	2
		Reactor (200-R1)	Flammable	Vapour (343^{O}C @ 27.65barg)	Pressurized vessel	100
		Separator (200-V3)	Flammable	Vapour (46^{O}C @ 24.12barg)	Pressurized vessel	300
		Recycle Compressor Suction Drum (200-V4)	Flammable	Vapour (46^{O}C @ 24.12barg)	Pressurized vessel	5
		Reactor 1 (300-R1)	Flammable	Vapour (549^{O}C @ 5.1barg)	Pressurized vessel	80
		Reactor 2 (300-R2)	Flammable	Vapour (549^{O}C @ 4.61barg)	Pressurized vessel	90
		Reactor 3 (300-R3)	Flammable	Vapour (549^{O}C @ 4.12barg)	Pressurized vessel	105
		Reactor 4 (300-R4)	Flammable	Vapour (549^{O}C @ 3.53barg)	Pressurized vessel	115
		Separator (300-V1)	Flammable	Vapour (46^{O}C @ 2.45barg)	Pressurized vessel	85
		Net Gas Suction Drum	Flammable			20

No.	Chemical	Handling Location	Major Hazards	Physical Form at Operating Condition	Type of Container	Unit Capacity of Container (m^3)
		(300-V2)		Vapour (46^{O}C @ 5.49barg)	Pressurized vessel	
		Recontact Drum No 1 (300-V3)	Flammable	Vapour (40^{O}C @ 16.57barg)	Pressurized vessel	45
		Recontact Drum No 2 (300-V4)	Flammable	Vapour (40^{O}C @ 33.15barg)	Pressurized vessel	40
		Net Gas Chloride Treaters (300-V5A/B)	Flammable	Vapour (32^{O}C @ 30.2barg)	Pressurized vessel	65
		Reactor (320-R1)	Flammable	Vapour (420^{O}C @ 12.41barg)	Pressurized vessel	65
		Separator (320-V1)	Flammable	Vapour (46^{O}C @ 10.98barg)	Pressurized vessel	65
		Reactor (380-R1)	Flammable	Vapour (501^{O}C @ 29.99barg)	Pressurized vessel	60
		Separator (380-V2)	Flammable	Vapour (40^{O}C @ 27.65barg)	Pressurized vessel	40
13	Diesel UN ID: 1203	Reactor 2 (130-R2)	Flammable	Liquid (380^{O}C @ 74.00barg)	Pressurized vessel	125
		Diesel Tanks (825-TK1A/B)	Flammable	Liquid (40^{O}C @ 0.00barg)	Tank	17,600
14	Heptane UN ID: 1206	Separator (130-V3)	Flammable	Liquid (54^{O}C @ 60.31barg)	Pressurized vessel	25
15	Sulfolane UN ID: 3334	Extractive Distillation Column (541-V1)	Flammable	Liquid (174^{O}C @ 1.47barg)	Pressurized vessel	765
		Recovery Column (541-V3)	Flammable	Liquid (174^{O}C @ -0.49barg)	Pressurized vessel	350
		Sulfolane Sump (541-V7)	Flammable	Liquid (180^{O}C @ 0.00barg)	Pressurized vessel	25
16	Hydrogen Sulfide UN ID: 1053	Amine Regenerator Receiver (640-V3)	Flammable and Toxic	Vapour (40^{O}C @ 0.98barg)	Pressurized vessel	1
		Sour Water Stripper Receiver (650-V3)	Flammable and Toxic	Vapour (88^{O}C @ 1.03barg)	Pressurized vessel	10
17	Toluene UN ID: 1294	Debutanizer (300-V6)	Flammable	Liquid (63^{O}C @ 11.77barg)	Pressurized vessel	270
		Debutanizer (320-V5)	Flammable	Liquid (68^{O}C @3.92barg)	Pressurized vessel	80
		Reactor 1/2 (322-R1/R2)	Flammable	Liquid (122^{O}C @ 28.73barg)	Pressurized vessel	50
		Feed Surge Drum (380-V1)	Flammable	Liquid (163^{O}C @ 5.1barg)	Pressurized vessel	315

No.	Chemical	Handling Location	Major Hazards	Physical Form at Operating Condition	Type of Container	Unit Capacity of Container (m^3)
		Stripper (380-V3)	Flammable	Liquid (209^{O}C @ 6.47barg)	Pressurized vessel	470
		Reformate Splitter (431-V1)	Flammable	Liquid (105^{O}C @ 0.49barg)	Pressurized vessel	755
		Reformate Splitter Receiver (431-V2)	Flammable	Liquid (56^{O}C @ 0.098barg)	Pressurized vessel	120
		Toluene Tank (432-TK1)	Flammable	Liquid (38^{O}C @ 0.005barg)	Tank	1,475
		Clay Treaters (432-V1A/B)	Flammable	Liquid (199^{O}C @ 14.22barg)	Pressurized vessel	60
		Benzene Column (432-V2)	Flammable	Liquid (152^{O}C @ 0.7barg)	Pressurized vessel	860
		Toluene Column (432-V4)	Flammable	Vapour and Liquid (232^{O}C @ 4.60barg)	Pressurized vessel	1,340
		Toluene Column Receiver (432-V5)	Flammable	Liquid (168^{O}C @ 0.099barg)	Pressurized vessel	105
		Finishing Column (500-V9)	Flammable	Vapour (117^{O}C @ 0.196barg)	Pressurized vessel	345
		Finishing Column Receiver (500-V10)	Flammable	Liquid (66^{O}C @ 0.098barg)	Pressurized vessel	45
		Recovery Column Receiver (541-V4)	Flammable	Liquid (38^{O}C @- 0.686barg)	Pressurized vessel	125
18	Xylene UN ID: 1307	Separator (320-V1)	Flammable	Vapour (46^{O}C @ 10.98barg)	Pressurized vessel	65
		Deheptanizer (320-V2)	Flammable	Liquid (154^{O}C @ 4.21barg)	Pressurized vessel	645
		Clay Treaters (431-V3A/B)	Flammable	Liquid (199^{O}C @ 15.68barg)	Pressurized vessel	160
		Xylene Splitter (431-V4)	Flammable	Vapour and Liquid (237^{O}C @ 0.50barg)	Pressurized vessel	4,645
		Xylene Splitter Receiver (431-V6)	Flammable	Liquid (227^{O}C @ 5.59barg)	Pressurized vessel	315
		Parex Feed Surge Drum (431-V7)	Flammable	Liquid (227^{O}C @ 6.66barg)	Pressurized vessel	2.9456
		Raffinate Column (500-V3)	Flammable	Liquid (148^{O}C @ 0.294barg)	Pressurized vessel	2,225
		Raffinate Column Side Cut Surge Drum (500-V4)	Flammable	Liquid (148^{O}C @0.294barg)	Pressurized vessel	130
		Raffinate Column Receiver (500-V5)	Flammable	Liquid (121^{O}C @ 0.098barg)	Pressurized vessel	140
		Raffinate Column Vent Drum	Flammable			2

No.	Chemical	Handling Location	Major Hazards	Physical Form at Operating Condition	Type of Container	Unit Capacity of Container (m^3)
		(500-V6)		Liquid (40^{O}C @ 0.098barg)	Pressurized vessel	
		Extract Column (500-V7)	Flammable	Vapour (146^{O}C @ 0.196barg)	Pressurized vessel	790
		Extract Column Receiver (500-V8)	Flammable	Liquid (121^{O}C @ 0.098barg)	Pressurized vessel	60
		Finishing Column (500-V9)	Flammable	Liquid (117^{O}C @ 3.43barg)	Pressurized vessel	345
		Xylene Tank (852-TK1)	Flammable	Liquid (40^{O}C @ 0.00barg)	Tank	12,100
19	Para-xylene UN ID: 1307	Para-xylene Tanks (500-TK3A/B)	Flammable	Liquid (40^{O}C @ 0.001barg)	Tank	3,860
		Para-xylene Tanks (810-TK1A/B/C/D/E)	Flammable	Liquid (40^{O}C @ 0.00barg)	Tank	19,200
20	Hexane UN ID: 1208	Extractive Distillation Column (541-V1)	Flammable	Vapour (174^{O}C @ 1.47barg)	Pressurized vessel	765
		Extractive Distillation Column Receiver (541-V2)	Flammable	Liquid (49^{O}C @ 0.49barg)	Pressurized vessel	40
		Stripper (380-V3)	Flammable	Vapour (209^{O}C @ 5.98barg)	Pressurized vessel	470
21	Aromatics UN ID: 1993	Separator (380-V2)	Flammable	Liquid (40^{O}C @ 27.54barg)	Pressurized vessel	40
		Heavy Aromatics Tanks (834-TK1A/B)	Flammable	Liquid (46^{O}C @ 0.00barg)	Tank	1,245
		Aromatics Tank (431-TK1)	Flammable	Liquid (40^{O}C @ 0.00barg)	Tank	17,200
22	Benzene UN ID: 1114	Separator Net Gas Suction Drum (300-V2)	Flammable	Liquid (46^{O}C @ 5.49barg)	Pressurized vessel	20
		Recontact Drum No 1 (300-V3)	Flammable	Liquid (40^{O}C @ 16.57barg)	Pressurized vessel	45
		Recontact Drum No 2 (300-V4)	Flammable	Liquid (40^{O}C @ 33.15barg)	Pressurized vessel	40
		Deheptanizer Receiver (320-V3)	Flammable	Liquid (41^{O}C @ 3.63barg)	Pressurized vessel	125
		Deheptanizer Vent Drum (320-V4)	Flammable	Liquid (10^{O}C @ 3.43barg)	Pressurized vessel	2
		Stripper Receiver (380-V4)	Flammable	Liquid (40^{O}C @ 5.2barg)	Pressurized vessel	40
		Benzene Column	Flammable			860

No.	Chemical	Handling Location	Major Hazards	Physical Form at Operating Condition	Type of Container	Unit Capacity of Container (m^3)
		(432-V2)		Vapour (152^{O}C @ 0.7barg)	Pressurized vessel	
		Benzene Column Receiver (432-V3)	Flammable	Liquid (59^{O}C @ 0.1barg)	Pressurized vessel	285
		Sulfolane Feed Tank (541-TK1)	Flammable	Liquid (40^{O}C @ 0.005barg)	Tank	4,140
		Recovery Column (541-V3)	Flammable	Vapour (174^{O}C @ -0.49barg)	Pressurized vessel	350
		Benzene Tanks (812-TK1A/B/C/D)	Flammable	Liquid (40^{O}C @ 0.00barg)	Tank	8,700
		Benzene Day Tanks (432-TK2A/B)	Flammable	Liquid (40^{O}C @ 0.00barg)	Tank	2,060
23	Diethyl-benzene UN ID: 2049	Adsorber Chamber No 1 (500-V1)	Flammable	Liquid (156^{O}C @ 13.03barg)	Pressurized vessel	720
		Desorber Chamber No 2 (500-V2)	Flammable	Liquid (156^{O}C @ 13.03barg)	Pressurized vessel	720
		Raffinate Column (500-V3)	Flammable	Liquid (148^{O}C @ 0.294barg)	Pressurized vessel	2,225
		Extract Column (500-V7)	Flammable	Liquid (146^{O}C @ 0.196barg)	Pressurized vessel	790
		Desorbent Rerun Column (500-V11)	Flammable	Liquid (204^{O}C @ 0.588barg)	Pressurized vessel	20
		Desorbent Storage Tank (500-TK1)	Flammable	Liquid (35^{O}C @ 0.001barg)	Tank	2,000
		Plant Inventory Storage Tank (500-TK2)	Flammable	Liquid (35^{O}C @ 0.001barg)	Tank	3,860
		Parex Sump Drum (500-V12)	Flammable	Liquid (40^{O}C @ 0.98barg)	Pressurized vessel	25
24	Methane UN ID: 1971	Stripper Receiver (130-V8)	Flammable	Vapour (46^{O}C @ 6.30barg)	Pressurized vessel	10

Table 3 – Pipeline Information

No.	Chemical	From	To	Pipe Diameter (inch)	Pipe Flowrate (MT/hr)
1	Condensate	Tank Farm	PEC Plant	32	2,000
2	FR Naphtha	Tank Farm	PEC Plant	20	800
3	Para Xylene	PEC Plant	Tank Farm	20	800
4	Benzene	PEC Plant	Tank Farm	14	400
5	Jet Kero	PEC Plant	Tank Farm	16	500
6	Diesel	PEC Plant	Tank Farm	20	800
7	Light Naphtha	PEC Plant	Tank Farm	16	400
8	C3 LPG	PEC Plant	Tank Farm	168	800
9	C4 LPG	PEC Plant	Tank Farm	10	150

No.	Chemical	From	To	Pipe Diameter (inch)	Pipe Flowrate (MT/hr)
10	LSFO	PEC Plant	Tank Farm	10	200

Table 4 – Nature and Application of PEC Products, Co-products and By-products

Primary Products
Benzene (Primary product): Benzene is an important basic chemical, as the base for many intermediates and polymers. It is the major raw material for the production of the following: • Cumene, from which phenol and bisphenol A, the precursors of epoxy resins and polycarbonates, are made; • Styrene, from which polystyrene is then made; and • Cyclohexane, the precursor of caprolactam and adipic acid, which in turn feed into nylon production. Benzene derived products are themselves raw materials for a vast range of everyday items such as clothing, packaging, paints, adhesives, unbreakable windows, plywood, computer casings, compact discs and many more. Benzene has the chemical formula C_6H_6. It is a clear, colourless, volatile liquid, with a characteristic "aromatic" odour; benzene is highly flammable, vapour/air mixtures are explosive and carcinogenic to humans. Benzene is also very toxic to aquatic organisms.
Para-xylene (Primary product): Paraxylene is an aromatic chemical. It is used as a plasticizer, chemical intermediate and polyester intermediate. Paraxylene is used for polyester fibres for clothing and fabrics, PET soft drink bottles and films for audio and video tapes. Paraxylene is a colourless liquid and has a characteristic odour. Paraxylene is flammable, harmful to humans and toxic to aquatic organisms.
Co-products
Jet Fuel (Co-product): Jet fuel is a mixture of large number of hydrocarbons (usually C_8 – C_{16}) and is clear to straw coloured liquid and has fuel oil odour. It is highly flammable and may have some 1% aromatics including BTX (benzene, toluene, and xylene). Jet fuel does not gel at low temperature, hence it is primarily used as aviation fuel.
Diesel (Co-product): It is colourless to yellow-brown saturated hydrocarbon liquid (C_{10}-C_{16}) which has a mild petroleum odour. Diesel may contain many traces elements which are corrosive to aircraft turbines; hence diesel is primarily used as a fuel for on-land vehicles. Diesel is flammable and gives off irritating and toxic fumes/ particulates. It is harmful to aquatic organisms.
C3 and C4 LPG (Co-products): Liquefied Petroleum Gas (LPG) is a mixture of hydrocarbon gases; C3 (propane) and C4 (butane and iso-butane). LPG is extremely flammable/ explosive and is used as fuel in heating appliances and vehicles, and increasingly replaces chlorofluorocarbons as an aerosol propellant. Pressurised LPG containers that are subjected to fire of sufficient duration and intensity can undergo a boiling liquid expanding vapour explosion (BLEVE).
Fuel Oil (Co-product): Fuel oil is another fraction obtained from petroleum distillation/ refining, as with Jet fuel or Diesel, either as a distillate or a residue. It is made of longer hydrocarbon chains, particularly alkanes, cycloalkanes, and aromatics. It has an oil type odour and is black in colour. It is flammable and primarily used as a fuel in various industrial, marine, off-road vehicle and home heating applications, where air regulations permit.
By-products
Light naphtha (By-product): Light naphtha is a hydrocarbon mixture consisting of straight-chained and cyclic aliphatic compounds, generally with 5 to 9 carbon atoms per molecule. Light Naphtha's boiling point ranges from 30-70^{o}C and it has a high paraffin content. It is mainly used as a petrochemical feedstock in olefins production (e.g. ethylene).
Hydrogen rich gas (By-product)*: Hydrogen gas is light, colourless, and a highly flammable/ explosive gas. As a strong reducing agent, hydrogen gas can reacts easily with other chemical substances. Large quantities of hydrogen are needed in the petroleum and chemical industries for hydrogenation reaction, hydrodealkylation, hydrodesulphurisation, and hydrocracking. It is also used in the production of plastics, polyester, and nylon.
Fuel Gas (By-product): Fuel gas is a mixture of hydrogen, methane (C1), ethane (C2), and propane (C3) gases, (typical composition H_2: 0.13 wt-% CH_4: 1.56 wt% C_2H_6: 58.57 wt% C3+: 39.74 wt-%). Fuel gas is flammable, non-toxic and is used as a combustion fuel.
Light Ends (C1-C5) (By-product): Light ends (except C5s) are gases at atmospheric pressure and temperature. These are used as fuel in various industrial operations as well as for heating. Light ends can be dangerous when heavier than air as they can settle in a flammable cloud on the ground or in hollows/ drains/ utility trenches etc.
Sulphur (By-product): The production of low sulphur fuels requires the treatment, or desulphurisation, of product oils and this is recovered as elemental sulphur by-product, a yellow solid powder. Almost 70% of world sulphur production originates from refineries. It can be used include in phosphate fertiliser and the chemicals industry, but as world production outstrips demand it is also disposed to landfill.
Note *: Typical component of Hydrogen rich gas:

3.3 Hazard Identification

Based on potential loss of containment (LoC) from the storage vessels and ancillary equipment and the process vessels and ancillary equipment, the major flammable hazards identified are releases of dodecane/diesel, hexane, butane, ethane, propane and hydrogen. The potential outcomes are a jet fire, pool fire, flash fire, vapour cloud explosion, fire ball. Toxic hazards identified are releases from hydrogen sulphide.

Leaks can range in size from a pinhole leak to a catastrophic failure. In general smaller leaks have higher accident likelihood but lower consequence distances. On the other hand larger releases have lower accident likelihood but longer consequence distance. The representative scenarios considered in this study are:

- Pipelines;
  - Small leak (10 mm);
  - Large leak (25 mm); and
  - Catastrophic failure (which is represented by inner diameter of the pipe).
- Pressurised Vessels;
  - Small leak (10 mm);
  - Large leak (50 mm);
  - Catastrophic failure; and
- Atmospheric Tanks;
  - Small leak (150 mm);
  - Large leak (500 mm); and
  - Catastrophic failure.

Table 5 presents the listing of the release scenarios and outcome events. *Appendix C* presents the release scenarios modelled (isolatable sections) for the PEC operations and the possible events from the respective release scenarios.

Table 5: Release Scenarios and Outcome Events

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
1	IS01_COND_PIPE_L	Release of condensate due to leak/catastrophic failure of condensate pipeline (stream 100) and associated fittings/pipings from condensate tank. An immediate and delay outcome of the released condensate will result in fire.	n-Octane	10 mm	4 inch		32 inch	1. 1,133m pipe; Ø0.81288m 2. Free spreading pool	-	Pool Fire
2	IS02_NAPHTHA_PIPE_L	Release of naphtha due to leak/catastrophic failure of naphtha pipeline (stream 500) and associated fittings/pipings from distillate unionfining process unit. An immediate and delay outcome of the released naphtha will result in fire.	n-Hexane	10 mm	25mm		2 inch	1. 132m pipe; Ø0.0508m 2. Free spreading pool	-	Pool Fire
3	IS03_PENTANE_CFSD_L	Release of pentane due to leak/catastrophic failure of pentane and associated fittings/pipings from condensate feed surge drum (100-V18). An immediate and delay outcome of the released pentane will result in fire.	Pentane	10 mm	50mm	Full vessel		1 pressure vessel, 1 valve, 1 pump	Area C1 - 28,600m^2	Pool Fire, Flash Fre, VCE
4	IS04_DODEC_DESALT_L	Release of dodecane due to leak/catastrophic failure of desalter (100-V9) and associated fittings/pipings. An immediate and delay outcome of the released dodecane will result in fire.	Dodecane	10 mm	50mm	Full vessel		1 pressure vessel, 5 valves		Pool Fire
5	IS05_PENTANE_FFR_L	Release of pentane due to leak/catastrophic failure of feed fractionator receiver (100-V5) and associated fittings/pipings. An immidiate and delay outcome of the released pentane will result in fire.	Pentane	10 mm	50mm	Full vessel		1 pressure vessel; 2 valves; 1 pump1; 1 heat exchanger		Jet Fire, Pool Fire, VCE, Flash Fire, BLEVE (Fireball)
6	IS06_LPG_FFTP_V	Release of LPG due to leak/catastrophic failure offailure of feed fractionator (100-V1) Top Part and associated fittings/pipings. An	LPG	10 mm	50mm	Full vessel		1 pressure vessel; 2 valves		Jet Fire, Flash Fire, VCE

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
		immediate and delay outcome of the released LPG will result in fire.								
7	IS06_DODEC_FFBP_L	Release of dodecane due to leak/catastrophic failure of feed fractionator (100-V1) Bottom Part and associated fittings/pipings. An immediate and delay outcome of the released dodecane will result in fire.	Dodecane	10 mm	50mm	Full vessel		1 pressure vessel; 2 valves		Pool Fire
8	IS07_PENTANE_FFRCO_L	Release of pentane due to leak/catastrophic failure of feed fractionator reflux coalescer (100-V10) and associated fittings/pipings. An immediate and delay outcome of the released pentane will result in fire.	Pentane	10 mm	50mm	Full vessel		1 pressure vessel; 3 valves		Jet Fire, Pool Fire, VCE, Flash Fire, BLEVE (Fireball)
9	IS08_BUTANE_STABTP_V	Release of butane due to leak/catastrophic failure of stabilizer (100-V4) Top Part and associated fittings/pipings. An immediate and delay outcome of the released butane will result in fire.	Butane	10 mm	50mm	Full vessel		1 pressure vessel		Jet Fire, Pool Fire, VCE, Flash Fire, BLEVE (Fireball)
10	IS08_PENTANE_STABBP_L	Release of pentane due to leak/catastrophic failure of stabilizer (100-V4) bottom part and associated fittings/pipings. An immediate and delay outcome of the released pentane will result in fire.	Pentane	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 1 pump; 1 valve		Jet Fire, Pool Fire, VCE, Flash Fire, BLEVE (Fireball)
11	IS09_BUTANE_STABREC_V	Release of butane due to leak/catastrophic failure of stabilizer receiver (100-V7) and associated fittings/pipings. An immediate and delay outcome of the released butane will result in fire.	Butane	10 mm	50mm	Full vessel		1 pressure vessel; 2 pumps; 3 valves; 1 heat exchanger		Jet Fire, Pool Fire, VCE, Flash Fire, BLEVE (Fireball)
12	IS10_KERO_DFTP_V	Release of kerosene due to leak/catastrophic failure of distillate fractionator (100-V2) and associated fittings/pipings. An immediate and	n-Nonane	10 mm	50mm	Full vessel		1 pressure vessel		Jet Fire, Flash Fire, VCE

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
		delay outcome of the released kerosene will result in fire.								
13	IS10_DODEC_DFBP_L	Release of dodecane due to leak/catastrophic failure ofdistillate fractionator (100-V2) and associated fittings/pipings. An immediate ignition of the released dodecane will result in fire.	Dodecane	10 mm	50mm	Full vessel		1 pressure vessel; 3 valves 3 heat exchangers; 1 pump		Pool Fire
14	IS11_KERO_DSTP_V	Release of kerosene due to leak/catastrophic failure of diesel stripper (100-V3) top part and associated fittings/pipings. An immidiate ignition of the released kerosene will result in fire.	n-Nonane	10 mm	50mm	Full vessel		1 pressure vessel		Jet Fire, Flash Fire, VCE
15	IS11_DODEC_DSBP_L	Release of dodecane due to leak/catastrophic failure of diesel stripper (100-V3) bottom part and associated fittings/pipings. An immidiate ignition of the released dodecane will result in fire.	Dodecane	10 mm	50mm	Full vessel		1 pressure vessel; 1 pump, 2 valves		Pool Fire
16	IS12_DODEC_DFR_L	Release of dodecane due to leak/catastrophic failure of distillate fractionator receiver (100-V6) and associated fittings/pipings. An immidiate and delay outcome of the released dodecane will result in fire.	Dodecane	10 mm	50mm	Full vessel		1 pressure vessel; 4 heat exchangers; 1 pump		Pool Fire
17	IS13_BUTANE_AMAB_V	Release of butanedue to leak/catastrophic failure of amine absorber (110-V8) and associated fittings/pipings. An immediate and delay outcome of the released butane will result in fire.	Butane	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Jet Fire, Flash Fire, VCE
18	IS14_BUTANE_EXPLUS_V	Release of butane due to leak/catastrophic failure of extractor plus (110-V1) and associated fittings/pipings. An immediate	Butane	10 mm	50mm	Full vessel		1 pressure vessel; 2 valves; 1 pump		Jet Fire, Flash Fire, VCE

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
		ignition of the released butane will result in fire.								
19	IS15_DODEC_SANDF_L	Release of dodecane due to leak/catastrophic failure of disulfide sand filter (110-V6) and associated fittings/pipings. An immediate and delay outcome of the released dodecane will result in fire.	Dodecane	10 mm	50mm	Full vessel		1 pressure vessel; 1 pump; 1 valve		Pool Fire
20	IS16_PROPANE_PIPELINE_L	Release of propane due to leak/catastrophic failure of LPG pipeline (stream 100) from CCR platforming process unit and associated fittings/pipings. An immediate and delay outcome of the released propane will result in fire.	Propane	10 mm	25 mm		3 inch	168m pipe (Ø0.0762m)		Pool Fire
22	IS18_BUTANE_PIPELINE_L	Release of butane due to leak/catastrophic failure of butane pipeline to storage (stream 220) and associated fittings/pipings. An immediate ignition of the released butane will result in fire.	Butane	10 mm	25 mm		4 inch	776m pipe (Ø0.1016m)		Pool Fire
23	IS19_ETHANE_DETP_V	Release of ethane due to leak/catastrophic failure of deethanizer (115-V1) top part and associated fittings/pipings. An immediate ignition of the released ethane will result in fire.	Ethane	10 mm	50mm	Full vessel		1 pressure vessel	Area C1 - 28,600m2	Jet Fire, Flash Fire, VCE
24	IS19_BUTANE_DEBP_L	Release of butane due to leak/catastrophic failure of deethanizer (115-V1) bottom part and associated fittings/pipings. An immediate ignition of the released butane will result in fire.	Butane	10 mm	50mm	Full vessel		1 pressure vessel; 2 valves; 1 heat exchanger		Pool Fire
25	IS20_ETHANE_DERTP_V	Release of ethane due to leak/catastrophic failure of deethanizer receiver top part (115-V2) and associated fittings/pipings. An	Ethane	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 1 valve		Jet Fire, Flash Fire, VCE

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
		immediate ignition of the released ethane will result in fire.								
27	IS21_PROPANE_SPLITTP_V	Release of propane due to leak/catastrophic failure of C3/C4 splitter top part (115-V3) and associated fittings/pipings. An immediate ignition of the released propane will result in fire.	Propane	10 mm	50mm	Full vessel		1 pressure vessel		Jet Fire, Flash Fire, VCE
28	IS21_BUTANE_SPLITBP_L	Release of butane due to leak/catastrophic failure of dC3/C4 splitter bottom part (115-V3) and associated fittings/pipings. An immediate ignition of the released butane will result in fire.	Butane	10 mm	50mm	Full vessel		1 pressure vessel, 2 valves; 1 heat exchanger		Pool Fire
29	IS22_PROPANE_SPLITR_L	Release of propane due to leak/catastrophic failure of C3/C4 splitter receiver (115-V4) and associated fittings/pipings. An immediate ignition of the released propane will result in fire.	Propane	10 mm	50mm	Full vessel		1 pressure vessel, 3 valves; 1 pump, 2 heat exchangers		Pool Fire
30	IS23_PROPANE_PIPELINE_L	Release of propane due to leak/catastrophic failure of C3 LPG pipeline to storage (stream 214) and associated fittings/pipings. An immediate ignition of the released propane will result in fire.	Propane	10 mm	25 mm		3 inch	664m pipe (Ø0.0762m)		Pool Fire
31	IS24_KERO_COALES_L	Release of kerosene due to leak/catastrophic failure of coalescer (120-V1) and associated fittings/pipings. An immediate ignition of the released kerosene will result in fire.	n-Nonane	10 mm	50mm	Full vessel		1 pressure vessel; 5 valves	Area C1 - 28,600m2	Pool Fire
32	IS25_KERO_ECPW_L	Release of kerosene due to leak/catastrophic failure of electrostatic coalescer prewash (120-V2) and associated fittings/pipings. An	n-Nonane	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Pool Fire

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
		immediate ignition of the released kerosene will result in fire.								
33	IS26_KERO_REAC_L	Release of kerosene due to leak/catastrophic failure of reactor (120-R1) and associated fittings/pipings. An immediate ignition of the released kerosene will result in fire.	n-Nonane	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Pool Fire
34	IS27_KERO_CAUSET_L	Release of kerosene due to leak/catastrophic failure of caustic settler (120-V3) and associated fittings/pipings. An immediate ignition of the released kerosene will result in fire.	n-Nonane	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Pool Fire
35	IS28_KERO_WWASH_L	Release of kerosene due to leak/catastrophic failure of water wash (120-V4) and associated fittings/pipings. An immediate ignition of the released kerosene will result in fire.	n-Nonane	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Pool Fire
36	IS29_KERO_SANDFIL_L	Release of kerosene due to leak/catastrophic failure of sand filter (120-V5A/B) and associated fittings/pipings. An immediate ignition of the released kerosene will result in fire.	n-Nonane	10 mm	50mm	Full vessel		2 pressure vessels; 5 valves		Pool Fire
37	IS30_KERO_CLAYFIL_L	Release of kerosene due to leak/catastrophic failure of clay filter (120-V6A/B) and associated fittings/pipings. An immediate ignition of the released kerosene will result in fire.	n-Nonane	10 mm	50mm	Full vessel		2 pressure vessels; 7 valves		Pool Fire
38	IS31_KERO_PIPELINE_L	Release of kerosene due to leak/catastrophic failure of kerosene pipeline (stream 38) and associated fittings/pipings. An immediate	n-Nonane	10 mm	2 inch		6 inch	146m pipe (Ø0.1524m)		Pool Fire

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
		ignition of the released kerosene will result in fire.								
39	IS32_DODEC_FEEDCO_L	Release of dodecane due to leak/catastrophic failure of feed coalescer (130-ME1) and associated fittings/pipings. An immediate ignition of the released dodecane will result in fire.	Dodecane	10 mm	50mm	Full vessel		1 pressure vessel; 3 valves	Area C2 - 25,800m^2	Pool Fire
40	IS33_DODEC_PIPELINE_L	Release of dodecane due to leak/catastrophic failure of diesel pipeline from condesate fractionation unit (stream 101) and associated fittings/pipings. An immediate ignition of the released dodecane will result in fire.	Dodecane	10 mm	2 inch		6 inch	282m pipe (Ø0.1524m)		Pool Fire
41	IS34_DODEC_FSD_L	Release of dodecane due to leak/catastrophic failure of feed surge drum (130-V1) and associated fittings/pipings. An immediate ignition of the released dodecane will result in fire.	Dodecane	10 mm	50mm	Full vessel		1 pressure vessel; 2 pumps; 1 valve	Area C2 - 25,800m2	Pool Fire
42	IS35_H2_REAC1_V	Release of hydrogen due to leak/catastrophic failure of reactor 1 (130-R1) and associated fittings/pipings. An immidiate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 3 heat exchanger; 3 valve		Jet Fire, Flash Fire, VCE
43	IS36_H2_REAC2TP_V	Release of hydrogen due to leak/catastrophic failure of reactor 2 (130-R2) top part and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Jet Fire, Flash Fire, VCE
45	IS37_H2_SEPTP_V	Release of hydrogen due to leak/catastrophic failure of separator (130-V3) top part and associated fittings/pipings. An immediate and	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 2 valves		Jet Fire, Flash Fire, VCE

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
		delay outcome of the released hydrogen will result in fire.								
47	IS38_H2_FDTP_V	Release of hydrogen due to leak/catastrophic failure of flash drum (130-V4) top part and associated fittings/pipings. An immediate and delay outcome of the released hydrogen sulfide will result in fire	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 2 valves;		Jet Fire, Flash Fire, VCE
49	IS39_H2_RGCSD_V	Release of hydrogen due to leak/catastrophic failure of recycle gas compressor suction drum (130-V5) bottom part and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 2 compressor, 1 heat exchanger; 1 valve		Jet Fire, Flash Fire, VCE
50	IS40_H2_PIPELINE_V	Release of hydrogen due to leak/catastrophic failure of make up gas pipeline from platforming unit (stream 501) and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	25 mm		3 inch	230m pipe (Ø0.0762m)		Jet Fire, Flash Fire, VCE
51	IS41_H2_MGCSD_V	Release of hydrogen due to leak/catastrophic failure of make up gas compressors suction drum (130-V6) and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 2 compressors, 1 valve		Jet Fire, Flash Fire, VCE
52	IS42_H2_STRIPTP_V	Release of hydrogen due to leak/catastrophic failure of stripper (130-V7) top part and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Jet Fire, Flash Fire, VCE
53	IS42_DODEC_STRIPBP_L	Release of dodecane due to leak/catastrophic failure of stripper (130-V7) bottom part and associated	Dodecane	10 mm	50mm	Full vessel		1 pressure vessel; 2 heat		Pool Fire

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
		fittings/pipings. An immediate and delay outcome of the released dodecane will result in fire.						exchangers; 1 valve		
54	IS43_MET_SRTP_V	Release of methane due to leak/catastrophic failure of stripper receiver (130-V8) and associated fittings/pipings. An immediate and delay outcome of the released hydrogen sulfide will result in fire.	Methane	10 mm	50 mm			1 valve		Jet Fire, Flash Fire, VCE
55	IS43_NAPHTHA_SRBP_L	Release of naphtha due to leak/catastrophic failure of stripper receiver (130-V8) and associated fittings/pipings. An immediate and delay outcome of the released of naphtha will result in fire.	n-Hexane	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 2 valves		Pool Fire
56	IS44_DODEC_VACDRY_L	Release of dodecane due to leak/catastrophic failure of vacuum dryer (130-V9) and associated fittings/pipings. An immediate and delay outcome of the released dodecane will result in fire.	Dodecane	10 mm	50mm	Full vessel		1 pressure vessel; 3 heat exchangers; 1 pump; 3 valves		Pool Fire
57	IS45_DIESEL_PIPELINE_L	Release of diesel due to leak/catastrophic failure of diesel product pipeline to storage (stream 739) and associated fittings/pipings. An immediate and delay outcome of the released diesel will result in fire.	Diesel	10 mm	2 inch		6 inch	780m pipe (Ø0.1524m)		Pool Fire
59	IS47_H2_PIPELINE_V	Release of hydrogen due to leak/catastrophic failure of off gas pipeline from naphtha hydritreating unit (stream 741) and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	25 mm		4 inch	401m pipe (Ø0.1016m)		Jet Fire, Flash Fire, VCE
60	IS48_H2_OGA_V	Release of hydrogen due to leak/catastrophic failure of off gas absorber/knock out drum (130-V11) and associated fittings/pipings. An	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 1 valve	Area C2 - 25,800m2	Jet Fire, Flash Fire, VCE

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
		immediate and delay outcome of the released hydrogen will result in fire.								
61	IS49_H2_TOGKD_V	Release of hydrogen due to leak/catastrophic failure of treated off gas knock out drum (130-V12) and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 2 valves		Jet Fire, Flash Fire, VCE
62	IS50_H2_RETP_V	Release of hydrogen due to leak/catastrophic failure of reactor top part (200-R1) and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 3 heat exchangers; 1 valve	Area R1 - 31,800m2	Jet Fire, Flash Fire, VCE
63	IS50_NAPHTHA_REBP_L	Release of naphtha due to leak/catastrophic failure of reactor bottom part (200-R1) and associated fittings/pipings. An immediate and delay outcome of the released naphtha will result in fire.	n-Hexane	10 mm	50mm	Full vessel		1 pressure vessel; 3 heat exchangers; 1 valve		Pool Fire
64	IS51_H2_SEPTP_V	Release of hydrogen due to leak/catastrophic failure of separator top part (200-V3) and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel		Jet Fire, Flash Fire, VCE
65	IS51_HEAVY NAPHTHA_SEPBP_L	Release of x due to leak/catastrophic failure of separator bottom part (200-V3) and associated fittings/pipings. An immediate and delay outcome of the released x will result in fire.	n-Hexane	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Pool Fire
66	IS52_H2_RCSD_V	Release of hydrogen due to leak/catastrophic failure of recycle compressor suction drum (200-V4) and associated fittings/pipings. An	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve; 1 compressor		Jet Fire, Flash Fire, VCE

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
		immediate and delay outcome of the released hydrogen will result in fire.								
67	IS53_BUT_STRITP_V	Release of butane due to leak/catastrophic failure of stripper top part (200-V5) and associated fittings/pipings. An immediate and delay outcome of the released hydrogen sulfide will result in fire	Butane	10 mm	50mm	Full vessel		1 pressure vessel		Jet Fire, Flash Fire, VCE
68	IS53_PENTANE_STRIBP_L	Release of pentane due to leak/catastrophic failure of stripper bottom part (200-V5) and associated fittings/pipings. An immediate and delay outcome of the released pentane will result in fire.	Pentane	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 2 pumps; 1 valve		Pool Fire
69	IS54_BUTANE_STRTP_V	Release of butane due to leak/catastrophic failure of stripper receiver top part (200-V6) and associated fittings/pipings. An immediate and delay outcome of the released butane will result in fire.	Butane	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Jet Fire, Flash Fire, VCE
70	IS54_PENTANE_STRBP_L	Release of pentane due to leak/catastrophic failure of stripper receiver bottom part (200-V6) and associated fittings/pipings. An immediate and delay outcome of the released pentane will result in fire.	Pentane	10 mm	50mm	Full vessel		1 pressure vessel; 2 heat exchangers; 2 valves		Pool Fire
71	IS55_LIGHT NAPHTHA_NASTP_V	Release of x due to leak/catastrophic failure of naphtha splitter top part (200-V7) and associated fittings/pipings. An immediate and delay outcome of the released x will result in fire.	n-Hexane	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Jet Fire, Flash Fire, VCE
72	IS55_PENTANE_NASBP_L	Release of pentane due to leak/catastrophic failure of naphtha splitter bottom part (200-V7) and associated fittings/pipings. An	Pentane	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 2 pumps; 1 valve		Pool Fire

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
		immediate and delay outcome of the released pentane will result in fire.								
73	IS56_PENTANE_NASR_L	Release of pentane due to leak/catastrophic failure of naphtha splitter receiver (200-V8) and associated fittings/pipings. An immediate and delay outcome of the released pentane will result in fire.	Pentane	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 2 pumps; 3 valves		Pool Fire
74	IS57_PENTANE_DEPTP_V	Release of x due to leak/catastrophic failure of depentanizer top part (200-V9) and associated fittings/pipings. An immediate and delay outcome of the released x will result in fire.	Pentane	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Jet Fire, Flash Fire, VCE
76	IS58_PENTANE_DEPR_L	Release of pentane due to leak/catastrophic failure of depentanizer receiver (200-V10) and associated fittings/pipings. An immediate and delay outcome of the released pentane will result in fire.	Pentane	10 mm	50mm	Full vessel		1 pressure vessel; 2 heat exchangers; 2 pumps; 1 valve		Pool Fire
77	IS59_PENTANE_ADSORB_L	Release of pentane due to leak/catastrophic failure of adsorber (230-V1A/B) and associated fittings/pipings. An immediate and delay outcome of the released pentane will result in fire.	Pentane	10 mm	50mm	Full vessel		2 pressure vessels; 2 heat exchangers; 2 valves		Pool Fire
78	IS60_H2_REAC1_V	Release of hydrogen due to leak/catastrophic failure of Reactor 1 (300-R1) and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 2 valves		Jet Fire, Flash Fire, VCE
79	IS61_H2_REAC2_V	Release of hydrogen due to leak/catastrophic failure of Reactor 2 (300-R2) and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Jet Fire, Flash Fire, VCE

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
80	IS62_H2_REAC3_V	Release of hydrogen due to leak/catastrophic failure of Reactor 3 (300-R3) and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Jet Fire, Flash Fire, VCE
81	IS63_H2_REAC4_V	Release of hydrogen due to leak/catastrophic failure of Reactor 4 (300-R4) and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 1 valve		Jet Fire, Flash Fire, VCE
82	IS64_H2_SEPTP_V	Release of hydrogen due to leak/catastrophic failure of separator (300-V1) top part and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 1 compressor; 2 valves		Jet Fire, Flash Fire, VCE
83	IS64_HEAVY NAPHTHA_SEPBP_L	Release of x due to leak/catastrophic failure of separator (300-V1) bottom part and associated fittings/pipings. An immediate and delay outcome of the released x will result in fire.	n-Hexane	10 mm	50mm	Full vessel		1 pressure vessel; 2 heat exchangers; 2 pumps; 1 valve		Pool Fire
84	IS65_H2_NGSDTP_V	Release of hydrogen due to leak/catastrophic failure of net gas suction drum top part (300-V2) and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 1 compressor; 1 valve		Jet Fire, Flash Fire, VCE
85	IS65_BENZENE_NGSDBP_L	Release of benzene due to leak/catastrophic failure of separator net gas suction drum bottom part (300-V2) and associated fittings/pipings. An immediate and delay outcome of the released benzene will result in fire	Benzene	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Pool Fire

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
86	IS66_H2_RD1TP_V	Release of hydrogen due to leak/catastrophic failure of recontact drum no 1 top part (300-V3) and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 1 compressor; 2 valves		Jet Fire, Flash Fire, VCE
87	IS66_BENZENE_RD1BP_L	Release of benzene due to leak/catastrophic failure of recontact drum no 1 bottom part (300-V3) and associated fittings/pipings. An immediate and delay outcome of the released benzene will result in fire	Benzene	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Jet Fire, Flash Fire, VCE
88	IS67_H2_RD2TP_V	Release of hydrogen due to leak/catastrophic failure of recontact drum no 2 top part (300-V4) and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 1 valve		Jet Fire, Flash Fire, VCE
89	IS67_BENZENE_RD2BP_L	Release of benzene due to leak/catastrophic failure of recontact drum no 2 bottom part (300-V4) and associated fittings/pipings. An immediate and delay outcome of the released benzene will result in fire	Benzene	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Pool Fire
90	IS68_H2_NGCT_V	Release of hydrogen due to leak/catastrophic failure of net gas chloride treaters (300-V5A/B) and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	50mm	Full vessel		2 pressure vessels; 5 valves		Jet Fire, Flash Fire, VCE
91	IS69_BUTANE_DBTP_V	Release of x due to leak/catastrophic failure of debutanizer top part (300-V6) and associated fittings/pipings. An immediate and delay outcome of the released x will result in fire.	Butane	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Jet Fire, Flash Fire, VCE
92	IS69_TOLUENE_DBBP_L	Release of toluene due to leak/catastrophic failure of debutanizer bottom part (300-V6) and	Toluene	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve;		Pool Fire

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
		associated fittings/pipings. An immediate and delay outcome of the released toluene will result in fire.						1 heat exchanger		
93	IS70_BUTANE_DBRTP_V	Release of butane due to leak/catastrophic failure of debutanizer receiver top part (300-V7) and associated fittings/pipings. An immediate and delay outcome of the released butane will result in fire.	Butane	10 mm	50mm	Full vessel		1 pressure vessel; 3 heat exchangers; 1 valve		Jet Fire, Flash Fire, VCE
94	IS70_PENTANE_DBRBP_L	Release of pentane due to leak/catastrophic failure of debutanizer receiver bottom part (300-V7) and associated fittings/pipings. An immediate and delay outcome of the released pentane will result in fire.	Pentane	10 mm	50mm	Full vessel		1 pressure vessel; 2 pumps; 2 valves		Pool Fire
95	IS71_BUTANE_LPGCT_L	Release of butane due to leak/catastrophic failure of LPG chloride treaters (300-V8A/B) and associated fittings/pipings. An immediate and delay outcome of the released butane will result in fire.	Butane	10 mm	50mm	Full vessel		2 pressure vessels; 6 valves		Pool Fire
96	IS72_H2_REAC_V	Release of hydrogen due to leak/catastrophic failure of reactor (320-R1) and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 2 valves; 2 heat exchangers	Area A3 - 7,500m2	Jet Fire, Flash Fire, VCE
97	IS73_H2_SEPTP_V	Release of hydrogen due to leak/catastrophic failure of separator top part (320-V1) and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 1 compressor; 1 valve		Jet Fire, Flash Fire, VCE
98	IS73_XYLENE_SEPBP_L	Release of x due to leak/catastrophic failure of separator bottom part (320-V1) and associated fittings/pipings. An	m-xylene	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve; 1 heat exchanger		Pool Fire

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
		immediate and delay outcome of the released x will result in fire.								
99	IS74_XYLENE_PIPELINE_L	Release of x due to leak/catastrophic failure of feed pipeline from raffinate side cut surge drum in parex process unit (stream 108) and associated fittings/pipings. An immediate and delay outcome of the released x will result in fire.	m-xylene	10 mm	3.3 inch		10 inch	410m pipe (Ø0.254m)		Pool Fire
100	IS75_ETHANE_DHTP_V	Release of ethane due to leak/catastrophic failure of deheptanizer top part (320-V2) and associated fittings/pipings. An immediate and delay outcome of the released ethane will result in fire.	Ethane	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve	Area A3 - 7,500m2	Jet Fire, Flash Fire, VCE
101	IS75_XYLENE_DHBP_L	Release of xylene due to leak/catastrophic failure of deheptanizer bottom part (320-V2) and associated fittings/pipings. An immediate and delay outcome of the released xylene will result in fire.	Xylene	10 mm	50mm	Full vessel		1 pressure vessel; 1 pump; 1 valve		Pool Fire
102	IS76_ETHANE_DHRTP_V	Release of ethane due to leak/catastrophic failure of deheptanizer receiver top part (320-V3) and associated fittings/pipings. An immediate and delay outcome of the released ethane will result in fire.	Ethane	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Jet Fire, Flash Fire, VCE
103	IS76_BENZENE_DHRBP_L	Release of benzene due to leak/catastrophic failure of deheptanizer receiver bottom part (320-V3) and associated fittings/pipings. An immediate and delay outcome of the released benzene will result in fire	Benzene	10 mm	50mm	Full vessel		1 pressure vessel; 1 pump; 1 heat exchanger; 1 valve		Jet Fire, Flash Fire, VCE
104	IS77_ETHANE_DHVDTP_V	Release of ethane due to leak/catastrophic failure of deheptanizer vent drum top part	Ethane	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Jet Fire, Flash Fire, VCE

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
		(320-V4) and associated fittings/pipings. An immediate and delay outcome of the released ethane will result in fire.								
105	IS77_BENZENE_DHVDBP_L	Release of benzene due to leak/catastrophic failure of deheptanizer vent drum bottom part (320-V4) and associated fittings/pipings. An immediate and delay outcome of the released benzene will result in fire.	Benzene	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 1 valve		Jet Fire, Flash Fire, VCE
106	IS78_BENZENE_PIPELINE_L	Release of benzene due to leak/catastrophic failure of benzene pipeline from stripper overhead at tatoray process unit (stream 602) and associated fittings/pipings. An immediate and delay outcome of the released benzene will result in fire.	Benzene	10 mm	2.6 inch		8 inch	330m pipe (Ø0.2032m)		Jet Fire, Flash Fire, VCE
107	IS79_TOLUENE_PIPELINE_L	Release of toluene due to leak/catastrophic failure of toluene pipeline from reactor outlet at olefin reduction process unit (stream 601) and associated fittings/pipings. An immediate and delay outcome of the released toluene will result in fire.	Toluene	10 mm	2 inch		6 inch	260m pipe (Ø0.1524m)		Pool Fire
108	IS80_BUTANE_DBTP_V	Release of butane due to leak/catastrophic failure of debutanizer top part (320-V5) and associated fittings/pipings. An immediate and delay outcome of the released butane will result in fire.	Butane	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve	Area A3 - 7,500m2	Jet Fire, Flash Fire, VCE
109	IS80_TOLUENE_DBBP_L	Release of toluene due to leak/catastrophic failure of debutanizer bottom part (320-V5) and associated fittings/pipings. An immediate and delay outcome of the released toluene will result in fire.	Toluene	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 1 valve		Pool Fire

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
110	IS81_BUTANE_DBRTP_V	Release of butane due to leak/catastrophic failure of debutanizer receiver top part (320-V6) and associated fittings/pipings. An immediate and delay outcome of the released butane will result in fire.	Butane	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Jet Fire, Flash Fire, VCE
111	IS81_PENTANE_DBRBP_L	Release of pentane due to leak/catastrophic failure of debutanizer receiver bottom part (320-V6) and associated fittings/pipings. An immediate and delay outcome of the released pentane will result in fire.	Pentane	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 1 pump; 1 valve		Pool Fire
112	IS82_TOLUENE_PIPELINE_L	Release of toluene due to leak/catastrophic failure of reformate splitter overhead (toluene pipeline) from xylene fractionation unit (stream 104) and associated fittings/pipings. An immediate and delay outcome of the released toluene will result in fire.	Toluene	10 mm	4 inch		12 inch	560m pipe (Ø0.3048m)		Pool Fire
113	IS83_H2_PIPELINE_V	Release of hyrogen due to leak/catastrophic failure of make up hydrogen pipeline (stream 180) from CCR platforming process unit An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	4 inch		12 inch	170m pipe (Ø0.3048m)		Jet Fire, Flash Fire, VCE
114	IS84_TOLUENE_REAC12_L	Release of toluene due to leak/catastrophic failure of reactor 1/2 (322-R1/R2) and associated fittings/pipings. An immediate and delay outcome of the released toluene will result in fire.	Toluene	10 mm	50mm	Full vessel		2 pressure vessels; 1 heat exchanger; 5 valves	Area A3 - 7,500m2	Pool Fire
115	IS85_TMBZ_PIPELINE_L	Release of trimethylbenzene (TMBZ) due to leak/catastrophic failure of C9+ aromatics (TMBZ pipeline) (stream 102) from xylenes fractionation unit and associated fittings/pipings. An	TMBZ	10 mm	2 inch		6 inch	260m pipe (Ø0.1524m)		Jet Fire, Flash Fire, VCE

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
		immediate and delay outcome of the released TMBZ will result in fire								
116	IS86_TOLUENE_PIPELINE_L	Release of toluene due to leak/catastrophic failure of toluene pipeline (stream 101) from benzene-toluene fractionation unit and associated fittings/pipings. An immediate and delay outcome of the released toluene will result in fire.	Toluene	10 mm	3.3 inch		10 inch	110m pipe (Ø0.254m)		Pool Fire
117	IS87_TOLUENE_FSD_L	Release of toluene due to leak/catastrophic failure of feed surge drum (380-V1) and associated fittings/pipings. An immediate and delay outcome of the released toluene will result in fire.	Toluene	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 2 valves; 1 pump	Area A1 - 24,800 m2	Pool Fire
118	IS88_H2_REAC_V	Release of hydrogen due to leak/catastrophic failure of reactor (380-R1) and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 2 heat exchangers; 1 valve		Jet Fire, Flash Fire, VCE
119	IS89_H2_PIPELINE_V	Release of hydrogen due to leak/catastrophic failure ofmake up hydrogen pipeline from PSA unit (stream 180) associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	2.6 inch		8 inch	408m pipe (Ø0.2032m)		Jet Fire, Flash Fire, VCE
120	IS90_H2_SEPTP_V	Release of hydrogen due to leak/catastrophic failure of separator (380-V2) top part and associated fittings/pipings. An immediate and delay outcome of the released hydrogen will result in fire.	Hydrogen	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve	Area A1 - 24,800 m2	Jet Fire, Flash Fire, VCE

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
121	IS90_AROMATICS_SEPBP_L	Release of x due to leak/catastrophic failure of separator (380-V2) bottom part and associated fittings/pipings. An immediate and delay outcome of the released x will result in fire.	n-Octane	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 1 valve		Pool Fire
122	IS91_HEXANE_STP_V	Release of X due to leak/catastrophic failure of stripper (380-V3) top part and associated fittings/pipings. An immediate and delay outcome of the released X will result in fire.	Hexane	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Jet Fire, Flash Fire, VCE
123	IS91_TOLUENE_SBP_L	Release of toluene due to leak/catastrophic failure of stripper (380-V3) bottom part and associated fittings/pipings. An immediate and delay outcome of the released toluenewill result in fire.	Toluene	10 mm	50mm	Full vessel		1 pressure vessel; 2 heat exchangers; 1 valve		Pool Fire
124	IS92_ETHANE_SRTP_V	Release of ethane due to leak/catastrophic failure of stripper condenser (380-V4) top part and associated fittings/pipings. An immediate and delay outcome of the released ethane will result in fire.	Ethane	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Jet Fire, Flash Fire, VCE
125	IS92_BENZENE_SRBP_L	Release of benzene due to leak/catastrophic failure of stripper condenser (380-V4) bottom part and associated fittings/pipings. An immediate and delay outcome of the released benzene will result in fire.	Benzene	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 2 pumps; 1 valve		Jet Fire, Flash Fire, VCE
126	IS93_BUTANE_RSTP_V	Release of butane due to leak/catastrophic failure of reformate splitter (431-V1) top part and associated fittings/pipings. An immediate and delay outcome of the released butane will result in fire.	Butane	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve	Area A2 - 17,500m2	Jet Fire, Flash Fire, VCE
127	IS93_TOLUENE_RSBP_L	Release of toluene due to leak/catastrophic failure of reformate splitter (431-V1) bottom part and associated fittings/pipings. An	Toluene	10 mm	50mm	Full vessel		1 pressure vessel; 2 pumps; 3 valves		Pool Fire

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
		immediate and delay outcome of the released toluene will result in fire.								
128	IS94_TOLUENE_RSR_L	Release of toluene due to leak/catastrophic failure of reformate splitter receiver (431-V2) and associated fittings/pipings. An immediate and delay outcome of the released toluene will result in fire.	Toluene	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger, 2 pumps; 3 valves		Pool Fire
129	IS95_XYLENE_CT_L	Release of xylene due to leak/catastrophic failure of clay treaters (431-V3A/B) and associated fittings/pipings. An immediate and delay outcome of the released xylene will result in fire.	Xylene	10 mm	50mm	Full vessel		2 pressure vessels; 4 valves		Pool Fire
130	IS96_XYLENE_PIPELINE_L	Release of xylene due to leak/catastrophic failure of xylene pipeline (deheptanizer bottoms) (stream 203) from isomar process unit and associated fittings/pipings. An immediate and delay outcome of the released xylene will result in fire.	Xylene	10 mm	3.3 inch		10 inch	100m pipe (Ø0.254m)		Pool Fire
131	IS97_XYLENE_XSTP_V	Release of x due to leak/catastrophic failure of xylene splitter (431-V4) top part and associated fittings/pipings. An immediate and delay outcome of the released x will result in fire.	Xylene	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve	Area A2 - 17,500m2	Jet Fire, Flash Fire, VCE
132	IS97_XYLENE_XSBP_L	Release of xylene due to leak/catastrophic failure of xylene splitter (431-V4) bottom part and associated fittings/pipings. An immediate and delay outcome of the released xylene will result in fire.	Xylene	10 mm	50mm	Full vessel		1 pressure vessel; 3 pumps; 1 valve		Pool Fire
133	IS98_PENTANE_KOD_L	Release of pentane due to leak/catastrophic failure of C5 gas knockout drum (431-V14) and associated fittings/pipings. An	Pentane	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 3 valves		Pool Fire

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
		immediate and delay outcome of the released pentane will result in fire.								
134	IS99_XYLENE_XSR_L	Release of xylene due to leak/catastrophic failure of xylene splitter receiver (431-V6) bottom part and associated fittings/pipings. An immediate and delay outcome of the released xylene will result in fire.	Xylene	10 mm	50mm	Full vessel		1 pressure vessel; 2 pumps; 1 valve		Pool Fire
135	IS100_XYLENE_PFSD_L	Release of xylene due to leak/catastrophic failure of parex feed surge drum (431-V7) and associated fittings/pipings. An immediate and delay outcome of the released xylene will result in fire.	Xylene	10 mm	50mm	Full vessel		19 pressure vessel; 1 valve		Pool Fire
144	IS107_TMBZ_PIPELINE_L	Release of trimethylbenzene (TMBZ) due to leak/catastrophic failure of TMBZ pipeline (stream 425) to tatoray process unit and associated fittings/pipings. An immediate and delay outcome of the released TTMBZ will result in fire	TMBZ	10 mm	2 inch		6 inch	80m pipe (Ø0.1524m)		Jet Fire, Flash Fire, VCE
145	IS108_TMBZ_PIPELINE_L	Release of tetramethylbenzene (TTMBZ) due to leak/catastrophic failure of TTMBZ pipeline (stream 479) to heavy aromatics tank and associated fittings/pipings. An immediate and delay outcome of the released TTMBZ will result in fire	TTMBZ	10 mm	25 mm		2 inch	798m pipe (Ø0.0508m)		Jet Fire, Flash Fire, VCE
146	IS109_TOLUENE_PIPELINE_L	Release of toluene due to leak/catastrophic failure of toluene pipeline (stream 100) to 432-TK1 and associated fittings/pipings. An immediate and delay outcome of the released toluene will result in fire.	Toluene	10 mm	2 inch		6 inch	170m pipe (Ø0.1524m)		Pool Fire
147	IS110_TOLUENE_TANK_L	Release of toluene due to leak/catastrophic failure of toluene tank (432-TK1) and associated	Toluene	150 mm	500 mm	Full Vessel		1 tank; 2 pumps; 1 valve	Area A1 - 24,800 m2	Pool Fire

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
		fittings/pipings. An immediate and delay outcome of the released toluene will result in fire.								
148	IS111_TOLUENE_CT_L	Release of toluene due to leak/catastrophic failure of clay treaters (432-V1A/B) and associated fittings/pipings. An immediate and delay outcome of the released toluene will result in fire.	Toluene	10 mm	50mm	Full vessel		2 pressure vessel; 5 valves; 1 heat exchanger		Pool Fire
149	IS112_TOLUENE_PIPELINE_L	Release of toluene due to leak/catastrophic failure of toluene pipeline (stripper bottom) (stream 131) from tatoray unit and associated fittings/pipings. An immediate and delay outcome of the released toluene will result in fire.	Toluene	10 mm	2.6 inch		8 inch	500m pipe (Ø0.2032m)		Pool Fire
150	IS113_TOLUENE_PIPELINE_L	Release of toluene due to leak/catastrophic failure of toluene pipeline (finishing column overhead) (stream 140) from parex unit and associated fittings/pipings. An immediate and delay outcome of the released toluene will result in fire.	Toluene	10 mm	2 inch		6 inch	440m pipe (Ø0.1524m)		Pool Fire
151	IS114_BENZENE_BCTP_V	Release of benzene due to leak/catastrophic failure of benzene column (432-V2) top part and associated fittings/pipings. An immediate and delay outcome of the released benzene will result in fire	Benzene	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 2 pumps; 1 valve	Area A1 - 24,800 m2	Jet Fire, Flash Fire, VCE
152	IS114_TOLUENE_BCBP_L	Release of toluene due to leak/catastrophic failure of benzene column (432-V2) bottom part and associated fittings/pipings. An immediate and delay outcome of the released toluene will result in fire.	Toluene	10 mm	50mm	Full vessel		1 pressure vessel; 2 pumps; 2 valves		Pool Fire

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
153	IS115_BENZENE_BCR_L	Release of benzene due to leak/catastrophic failure of benzene column receiver (432-V3) and associated fittings/pipings. An immediate and delay outcome of the released benzene will result in fire	Benzene	10 mm	50mm	Full vessel		1 pressure vessel; 2 pumps; 1 valve; 1 heat exchanger		Jet Fire, Flash Fire, VCE
154	IS116_TOLUENE_TCTP_V	Release of toluene due to leak/catastrophic failure of toluene column (432-V4) top part and associated fittings/pipings. An immediate and delay outcome of the released toluene will result in fire.	Toluene	10 mm	50mm	Full vessel		1 pressure vessel		Jet Fire, Flash Fire, VCE
155	IS116_TOLUENE_TCBP_L	Release of toluene due to leak/catastrophic failure of toluene column (432-V4) bottom part and associated fittings/pipings. An immediate and delay outcome of the released toluene will result in fire.	Toluene	10 mm	50mm	Full vessel		1 pressure vessel; 2 pumps; 1 valve		Pool Fire
156	IS117_TOLUENE_TCR_L	Release of toluene due to leak/catastrophic failure of toluene column receiver (432-V5) and associated fittings/pipings. An immediate and delay outcome of the released toluene will result in fire.	Toluene	10 mm	50mm	Full vessel		1 pressure vessel; 2 pumps; 2 valves; 1 heat exchanger		Pool Fire
158	IS119_DEBZ_ADC1_L	Release of p-diethylbenzene (DEBZ) due to leak/catastrophic failure of adsorber chamber 1 (500-V1) and associated fittings/pipings. An immediate and delay outcome of the released DEBZ will result in fire	DEBZ	10 mm	50mm	Full vessel		1 pressure vessel; 4 valves; 2 pumps	Area A2 - 17,500m2	Jet Fire, Flash Fire, VCE
159	IS120_DEBZ_ADC2_L	Release of p-diethylbenzene (DEBZ) due to leak/catastrophic failure of adsorber chamber 2 (500-V2) and associated fittings/pipings. An immediate and delay outcome of the released DEBZ will result in fire	DEBZ	10 mm	50mm	Full vessel		1 pressure vessel; 4 valves; 2 pumps		Jet Fire, Flash Fire, VCE

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
160	IS121_XYLENE_RCTP_V	Release of xylene due to leak/catastrophic failure of raffinate column (500-V3) top part and associated fittings/pipings. An immediate and delay outcome of the released xylene will result in fire.	Xylene	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Jet Fire, Flash Fire, VCE
161	IS121_DEBZ_RCBP_L	Release of p-diethylbenzene (DEBZ) due to leak/catastrophic failure of raffinate column (500-V3) bottom part and associated fittings/pipings. An immediate and delay outcome of the released DEBZ will result in fire	DEBZ	10 mm	50mm	Full vessel		1 pressure vessel; 2 pumps; 1 heat exchanger; 1 valve		Jet Fire, Flash Fire, VCE
162	IS122_XYLENE_RCSCSD_L	Release of xylene due to leak/catastrophic failure of raffinate column side cut surge drum (500-V4) and associated fittings/pipings. An immediate and delay outcome of the released xylene will result in fire.	Xylene	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Pool Fire
163	IS123_XYLENE_RCR_L	Release of xylene due to leak/catastrophic failure of raffinate column receiver (500-V5) and associated fittings/pipings. An immediate and delay outcome of the released xylene will result in fire.	Xylene	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 2 pumps; 2 valves		Pool Fire
164	IS124_XYLENE_RCVD_L	Release of xylene due to leak/catastrophic failure of raffinate column vent drum (500-V6) and associated fittings/pipings. An immediate and delay outcome of the released xylene will result in fire.	Xylene	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 1 valve		Pool Fire
165	IS125_XYLENE_ECTP_V	Release of X due to leak/catastrophic failure of extract column (500-V7) top part and associated fittings/pipings. An immediate and delay outcome of the released X will result in fire.	Xylene	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Jet Fire, Flash Fire, VCE

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
166	IS125_DEBZ_ECBP_L	Release of p-diethylbenzene (DEBZ) due to leak/catastrophic failure of extract column (500-V7) bottom part and associated fittings/pipings. An immediate and delay outcome of the released DEBZ will result in fire.	DEBZ	10 mm	50mm	Full vessel		1 pressure vessel; 2 pumps; 1 heat exchanger; 2 valves		Jet Fire, Flash Fire, VCE
167	IS126_XYLENE_ECR_L	Release of xylene due to leak/catastrophic failure of extract column receiver (500-V8) and associated fittings/pipings. An immediate and delay outcome of the released xylene will result in fire.	Xylene	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve; 1 heat exchanger; 2 pumps		Pool Fire
168	IS127_TOLUENE_FCTP_V	Release of toluene due to leak/catastrophic failure of finishing column (500-V9) top part and associated fittings/pipings. An immediate and delay outcome of the released toluene will result in fire.	Toluene	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Jet Fire, Flash Fire, VCE
169	IS127_XYLENE_FCBP_L	Release of xylene due to leak/catastrophic failure of finishing column (500-V9) bottom part and associated fittings/pipings. An immediate and delay outcome of the released xylene will result in fire.	Xylene	10 mm	50mm	Full vessel		1 pressure vessel; 2 pumps; 2 heat exchangers; 1 valve		Pool Fire
170	IS128_TOLUENE_FCR_L	Release of toluene due to leak/catastrophic failure of finishing column receiver (500-V10) and associated fittings/pipings. An immediate and delay outcome of the released toluene will result in fire.	Toluene	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 2 pumps; 1 valve		Pool Fire
171	IS129_DEBZ_DRC_L	Release of p-diethylbenzene (DEBZ) due to leak/catastrophic failure of desorbent rerun column (500-V11) and associated fittings/pipings. An immediate and delay outcome of the released DEBZ will result in fire	DEBZ	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Jet Fire, Flash Fire, VCE

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
172	IS130_DEBZ_TANK_L	Release of p-diethylbenzene (DEBZ) due to leak/catastrophic failure of desorbent storage tank (500-TK1) and associated fittings/pipings. An immediate and delay outcome of the released DEBZ will result in fire.	DEBZ	150 mm	500 mm	Full Vessel		1 tank; 1 valve; 2 pumps		Jet Fire, Flash Fire, VCE
173	IS131_DEBZ_TANK_L	Release of p-diethylbenzene (DEBZ) due to leak/catastrophic failure of plant inventory storage tank (500-TK2) and associated fittings/pipings. An immediate and delay outcome of the released DEBZ will result in fire	DEBZ	150 mm	500 mm	Full Vessel		1 tank; 1 heat exchanger ; 2 pumps		Jet Fire, Flash Fire, VCE
174	IS132_PXYLENE_TANK_L	Release of paraxylene due to leak/catastrophic failure of paraxylene storage tank (500-TK3A/B) and associated fittings/pipings. An immediate and delay outcome of the released paraxylene will result in fire.	Paraxylene	150 mm	500 mm	Full Vessel		2 tanks; 2 pumps		Pool Fire
175	IS133_DEBZ_PSD_L	Release of p-diethylbenzene (DEBZ) due to leak/catastrophic failure of parex sump drum (500-V12) and associated fittings/pipings. An immediate and delay outcome of the released DEBZ will result in fire	DEBZ	10 mm	50mm	Full vessel		1 pressure vessel; 4 pumps; 1 heat exchanger; 1 valve		Jet Fire, Flash Fire, VCE
176	IS134_BENZENE_TANK_L	Release of benzene due to leak/catastrophic failure of sulfolane feed tank (541-TK1) and associated fittings/pipings. An immediate and delay outcome of the released benzene will result in fire	Benzene	150 mm	500 mm	Full Vessel		1 tank	Area A1 - 24,800 m2	Jet Fire, Flash Fire, VCE
177	IS135_HEXANE_EDCTP_V	Release of hexane due to leak/catastrophic failure of extractive distillation column (541-V1) top part and associated fittings/pipings. An immediate and delay outcome of the released hexane will result in fire.	Hexane	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Jet Fire, Flash Fire, VCE

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
178	IS135_SULFO_EDCBP_L	Release of sulfolane due to leak/catastrophic failure of extractive distillation column (541-V1) bottom part and associated fittings/pipings. An immediate and delay outcome of the released sulfolane will result in fire.	Sulfolane	10 mm	50mm	Full vessel		1 pressure vessel; 4 pumps; 1 heat exchanger; 3 valves		Pool Fire
179	IS136_HEXANE_EDCR_L	Release of hexane due to leak/catastrophic failure of extractive distillation column receiver (541-V2) and associated fittings/pipings. An immediate and delay outcome of the released hexane will result in fire.	Hexane	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 2 pumps; 1 valve		Pool Fire
180	IS137_BENZENE_PIPELINE_L	Release of benzene due to leak/catastrophic failure of benzene pipeline to storage (stream 136) and associated fittings/pipings. An immediate and delay outcome of the released benzene will result in fire	Benzene	10 mm	25 mm		4 inch	230m pipe (Ø0.1016m)		Jet Fire, Flash Fire, VCE
181	IS138_BENZENE_RCTP_V	Release of x due to leak/catastrophic failure of recovery column (541-V3) top part and associated fittings/pipings. An immediate and delay outcome of the released x will result in fire.	Benzene	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve	Area A1 - 24,800 m2	Jet Fire, Flash Fire, VCE
182	IS138_SULFO_RCBP_L	Release of sulfolane due to leak/catastrophic failure of recovery column (541-V3) bottom part and associated fittings/pipings. An immediate and delay outcome of the released sulfolane will result in fire.	Sulfolane	10 mm	50mm	Full vessel		1 pressure vessel; 2 pumps		Pool Fire
183	IS139_TOLUENE_RCR_L	Release of toluene due to leak/catastrophic failure of recovery column receiver (541-V4) and associated fittings/pipings. An immediate and delay outcome of the released toluene will result in fire.	Toluene	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 4 pumps; 2 valves)		Pool Fire

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
184	IS140_SULFO_SS_L	Release of sulfolane due to leak/catastrophic failure of sulfolane sump (541-V7) and associated fittings/pipings. An immediate and delay outcome of the released sulfolane will result in fire.	Sulfolane	10 mm	50mm	Full vessel		1 pressure vessel; 1 valve		Pool Fire
185	IS141_SULFO_TANK_L	Release of sulfolane due to leak/catastrophic failure of plant inventory tank (541-TK2) and associated fittings/pipings. An immediate and delay outcome of the released sulfolane will result in fire.	Sulfolane	10 mm	50mm	Full vessel		1 pressure vessel; 2 pumps; 1 heat exchanger; 2 valves		Pool Fire
188	IS144_H2S_ARR_V	Release of hydrogen sulfide due to leak/catastrophic failure of amine regenerator receiver (640-V3) and associated fittings/pipings. An immediate and delay outcome of the released hydrogen sulfide will result in toxic release.	Hydrogen Sulfide	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 1 valve	Area C2 - 25,800m^2	Jet Fire, Flash Fire, Explosion, Toxic Gas Dispersion
189	IS145_H2S_SWSR_V	Release of hydrogen sulfide due to leak/catastrophic failure of sour water stripper receiver (650-V3) and associated fittings/pipings. An immediate and delay outcome of the released hydrogen sulfide will result in toxic release.	Hydrogen Sulfide	10 mm	50mm	Full vessel		1 pressure vessel; 1 heat exchanger; 1 valve		Jet Fire, Flash Fire, Explosion, Toxic Gas Dispersion
190	IS146_COND_TANK_L	Release of condensate due to leak/catastrophic failure of condensate tanks (800-TK1A-C) and associated fittings/pipings. An immediate and delay outcome of the released condensate will result in fire.	n-Octane	150 mm	500 mm	Full Vessel		1. 3 tanks (ID: 46.59m, H: 24.38m) 2. bund size 25,550m2	Tank Farm Areas	Pool Fire
191	IS147_PXYLENE_TANK_L	Release of paraxylene due to leak/catastrophic failure of paraxylene tanks (810-TK1A-E) and associated fittings/pipings. An immediate and delay outcome of the released paraxylene will result in fire.	Paraxylene	150 mm	500 mm	Full Vessel		1. 5 tanks (ID: 31.06m, H: 16.45m) 2. Bund size 17,500m2		Pool Fire

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
192	IS148_BENZENE_TANK_L	Release of benzene due to leak/catastrophic failure of benzene tanks (812-TK1A-D) and associated fittings/pipings. An immediate and delay outcome of the releasedbenzene will result in fire	Benzene	150 mm	500 mm	Full Vessel		1. 4 tanks (ID: 26.21m, H: 15.24m) 2. Bund size 17,500m2		Jet Fire, Flash Fire, VCE
194	IS150_KEROSENE_TANK_L	Release of kerosene due to leak/catastrophic failure of kerosene tanks (820-TK1A,B) and associated fittings/pipings. An immediate and delay outcome of the released kerosene will result in fire.	n-Nonane	150 mm	500 mm	Full Vessel		1. 2 tanks (ID: 49.5m, H: 24.38m) 2. Bund size 17,500m2		Pool Fire
195	IS151_DIESEL_TANK_L	Release of diesel due to leak/catastrophic failure of diesel tanks (825-TK1A,B) and associated fittings/pipings. An immediate and delay outcome of the released diesel will result in fire.	Dodecane	150 mm	500 mm	Full Vessel		1. 2 tanks (ID: 49.5m, H: 24.38m) 2. Bund size 17,500m2		Pool Fire
196	IS152_NAPHTHA_TANK_L	Release of light naphtha due to leak/catastrophic failure of light naphtha tanks (830-TK1A,B) and associated fittings/pipings. An immediate and delay outcome of the released light naphtha will result in fire.	Light n-Hexane	150 mm	500 mm	Full Vessel		1. 2 tanks (ID: 43.68m, H: 21.34m) 2. Bund size 17,500m2		Pool Fire
198	IS154_FUEL_TANK_L	Release of fuel oil due to leak/catastrophic failure of fuel oil tanks (833-TK1A,B) and associated fittings/pipings. An immediate and delay outcome of the released fuel oil will result in fire.	Dodecane	150 mm	500 mm	Full Vessel		1. 2 tanks (ID: 31.06m, H: 16.45m) 2. Bund size 17,500m2		Pool Fire
199	IS155_PROPANE_TANK_V	Release of propane LPG due to leak/catastrophic failure of propane LPG tanks (840-TK1A,B) and associated fittings/pipings. An immediate and delay outcome of the released propane LPG will result in fire.	Propane			Full Vessel		1. 2 tanks (ID: 21m, H: ball tank) 2. Bund size 3,700m2		Bleve (Fireball), Flash Fire, VCE

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
200	IS156_BUTANE_TANK_V	Release of butane LPG due to leak/catastrophic failure of butane LPG tanks (842-TK1A-D) and associated fittings/pipings. An immediate and delay outcome of the released butane LPG will result in fire.	Butane			Full Vessel		1. 4 tanks (ID: 21m, H: ball tank) 2. Bund size 3,700m2		Bleve (Fireball), Pool Fire, Flash Fire, VCE
201	IS157_LPG_TANK_V	Release of LPG due to leak/catastrophic failure of LPG tank (841-TK1) and associated fittings/pipings. An immediate and delay outcome of the released LPG will result in fire.	LPG			Full Vessel		1. 1 tank (ID: 15m, H: ball tank) 2. Bund size 3,700m2		Flash Fire, VCE
202	IS158_PENTANE_TANK_V	Release of pentane due to leak/catastrophic failure of pentane tanks (843-TK1A,B) and associated fittings/pipings. An immediate and delay outcome of the released pentane will result in fire.	Pentane			Full Vessel		1. 2 tanks (ID: 21m, H: ball tank) 2. Bund size 3,700m2		Flash Fire, VCE
204	IS160_SONAPHTHA_TANK_L	Release of sour naphtha due to leak/catastrophic failure of sour naphtha tank (850-TK1) and associated fittings/pipings. An immediate and delay outcome of the released sour naphtha will result in fire.	Sour n-Hexane	150 mm	500 mm	Full Vessel		1. 1 tank (ID: 34.95m, H: 18.28m) 2. Bund size 21,800m2		Pool Fire
205	IS161_SWNAPHTHA_TANK_L	Release of sweet naphtha due to leak/catastrophic failure of sweet naphtha tank (851-TK1) and associated fittings/pipings. An immediate and delay outcome of the released sweet naphtha will result in fire.	Sweet n-Hexane	150 mm	500 mm	Full Vessel		1. 1 tank (ID: 37.85m, H: 21.34m) 2. Bund size 21,800m2		Pool Fire
206	IS162_AROMATICS_TANK_L	Release of aromatics due to leak/catastrophic failure of aromatics tank (431-TK1) and associated fittings/pipings. An immediate and delay outcome of the released aromatics will result in fire.	n-Octane	150 mm	500 mm	Full Vessel		1. 1 tank (ID: 37.85m, H: 18.28m) 2. Bund size 21,800m2		Pool Fire

No.	Isolatable Sub-section ID	Description	Representative Material	Leak Size				Note	Area	Potential Outcome
				Small	Large	Catastrophic Failure	Full Bore Rupture			
211	IS167_BENZENE_TANK_L	Release of benzene due to leak/catastrophic failure of benzene day tank (432-TK2A/B) and associated fittings/pipings. An immediate and delay outcome of the released benzene will result in fire	Benzene	150 mm	500 mm	Full Vessel		1. 2 tanks (ID: 13.4m, H: 14.6m) 2. bund size 21,800m2		Pool Fire

4 FREQUENCY ANALYSIS

4.1 Base Failure Frequencies

Generic failure rate data for these equipment items have been taken from publications and technical papers and from searches of database sources such as the *UK HSE Failure Rate and Event Database*. The table below summarises the generic equipment failure data used in this study. Please refer to *Appendix D* for the event tree calculations.

Table 6: Historical Onshore Equipment Failure Rates

Equipment Item	Failure Size	Base Failure Frequency
Tank	Small	2.5 x 10^{-3} per vessel year
	Large	1 x 10^{-4} per vessel year
	Catastrophic	5 x 10^{-6} per vessel year
LPG Butane Tank	Catastrophic	2 x 10^{-6} per vessel year
Pipe of diameter between 0 – 49mm	10 mm diameter	1 x 10^{-5} per m per year
	25mm diameter	5 x 10^{-6} per m per year
	Guillotine	5 x 10^{-6} per m per year
Pipe of diameter between 50 – 149mm	10mm diameter	1.68 x 10^{-6} per m per year
	25mm diameter	1 x 10^{-6} per m per year
	Guillotine	5 x 10^{-7} per m per year
Pipe of diameter between 150 – 299mm	10mm diameter	9.14x 10^{-7} per m per year
	1/3 pipework diameter	4 x 10^{-7} per m per year
	Guillotine	2 x 10^{-7} per m per year
Pipe of diameter between 300 – 499mm	10mm diameter	7.14 x 10^{-7} per m per year
	1/3 pipework diameter	2 x 10^{-7} per m per year
	Guillotine	7 x 10^{-8} per m per year
Pipe of diameter between 500 - 1000 mm	10mm diameter	6.14 x 10^{-7} per m per year
	1/3 pipework diameter	1 x 10^{-7} per m per year
	Guillotine	4 x 10^{-8} per m per year
Pressurized vessel	Small	1.00 x 10^{-5} per vessel per year
	Large	5.00 x 10^{-6} per vessel per year
	Catastrophic	6.00 x 10^{-6} per vessel per year
Pump	Small	3.50 x 10^{-4} per pump per year
	Large	1.50 x 10^{-4} per pump per year
Heat Exchanger/compressor	Small	2.61 x 10^{-3} per HE per year
	Large	8.07 x 10^{-5} per HE per year
Valve	Small	1.40 x 10^{-4} per valve per year
	Large	6.00 x 10^{-5} per valve per year

4.2 Ignition Probabilities

Apart the base failure frequency data, the ignition probability data is a key element for the event frequency calculation. The ignition probabilities were determined from the look-up correlation, *IP Research Report*[1] for onshore scenarios as provided in Table 7, selected based on the size of PEC plant.

Table 7: Look-up Correlation Selection Guide (Onshore Scenarios)

No.[1]	Look-up Release Type	Application
9	Large Plant Liquid (Liquid release from large onshore plant)	Releases of flammable liquid that does not have any significant flash fraction (10% or less) if it is released from large onshore outdoor plants (plant area above 1,200 m^2, site area above 35,000 m^2).
Note 1: Reference number based on look-up correlation selection guide.		

The ignition probability for each identified scenario was determined based on the release rate and representative release rate as presented in *Table 8*.

Table 8: Ignition Probability based on Release Area

Release Rate (kg/s)	Ignition Probability at Large Plant Liquid	Immediate Ignition Probability	Delayed Ignition Probability
0.1	0.001	0.001	0
0.2	0.0013	0.001	0.0003
0.5	0.0019	0.001	0.0009
1	0.0025	0.001	0.0015
2	0.0045	0.001	0.0035
5	0.0097	0.001	0.0087
10	0.013	0.001	0.012
20	0.031	0.001	0.03
50	0.067	0.001	0.066
100	0.12	0.001	0.119
200	0.13	0.001	0.129
500	0.13	0.001	0.129
1000	0.13	0.001	0.129

[1] IP Research Report, Ignition Probability Review, Model Development and Look-up Correlations, January 2006

4.3 Event Tree Analysis

Using the base failure frequency and ignition probabilities listed above in *Section 4.2*, each event outcome frequency is predicted via the use of event tree analysis as shown generically on ***Error! Reference source not found.***.

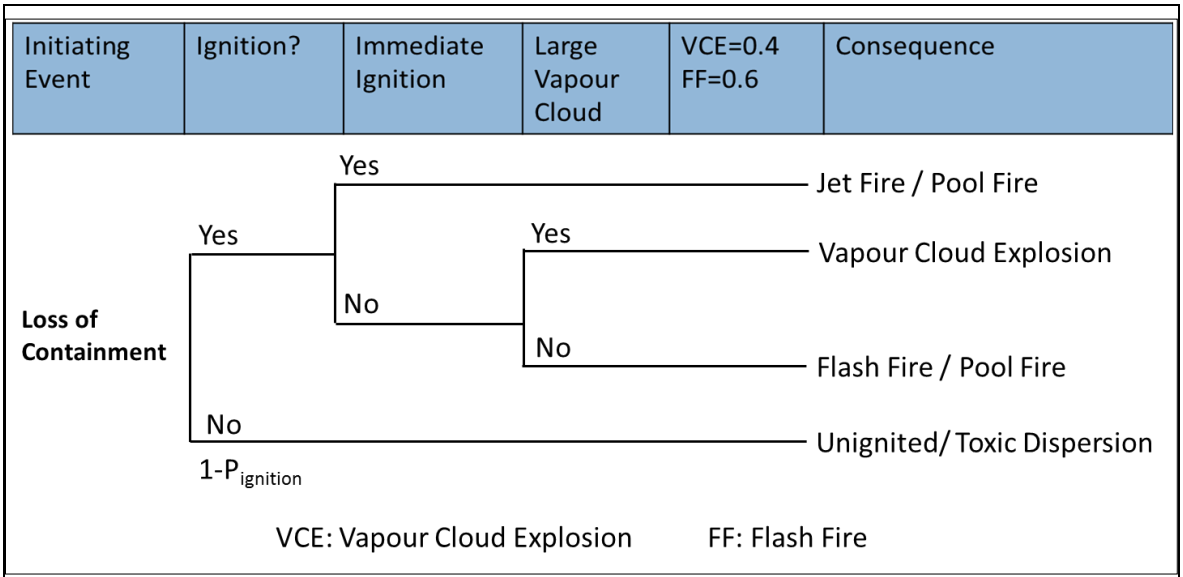


Figure 6 – Event Trees for Small, Large Releases and Catastrophic Failures

The event tree analysis is used to assess the final event frequency of all possible outcomes emanating from an initiating event considering various scenarios.

In the event tree analysis, the probability of ignition is multiplied to the base failure frequency to determine the probability of fire/explosion events upon release. The probability of ignition is dependent on the release phase and the mass release rate, as indicated in *Table 8.* For conservatism, the total mass release rate has been taken into account for selection of the ignition probabilities.

In this study, the pool fire is assessed as an immediate liquid phase ignition event as, say, could occur for a transfer pipeline release with the pool forming on the ground beneath the pipe rack.

For delayed gas phase ignition, the consequences are modelled as a vapour cloud explosion or flash fire event. Toxic dispersion hazards may arise if the material is assessed to be toxic and can generate a toxic vapour cloud which poses acute lethal effects to humans.

5 CONSEQUENCE ANALYSIS

5.1 Hazard Zones

To estimate the hazard zone distances, consequences analysis/modelling for each outcome event has been conducted as follows:

- *Jet Fires* - based on heat flux causing 90%, 50% and 3% fatalities (to those exposed), corresponding to 34.9, 24.7 and 13 kW/m^2 thermal radiation harm footprints
- *Pool fires* - based on heat flux causing 90%, 50% and 3% fatalities (to those exposed), corresponding to 34.9, 24.7 and 13 kW/m^2 thermal radiation harm footprints;
- *Flash Fires* - based on 100% fatality assumed within the extent of a flammable cloud to its Lower Flammable Limit (LFL);
- *Vapour Cloud Explosion*s - based on overpressures of 0.35, 0.5 bar (exposure to which is assumed to result in 15% and 100% fatality respectively); and
- *Toxic dispersion* - based on 90%, 50% and 3% fatality for those exposed to toxic concentrations.

5.2 Probit Analysis

The QRA uses probit analysis in deriving fire heat radiation levels and toxic concentrations that cause fatalities.

The probit function for fatality due to heat flux is given in *RIVM Reference Manual Bevi Risk Assessments*, consistent with the *DoE Guidelines for Risk Assessment*, as follows:

$Pr = -41.61 + 2.79 \ln (tI^{4/3})$

Where:

Pr	probit corresponding to the probability of death	(-)
t	duration of exposure to the radiation heat flux	(s)
I	heat flux at target	(W/m^2)

The probit function for fatality due to vapour cloud explosion is given by:

$Pr = a + b \ln (P^o)$

Where:

Pr	probit corresponding to the probability of death	(-)
Po	peak overpressure	(Pa)
a, b	constant describing the overpressure	(-)

The probit function for fatality due to toxic effects is given by:

$Pr = a + b \ln (C^n t)$

Where:

Pr	probit corresponding to the probability of death	(-)
C	gas concentration	(ppm)
t	exposure duration	(min)

In this study, the toxic effect of Hydrogen Sulphide were considered and the probit constants are shown in *Table 9*. The probit constants were extracted from *RIVM Reference Manual Bevi Risk Assessments*.

Table 9: Probit Constants

Material	Probit Constants [ppm]		
	a	b	n
Hydrogen Sulphide	-10.834	1	1.9

5.3 Methodology and Consequence Models Used

The software package *TNO Riskcurves version 10.1.9* has been used for calculation of consequence effects. Consequence analysis is carried out for identified outcome events, including release rates, and estimates of heat flux and toxic distances are made. Individual Risk calculations are performed with *TNO Riskcurves Version 10.1.9*.

5.4 Consequence Models Inputs

This QRA assesses the risks from the storage vessels and ancillary equipment and the process vessels and ancillary equipment.

5.5 Worst Case Scenarios

Table 10 presents the worst case scenarios identified for the PEC facilities.

It should be emphasised that all the hazard zones are confined either within the PEC Site or within the industrial areas and do not encroach to any locations where involuntary recipients of industrial risks might be present such as residential areas, schools, hospitals and places of continuous occupancy, etc. The nearest sensitive receptor is the Kg Lepau, approximately 1.5km to the west of the PEC site.

Table 10: Worst Case Scenarios

Isolatable Section	Hazard Type	Fatality Levels- Harm Footprint	Maximum Hazard Zone [m]
003_100V018_C (catastrophic rupture of feed surge drum under weather condition C3)	Pool Fire (Pentane)	90% fatality	170
		50% fatality	205
		3% fatality	258
130_Xylene_pipe_B (large leak of xylene pipeline under weather condition F1)	Jet Fire (Xylene)	90% fatality	181
		50% fatality	190
		3% fatality	206
200_842T001_C (catastrophic rupture of Butane LPG tanks under weather condition F1)	Fireball (BLEVE) (Butane LPG Tanks)	90% fatality	825
		50% fatality	1,083
		3% fatality	1,502
199_840T001_C (catastrophic rupture of propane tank under weather condition F1)	Flash Fire (Propane)	LFL	1,686
201_841T001_C (catastrophic rupture of LPG tank under weather condition F1)	Explosion (LPG)	90% fatality	Not Attained
		50% fatality	560
		3% fatality	561
189_650V003_C (catastrophic rupture of sour water stipper under weather condition F1)	Toxic Dispersion (H_2S)	90% fatality	1
		50% fatality	2
		3% fatality	100
Notes: 1. N/A – not attainable 2. LFL – Lower Flammable Limit			

6 RISK SUMMATION & EVALUTION

6.1 Definitions and Risk Acceptance Criteria

Internationally industrial risk is usually judged from one or both of two points of view. The first point of view is that of the individual and the second that of society as a whole or the community around an industrial facility. Published offsite Risk Acceptance Criteria are usually expressed in terms of fatalities.

6.1.1 Individual Risk Definition and its Calculation

Location specific Individual Risk (IR) may be defined as the frequency at which an individual may be expected to sustain a given level of harm from the realisation of specified hazards. This is usually expressed as the probability that an individual will be harmed if he stood at a given location for the course of one (1) year:

Individual Risk per year = Number of Fatalities per Individual per year

= Number of Fatalities per year/ Number of People Exposed to the Risk

Location specific Individual Risk (IR) is usually represented by iso-risk contours overlaid on a map of an industrial facility and its surroundings. The IR is the combination of the consequences of an event and the likelihood of the outcome of that event. Producing iso-risk contours, or the combination of these two (2) measures, can be conducted by hand, but is repetitive and more suited to computer software such as the *TNO RiskCurves* software ESC have used for the QRA. Inputs to the software comprise:

- Scenarios detailing all identified hazardous events and their frequencies;
- Release location containing the locations of hazardous events on the site;
- Consequence results including all the calculated consequences of each event under each possible weather condition; and
- Weather frequencies detailing the local meteorological data according to a matrix of weather class (wind speed, stability combinations) and wind directions.

6.1.2 DoE Offsite Individual Risk Acceptance Criteria

The offsite Individual Risk Acceptance Criteria adopted in this QRA are those from the DoE's *EIA Guidelines for Risk Assessment*, where by the iso-risk contours generated for the PEC facilities should satisfy the following*:*

- The $1x10^{-6}$ fatalities/person per year Individual Risk contour should not extend to any areas where involuntary recipients of industrial risks might be located, such as residential areas, schools, hospitals and places of continuous occupancy, etc.; and
- The $1x10^{-5}$ fatalities/person per year Individual Risk contour should not extend beyond the area of neighbouring industrial developments.

6.1.3 Societal Risk Definition and Acceptance Criteria

Societal Risk is often defined as "the relation between frequency and the number of people suffering from a specified level of harm in a given population from the realisation of specified hazards". If the specified level of harm is narrowed down to the loss of life, the Societal Risk may be modelled by the frequency of exceedance curve of the number of deaths, also called the FN-curve.

As the criteria for Societal Risk are not issued by regulatory authorities in Malaysia, the Dutch Guide Value is adopted as provided in *RIVM Reference Manual Bevi Risk Assessments*. These criteria usually divide the log-log FN curve into three areas (see *Section 6.3*):

- *An intolerable or unacceptable region* where risks are judged so high that they must be mitigated no matter what the cost or the facility will not be considered for planning permission.
- *A tolerable or acceptable region* where risks are so low that no additional mitigation measures are deemed necessary.

6.2 Individual Risk Results

6.2.1 PEC Individual Risk Results

Figure 7 presents the Individual Risk contours overlain on the satellite image of the Pengaran area, for loss of containment events as assessed in detail in this QRA. The 1 x 10^{-5} and 1 x 10^{-6}/year contours shown include the contributions from jet fires, pool fires, flash fires, explosions, fireballs and toxic dispersion.

As shown in the figure, the Individual Risk (IR) contour for 1x 10^{-5} and 1 x 10^{-6} per year contour are attained, and extends offsite, however is contained within the Industrial Area. The maximum offsite distance is ~75m and ~670m towards the North respectively. The QRA found the major offsite risk contributors from the PEC plant resulted from failures of the Butane Storage Tank (842TK1) and Area A2 (Xylene Splitter Area). The PEC Facilities is in compliance with *DoE's Risk Acceptance Criteria*.

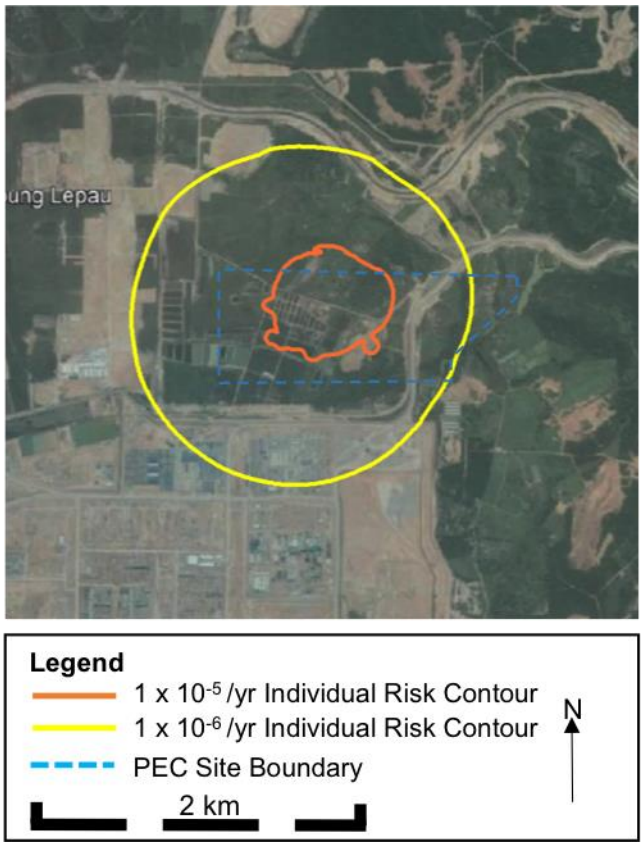


Figure 7 – PEC Individual Risk Contours

6.3 Societal Risk Results

Figure 8 presents the societal risks for the PEC Plant. The maximum number of offsite fatalities associated with major accidents events (MAEs) arising from within the PEC site was assessed at 22 with a frequency of 7.85 x 10^{-8}/year, which is found to be within the "Tolerable" region. Hence no additional mitigation measures are required to be implemented in accordance with the ALARP (*as low as reasonablly practical*) principle.

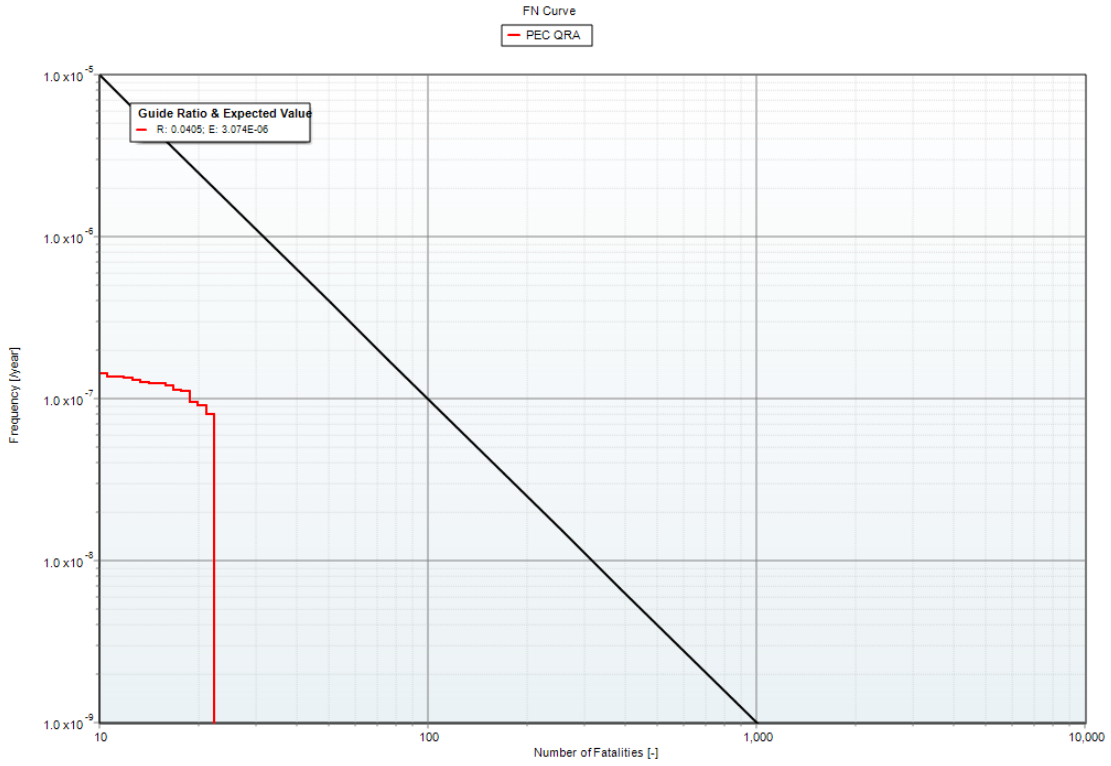


Figure 8 – FN Curve

7 QRA CONCLUSIONS

7.1 Frequency Analysis and Consequence Results

The QRA conservatively addresses the failure frequencies of all the facilities at the PEC site and determines the consequences of the hazards identified before performing risk summation and evaluation.

Conservatisms ensure risks are not underestimated and in this case include usage of maximum inventories of hazardous substances in vessels and modelling releases based on the worst case situation, i.e. the isolatable sections are modelled without quantitatively considering the benefits of all safety systems (excepting the tank bunds), procedural or firefighting safety measures onsite.

The identified worst case scenarios by event are summarised in *Table 11.*

7.2 Risk Summation and Evaluation against Risk Acceptance Criteria

7.2.1 Individual Risks

The QRA quantifies its Individual Risk (IR) and found that while the 1 x 10^{-6} per year IR contour extends offsite, it remains confined within the Industrial Area. Hence the risks comply with *DoE Risk Acceptance Criteria*. The QRA found the major offsite risk contributors from the PEC plant resulted from failures of the Butane Storage Tank (842TK1) and Area A2 (Xylene Splitter Area).

Table 11: Worst Case Scenarios Result Summary

Isolatable Section	Hazard Type	Fatality Levels- Harm Footprint	Maximum Hazard Zone [m]
003_100V018_C (catastrophic rupture of feed surge drum under weather condition C3)	Pool Fire (Pentane)	90% fatality	170
		50% fatality	205
		3% fatality	258
130_Xylene_pipe_B (large leak of xylene pipeline under weather condition F1)	Jet Fire (Xylene)	90% fatality	181
		50% fatality	190
		3% fatality	206
200_842T001_C (catastrophic rupture of Butane LPG tanks under weather condition F1)	Fireball (BLEVE) (Butane LPG Tanks)	90% fatality	825
		50% fatality	1,083
		3% fatality	1,502
199_840T001_C (catastrophic rupture of propane tank under weather condition F1)	Flash Fire (Propane)	LFL	1,686
201_841T001_C (catastrophic rupture of LPG tank under weather condition F1)	Explosion (LPG)	90% fatality	Not Attained
		50% fatality	560
		3% fatality	561
189_650V003_C (catastrophic rupture of sour water stipper under weather condition F1)	Toxic Dispersion (H_2S)	90% fatality	1
		50% fatality	2
		3% fatality	100
Notes: 1. N/A – not attainable 2. LFL – Lower Flammable Limit			

7.2.2 Societal Risks

The Societal Risk (SR) is within the 'Tolerable' region of the adopted Societal Risk Tolerability Criteria, adopted as provided in *RIVM Reference Manual Bevi Risk Assessments*. The maximum number of offsite fatalities associated with major accidents events (MAEs) arising from within the PEC site was assessed at 22 with a frequency of 7.85 x 10^{-8}/year, which is found to be within the "Tolerable" region. Hence no additional mitigation measures are required to be implemented in accordance with the ALARP (*as low as reasonablly practical*) principle.

7.3 Conclusions of the FCM KEP Revised Cumulative QRA

Based on the QRA results summarised above, it is concluded that the PEC Plant satisfies the *DoE Risk Acceptance Criteria* for Individual Risk as:

- The 1 x 10^{-5} fatalities per year contour remains within the industrial development; and
- The 1 x 10^{-6} fatalities per year contour does not encroach to any public areas, such as residential areas, schools, hospitals.

Therefore, no additional mitigation measures are deemed to be mandatory to further reduce the risks associated with the PEC.

The Societal Risk associated with the PEC Plant is found to be within the tolerable region. Therefore, it can be concluded risks are acceptable and no additional mitigation measures are required to reduce risks to a level *as low as reasonably practical (ALARP)*.

APPENDIX A

Landuse Planning, Population & Meteorological Data

A Landuse Planning, Population & Meteorological Data

A1 Landuse Planning

The main towns closest to the PEC project site are Bandar Penawar (located about 10km away to the northeast) and Kg Sungai Rengit (located about 6km away to the south east). Six villages are located inside 5km radius of the Project site boundary: Kg Lepau is the nearest, located 1.5km to the west; Kg Bukit Pelali, located about 3km to the east whilst Kg Bukit Gelugor, Kg Bukit Raja, Kg Bukit Buloh and Taman Rengit Jaya are about 4km to the southeast. (*Figure A1*) These six villages have a total of 326 households *(Table A1*). The existing Sebana Cove Resort and Marina is sited about 2km to the north and the new township at Bukit Pelali (under construction) is about 3km to the east.

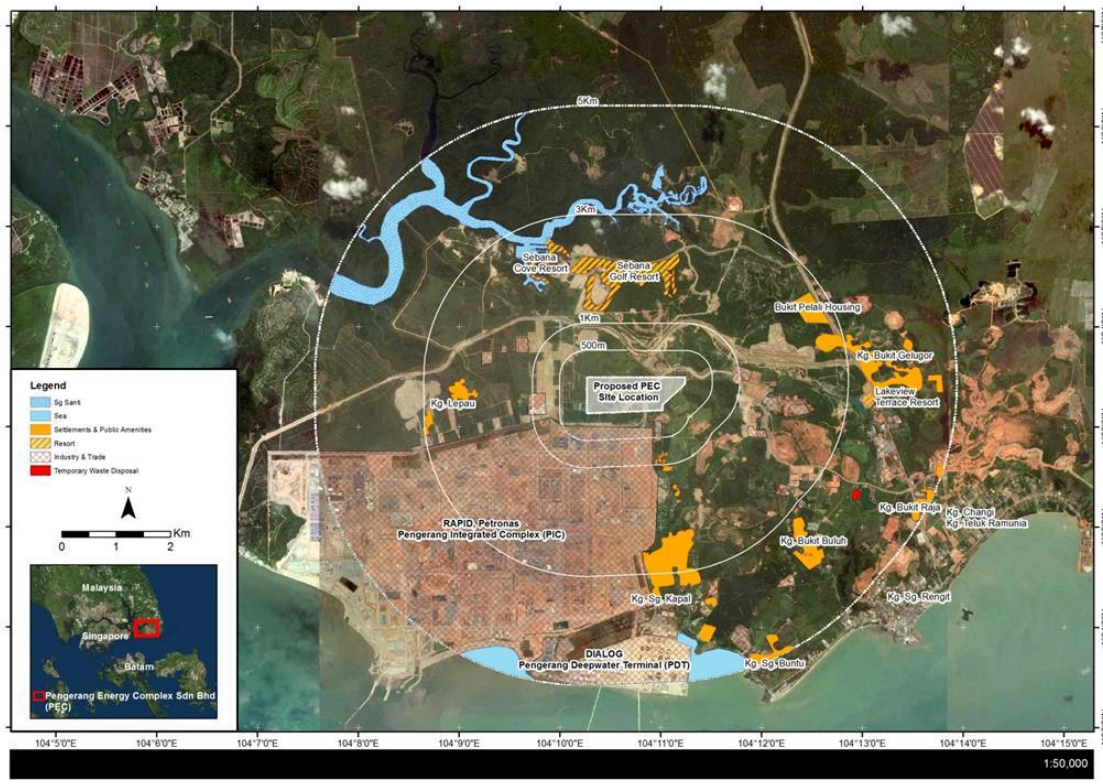


Figure A1 – The Project Site in Relation to Existing Towns and Villages within 5km Radius

Table A1: Distribution of Households inside 5km Radius of Project Site

Village	Distance from Project Site (km)	Direction from Project Site	Households (Number of People))
Kg Lepau	1.5	west	50 (250)
Kg Bukit Pelali	3	northeast	40 (200)
Taman Rengit Jaya	3.5	south	60 (300)
Kg Bukit Gelugor	4	east	56 (280)
Kg Bukit Buloh(1)	4	southeast	30 (150)
Kg Bukit Raja	4.5	east	100 (500)
Total			326 (1,630)
Kg Sg Rengit(2)	>5km	southeast	442
Kg Sg Buntu(3)	>5km	south	NA

Source: Former village heads of Kg Lepau, Kg Bukit Buloh and Kg Bukit Raja, Sept. 2018 Pejabat Penghulu of Mukim Pengerang and Pantai Timur, Sept. 2018

A3 Meteorological Data

The climate is Pengerang is typical of tropical equatorial climate with abundant rainfall, high and uniform temperatures, and high humidity all year round.

Meteorological data from 2015 to 2017 was sourced from the Malaysian Meteorological Department. The nearest meteorology monitoring station is the Felda Sg. Mas (Station No. 47125). This station is located approximately 26 km from the proposed project site and is the closest station compared to Senai Meteorological Station, which is located approximately 63 km from the proposed project site. The coordinates to the Felda Sungai Mas meteorology monitoring station is 01^{o} 37' N, 104^{o} 09' E. The station monitors parameters such as Temperature, Humidity, Wind and Rainfall as discussed below and summarized as follows:

- The average annual temperature in the area was recorded at 26.7^{o}C with little seasonal variation.
- Rainfall trends for the area show an irregular distribution. High with rainfall was recorded during the months of November, December, February, May and August. There is no particular dry season however the average annual rainfall was recorded to be 59.3 mm.
- The monthly mean relative humidity ranged from 81.3% to 86.6%, with an average of 84%. The highest mean relative humidity was in November and the lowest in March.

Wind was predominantly from northeast and south directions consistent with Malaysia's monsoons. Wind speeds typically range from 0.3 to 3.3 m/s. Maximum wind speed was recorded at 3.4 to 5.4 m/s.

The mean temperature from the year 2015 to 2017 in Felda Sg. Mas ranged from 26.2^{o}C to 27.2^{o}C. The temperature range was high during the Northeast monsoon period in the month of March to October. The average annual temperature was recorded to be 26.7^{o}C.

The daily rainfall level at Felda Sg. Mas ranged between 2 mm to 8.2 mm for 2015-2017. The rainfall trend shows an irregular distribution with high rainfall recorded during the months of November, December, February, May and August.

The monthly mean relative humidity measured at Felda Sg. Mas between 2015 to 2017 ranged from 81.3% to 86.6% with an average of 84%. The highest mean relative humidity was in November and the lowest in March.

Wind Probabilities

According to the wind rose diagram in *Figure A2*, wind data from 2015 to 2017 showed that wind was predominantly from northeast and south directions. Wind speeds typically range from 0.3 to 3.3 m/s. Maximum wind speed was recorded at 3.4 to 5.4 m/s.

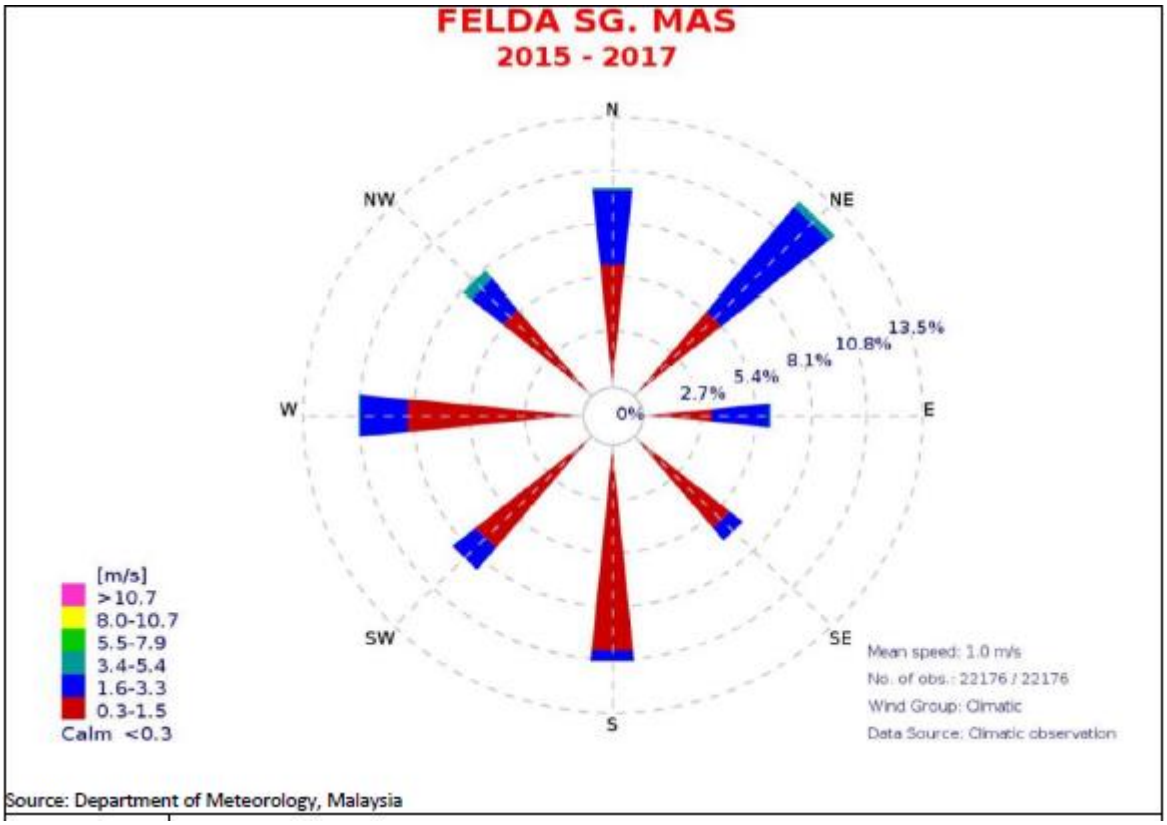


Figure A2 – Wind Roos

Surface Roughness

For ground level releases, the roughness parameter reflects the average roughness over which the cloud is dispersing. For consequence modelling conducted using *TNO Riskcurves Version 10.1.9*, a value of 0.10 m was selected, representing conditions of low crops and scattered large obstacles, resembling the process areas and buildings.

APPENDIX B

Safety Data Sheets

APPENDIX C

Isolatable Sections

Table C1 – Isolatable Sections

No.	Isolatable Sub-section ID	Representative Material	Operating Temp (°C)	Operating Press (barg)	Operating Press (bara)	Vol. (m^3)	Equipment			Pipe		Pipe Flow Rate (kg/s)	Note	Area
							Tank ID	Diameter (m)	Height (m)	Diameter (inch)	Length (m)			
1	IS01_COND_PIPE_L	n-Octane	30	1.960	2.973	83				32	1133	229.0454	1. 1,133m pipe; Ø0.8288m 2. Free spreading pool	-
2	IS02_NAPHTHA_PIPE_L	n-Hexane	22	1.666	2.679	0				2	132	1.3428	1. 132m pipe; Ø0.0508m 2. Free spreading pool	-
3	IS03_PENTANE_CFSD_L	Pentane	30	1.176	2.189	210	100-V18	4.5	13.1	Stream 100 = 12			1 pressure vessel, 1 valve, 1 pump	Area C1 - 28,600m^2
4	IS04_DODEC_DESALT_L	Dodecane	112	24.012	25.025	110	100-V9	3.0	15.0	stream 105 = 12			1 pressure vessel, 5 valves	
5	IS05_PENTANE_FFR_L	Pentane	46	0.490	1.503	275	100-V5	4.9	14.6	Stream 204 = 18			1 pressure vessel; 2 valves; 1 pump1; 1 heat exchanger	
6	IS06_LPG_FFTP_V	LPG	143	1.176	2.189	835	100-V1	6.7	23.7	Stream 140 = 12, stream 207 = 8			1 pressure vessel; 2 valves	
7	IS06_DODEC_FFBP_L	Dodecane	143	1.176	2.189	835	100-V1	6.7	23.7	Stream 140 = 12, stream 236 = 36			1 pressure vessel; 2 valves	
8	IS07_PENTANE_FFRCO_L	Pentane	47	12.251	13.264	45	100-V10	3.0	6.0	Inlet stream = 8			1 pressure vessel; 3 valves	
9	IS08_BUTANE_STABTP_V	Butane	56	6.370	7.384	1,100	100-V4	7	28.5	Stream 211 = 10, stream 406 = 6			1 pressure vessel	
10	IS08_PENTANE_STABBP_L	Pentane	56	6.370	7.384	1,100	100-V4	7	28.5	Stream 211 = 10, stream 422 = 26, stream 424 = 16			1 pressure vessel; 1 heat exchanger; 1 pump; 1 valve	
11	IS09_BUTANE_STABREC_V	Butane	38	5.978	6.992	45	100-V7	2.6	7.8	stream 402 = 6			1 pressure vessel; 2 pumps; 3 valves; 1 heat exchanger	
12	IS10_KERO_DFTP_V	n-Nonane	243	1.078	2.091	605	100-V2	4.6	36.3	Stream 341= 16, stream 332 = 8			1 pressure vessel	
13	IS10_DODEC_DFBP_L	Dodecane	243	1.078	2.091	95	100-V2	1.8	36.3	Stream 250= 28, stream 362 = 4, stream 374 = 6			1 pressure vessel; 3 valves 3 heat exchangers; 1 pump	
14	IS11_KERO_DSTP_V	n-Nonane	280	1.078	2.091	40	100-V3	2.1	10.5	Stream 340 = 10			1 pressure vessel	
15	IS11_DODEC_DSBP_L	Dodecane	280	1.078	2.091	40	100-V3	2.1	10.5	Stream 375= 4			1 pressure vessel; 1 pump, 2 valves	
16	IS12_DODEC_DFR_L	Dodecane	108	0.392	1.405	90	100-V6	3.2	10.9	Stream 304= 20			1 pressure vessel; 4 heat exchangers; 1 pump	
17	IS13_BUTANE_AMAB_V	Butane	38	10.095	11.108	30	110-V8	1.4	18	stream 3 = 4, stream 56 = 1.5			1 pressure vessel; 1 valve	
18	IS14_BUTANE_EXPLUS_V	Butane	38	8.821	9.834	55	110-V1	1.6	25.7	stream 9 = 4, stream 93 = 2, stream 75 = 2, stream 15 = 4			1 pressure vessel; 2 valves; 1 pump	

No.	Isolatable Sub-section ID	Representative Material	Operating Temp (°C)	Operating Press (barg)	Operating Press (bara)	Vol. (m^3)	Equipment			Pipe		Pipe Flow Rate (kg/s)	Note	Area
							Tank ID	Diameter (m)	Height (m)	Diameter (inch)	Length (m)			
19	IS15_DODEC_SANDF_L	Dodecane	43	3.626	4.639	1	110-V6	0.61	2.1	Inlet Stream = 1			1 pressure vessel; 1 pump; 1 valve	
20	IS16_PROPANE_PIPELINE_L	Propane	38	29.284	30.298	0				3	68	5.2971	168m pipe (Ø0.0762m)	
22	IS18_BUTANE_PIPELINE_L	Butane	40	6.762	7.776	6				4	776	11.2226	776m pipe (Ø0.1016m)	
23	IS19_ETHANE_DETP_V	Ethane	55	27.932	28.945	85	115-V1	2.2	22.1	Stream 103= 4, stream 114 = 3			1 pressure vessel	Area C1 - 28,600m2
24	IS19_BUTANE_DEBP_L	Butane	55	27.932	28.945	85	115-V1	2.2	22.1	Stream 103= 4			1 pressure vessel; 2 valves; 1 heat exchanger	
25	IS20_ETHANE_DERTP_V	Ethane	38	27.540	28.553	6	115-V2	1.3	3.9	Stream 105= 6			1 pressure vessel; 1 heat exchanger; 1 valve	
27	IS21_PROPANE_SPLITTP_V	Propane	50	15.387	16.400	75	115-V3	1.8	28.3	Stream 122 = 6 , stream 208 =6			1 pressure vessel	
28	IS21_BUTANE_SPLITBP_L	Butane	50	15.387	16.400	75	115-V3	1.8	28.3	Stream 122 = 6 , stream 208 =6, stream 231 = 16			1 pressure vessel, 2 valves; 1 heat exchanger	
29	IS22_PROPANE_SPLITR_L	Propane	46	15.583	16.596	20	115-V4	2	6.1	Stream 204 = 8			1 pressure vessel, 3 valves; 1 pump, 2 heat exchangers	
30	IS23_PROPANE_PIPELINE_L	Propane	40	16.171	17.184	3				3	664	3.3091	664m pipe (Ø0.0762m)	
31	IS24_KERO_COALES_L	n-Nonane	40	12.251	13.264	5	120-V1	1.2	4.0	Stream 3 = 6			1 pressure vessel; 5 valves	
32	IS25_KERO_ECPW_L	n-Nonane	40	12.349	13.362	45	120-V2	3.0	6.0	Inlet stream = 6, stream 72 = 1			1 pressure vessel; 1 valve	
33	IS26_KERO_REAC_L	n-Nonane	40	11.565	12.578	165	120-R1	5.2	7.7	Inlet stream = 6			1 pressure vessel; 1 valve	
34	IS27_KERO_CAUSET_L	n-Nonane	40	10.585	11.598	75	120-V3	2.9	11.4	Inlet stream = 6			1 pressure vessel; 1 valve	Area C1 - 28,600m2
35	IS28_KERO_WWASH_L	n-Nonane	40	10.193	11.206	65	120-V4	3.6	6.1	Inlet stream = 6			1 pressure vessel; 1 valve	
36	IS29_KERO_SANDFIL_L	n-Nonane	40	9.801	10.814	60	120-V5A/B	3.9	4.8	Inlet stream = 6			2 pressure vessels; 5 valves	
37	IS30_KERO_CLAYFIL_L	n-Nonane	40	8.429	9.442	130	120-V6A/B	5	6.6	Inlet stream = 6			2 pressure vessels; 7 valves	
38	IS31_KERO_PIPELINE_L	n-Nonane	40	3.430	4.443	3				6	146	43.0729	146m pipe (Ø0.1524m)	
39	IS32_DODEC_FEEDCO_L	Dodecane	35	6.174	7.188	30	130-ME1	3	4	Inlet stream = 6			1 pressure vessel; 3 valves	Area C2 - 25,800m^2
40	IS33_DODEC_PIPELINE_L	Dodecane	134	5.067	6.080	5				6	282	36.8651	282m pipe (Ø0.1524m)	

No.	Isolatable Sub-section ID	Representative Material	Operating Temp (°C)	Operating Press (barg)	Operating Press (bara)	Vol. (m^3)	Equipment			Pipe		Pipe Flow Rate (kg/s)	Note	Area
							Tank ID	Diameter (m)	Height (m)	Diameter (inch)	Length (m)			
41	IS34_DODEC_FSD_L	Dodecane	134	2.529	3.542	25	130-V1	2.1	6.8	stream 152 = 6			1 pressure vessel; 2 pumps; 1 valve	
42	IS35_H2_REAC1_V	Hydrogen	380	75.367	76.380	76	130-R1	2.4	16.8	stream 434 = 6, stream 243 = 10			1 pressure vessel; 3 heat exchanger; 3 valve	
43	IS36_H2_REAC2TP_V	Hydrogen	380	72.525	73.538	125	130-R2	2.4	27	stream 245 = 10, stream 442 = 3			1 pressure vessel; 1 valve	
45	IS37_H2_SEPTP_V	Hydrogen	54	60.274	61.287	125	130-V3	2	6.7	stream 225 = 12			1 pressure vessel; 1 heat exchanger; 2 valves	
47	IS38_H2_FDTP_V	Hydrogen	57	17.249	18.262	25	130-V4	2.6	9.2	stream 312 = 6			1 pressure vessel; 2 valves;	
49	IS39_H2_RGCSD_V	Hydrogen	60	60.274	61.287	3	130-V5	1.1	2.7	stream 491 = 6			1 pressure vessel; 2 compressor, 1 heat exchanger; 1 valve	
50	IS40_H2_PIPELINE_V	Hydrogen	32	31.254	32.268	1				3	230	0.5491	230m pipe (Ø0.0762m)	Area C2 - 25,800m2
51	IS41_H2_MGCSD_V	Hydrogen	40	31.362	32.375	2	130-V6	0.75	2.5	stream 501 = 3			1 pressure vessel; 2 compressors, 1 valve	
52	IS42_H2_STRIPTP_V	Hydrogen	260	6.860	7.874	50	130-V7	1.4	32.3	stream 334 = 6, stream 640 = 1.5			1 pressure vessel; 1 valve	
53	IS42_DODEC_STRIPBP_L	Dodecane	260	6.860	7.874	50	130-V7	1.4	32.3	stream 334= 6, stream 800 = 3			1 pressure vessel; 2 heat exchangers; 1 valve	
54	IS43_MET_SRTP_V	Methane	46	6.174	7.188	10	130-V8	1.6	4.5	stream 631 = 6			1 valve	
55	IS43_NAPHTHA_SRBP_L	n-Hexane	46	6.174	7.188	10	130-V8	1.6	4.5	stream 631 = 6			1 pressure vessel; 1 heat exchanger; 2 valves	
56	IS44_DODEC_VACDRY_L	Dodecane	173	-0.686	0.327	25	130-V9	2.1	6.4	stream 718 = 6			1 pressure vessel; 3 heat exchangers; 1 pump; 3 valves	
57	IS45_DIESEL_PIPELINE_L	Diesel	40	3.430	4.443	14				6	780	36.5027	780m pipe (Ø0.1524m)	
59	IS47_H2_PIPELINE_V	Hydrogen	39	6.116	7.129	3				4	401	1.5447	401m pipe (Ø0.1016m)	
60	IS48_H2_OGA_V	Hydrogen	53	5.880	6.894	20	130-V11	1	20.4	stream 743 = 6, stream 757 = 2, stream 744 = 6			1 pressure vessel; 1 heat exchanger; 1 valve	Area C2 - 25,800m2
61	IS49_H2_TOGKD_V	Hydrogen	47	5.880	6.894	2	130-V12	0.8	2.7	stream 754 = 6			1 pressure vessel; 2 valves	
62	IS50_H2_RETP_V	Hydrogen	343	27.638	28.651	100	200-R1	5	4.9	stream 115 = 18			1 pressure vessel; 3 heat exchangers; 1 valve	Area R1 - 31,800m2

No.	Isolatable Sub-section ID	Representative Material	Operating Temp (°C)	Operating Press (barg)	Operating Press (bara)	Vol. (m^3)	Equipment			Pipe		Pipe Flow Rate (kg/s)	Note	Area
							Tank ID	Diameter (m)	Height (m)	Diameter (inch)	Length (m)			
63	IS50_NAPHTHA_REBP_L	n-Hexane	343	27.638	28.651	100	200-R1	5	4.9	stream 115 = 18			1 pressure vessel; 3 heat exchangers; 1 valve	
64	IS51_H2_SEPTP_V	Hydrogen	46	24.110	25.123	300	200-V3	5	15	stream 137 = 14			1 pressure vessel	
65	IS51_HEAVY NAPHTHA_SEPBP_L	n-Hexane	46	24.110	25.123	300	200-V3	5	15	stream 137 = 14			1 pressure vessel; 1 valve	
66	IS52_H2_RCSD_V	Hydrogen	46	24.110	25.123	4	200-V4	1.4	2.6	stream 101 = 8			1 pressure vessel; 1 valve; 1 compressor	
67	IS53_BUT_STRITP_V	Butane	99	11.565	12.578	330	200-V5	4.3	22.7	stream 306 = 10, stream 317 = 6			1 pressure vessel	
68	IS53_PENTANE_STRIBP_L	Pentane	99	11.565	12.578	330	200-V5	4.3	22.7	stream 337 = 24			1 pressure vessel; 1 heat exchanger; 2 pumps; 1 valve	
69	IS54_BUTANE_STRTP_V	Butane	40	10.389	11.402	20	200-V6	2	6.5	stream 310 = 8			1 pressure vessel; 1 valve	
70	IS54_PENTANE_STRBP_L	Pentane	40	10.389	11.402	20	200-V6	2	6.5	stream 310 = 8			1 pressure vessel; 2 heat exchangers; 2 valves	
71	IS55_LIGHT NAPHTHA_NASTP_V	n-Hexane	71	1.568	2.581	600	200-V7	4.6	35.9	stream 1113 = 12, stream 1118 = 6			1 pressure vessel; 1 valve	
72	IS55_PENTANE_NASBP_L	Pentane	71	1.568	2.581	600	200-V7	4.6	35.9	stream 1113 = 12, stream 1138 = 28			1 pressure vessel; 1 heat exchanger; 2 pumps; 1 valve	
73	IS56_PENTANE_NASR_L	Pentane	58	1.176	2.189	50	200-V8	2.8	7.7	stream 1172 = 10			1 pressure vessel; 1 heat exchanger; 2 pumps; 3 valves	
74	IS57_PENTANE_DEPTP_V	Pentane	62	1.568	2.581	140	200-V9	2.8	22.6	stream 1303 = 8, stream 1316 = 4			1 pressure vessel; 1 valve	
76	IS58_PENTANE_DEPR_L	Pentane	53	1.176	2.189	25	200-V10	2.2	6.1	stream 1310 = 8			1 pressure vessel; 2 heat exchangers; 2 pumps; 1 valve	
77	IS59_PENTANE_ADSORB_L	Pentane	50	10.585	11.598	55	230-V1A/B	2.8	9	stream 124 = 10			2 pressure vessels; 2 heat exchangers; 2 valves	
78	IS60_H2_REAC1_V	Hydrogen	549	5.096	6.110	80	300-R1	2.55	15.3	stream 152 = 42			1 pressure vessel; 1 heat exchanger; 2 valves	
79	IS61_H2_REAC2_V	Hydrogen	549	4.606	5.620	90	300-R2	2.55	17.15	stream 154 = 42			1 pressure vessel; 1 valve	
80	IS62_H2_REAC3_V	Hydrogen	549	4.116	5.130	105	300-R3	2.55	20.5	stream 156 = 42			1 pressure vessel; 1 valve	
81	IS63_H2_REAC4_V	Hydrogen	549	3.528	4.541	115	300-R4	2.55	22.3	stream 158 = 42			1 pressure vessel; 1 heat exchanger; 1 valve	
82	IS64_H2_SEPTP_V	Hydrogen	46	2.450	3.463	85	300-V1	4	6.5	stream 181 = 54			1 pressure vessel; 1 heat exchanger; 1 compressor; 2 valves	
83	IS64_HEAVY NAPHTHA_SEPBP_L	n-Hexane	46	2.450	3.463	85	300-V1	4	6.5	stream 181 = 54			1 pressure vessel; 2 heat exchangers; 2 pumps; 1 valve	

No.	Isolatable Sub-section ID	Representative Material	Operating Temp (°C)	Operating Press (barg)	Operating Press (bara)	Vol. (m^3)	Equipment			Pipe		Pipe Flow Rate (kg/s)	Note	Area
							Tank ID	Diameter (m)	Height (m)	Diameter (inch)	Length (m)			
84	IS65_H2_NGSDTP_V	Hydrogen	46	5.488	6.502	20	300-V2	2.6	3.4	stream 1112 = 20			1 pressure vessel; 1 heat exchanger; 1 compressor; 1 valve	
85	IS65_BENZENE_NGSDBP_L	Benzene	46	5.488	6.502	20	300-V2	2.6	3.4	stream 1112 = 20			1 pressure vessel; 1 valve	
86	IS66_H2_RD1TP_V	Hydrogen	40	16.563	17.576	45	300-V3	2.6	7.9	stream 1165 = 20			1 pressure vessel; 1 heat exchanger; 1 compressor; 2 valves	
87	IS66_BENZENE_RD1BP_L	Benzene	40	16.563	17.576	45	300-V3	2.6	7.9	stream 1165 = 20			1 pressure vessel; 1 valve	
88	IS67_H2_RD2TP_V	Hydrogen	40	33.126	34.139	40	300-V4	2.5	8	stream 1215 = 16			1 pressure vessel; 1 heat exchanger; 1 valve	
89	IS67_BENZENE_RD2BP_L	Benzene	40	33.126	34.139	40	300-V4	2.5	8	stream 1215 = 16			1 pressure vessel; 1 valve	
90	IS68_H2_NGCT_V	Hydrogen	32	30.186	31.199	65	300-V5A/B	3	9	stream 1224 = 12			2 pressure vessels; 5 valves	
91	IS69_BUTANE_DBTP_V	Butane	63	11.761	12.774	270	300-V6	3.6	26.6	stream 1403 = 12, stream 1429 = 6			1 pressure vessel; 1 valve	
92	IS69_TOLUENE_DBBP_L	Toluene	63	11.761	12.774	270	300-V6	3.6	26.6	stream 1403 = 12, stream 1457 = 14			1 pressure vessel; 1 valve; 1 heat exchanger	
93	IS70_BUTANE_DBRTP_V	Butane	40	10.977	11.990	30	300-V7	2.4	6.4	stream 1409= 12			1 pressure vessel; 3 heat exchangers; 1 valve	
94	IS70_PENTANE_DBRBP_L	Pentane	40	10.977	11.990	30	300-V7	2.4	6.4	stream 1409= 12			1 pressure vessel; 2 pumps; 2 valves	
95	IS71_BUTANE_LPGCT_L	Butane	40	32.538	33.551	10	300-V8A/B	1.2	5.5	stream 1421= 3			2 pressure vessels; 6 valves	
96	IS72_H2_REAC_V	Hydrogen	420	12.447	13.460	65	320-R1	3.2	8.2	stream 119 = 30			1 pressure vessel; 2 valves; 2 heat exchangers	
97	IS73_H2_SEPTP_V	Hydrogen	46	10.977	11.990	65	320-V1	3	8.9	stream 124 = 24			1 pressure vessel; 1 compressor; 1 valve	Area A3 - 7,500m2
98	IS73_XYLENE_SEPBP_L	m-xylene	46	10.977	11.990	65	320-V1	3	8.9	stream 124 = 24			1 pressure vessel; 1 valve; 1 heat exchanger	
99	IS74_XYLENE_PIPELINE_L	m-xylene	150	0.823	1.837	25				10	410	121.2112	410m pipe (Ø0.254m)	
100	IS75_ETHANE_DHTP_V	Ethane	154	4.214	5.228	645	320-V2	4.6	38.6	stream 205 = 12, stream 225 = 8			1 pressure vessel; 1 valve	
101	IS75_XYLENE_DHBP_L	Xylene	154	4.214	5.228	645	320-V2	4.6	38.6	stream 205 = 12, stream 248 =30, stream 253 =16			1 pressure vessel; 1 pump; 1 valve	Area A3 - 7,500m2
102	IS76_ETHANE_DHRTP_V	Ethane	41	3.626	4.639	125	320-V3	3.6	12.2	stream 212 = 12, inlet stream from 320-V4 = 2			1 pressure vessel; 1 valve	

No.	Isolatable Sub-section ID	Representative Material	Operating Temp (°C)	Operating Press (barg)	Operating Press (bara)	Vol. (m^3)	Equipment			Pipe		Pipe Flow Rate (kg/s)	Note	Area
							Tank ID	Diameter (m)	Height (m)	Diameter (inch)	Length (m)			
103	IS76_BENZENE_DHRBP_L	Benzene	41	3.626	4.639	125	320-V3	3.6	12.2	stream 212 = 12			1 pressure vessel; 1 pump; 1 heat exchanger; 1 valve	
104	IS77_ETHANE_DHVDTP_V	Ethane	10	3.430	4.443	2	320-V4	0.8	2.4	stream 216 = 6			1 pressure vessel; 1 valve	
105	IS77_BENZENE_DHVDBP_L	Benzene	10	3.430	4.443	2	320-V4	0.8	2.4	stream 216 = 6			1 pressure vessel; 1 heat exchanger; 1 valve	
106	IS78_BENZENE_PIPELINE_L	Benzene	40.000	6.860	7.874	11				8	330	0.5409	330m pipe (Ø0.2032m)	
107	IS79_TOLUENE_PIPELINE_L	Toluene	57.000	6.860	7.874	5				6	260	41.9685	260m pipe (Ø0.1524m)	
108	IS80_BUTANE_DBTP_V	Butane	68	3.920	4.934	80	320-V5	2.1	22.3	stream 503 = 10, stream 520 = 4			1 pressure vessel; 1 valve	Area A3 - 7,500m2
109	IS80_TOLUENE_DBBP_L	Toluene	68	3.920	4.934	80	320-V5	2.1	22.3	stream 503 = 10, stream 548 = 18			1 pressure vessel; 1 heat exchanger; 1 valve	
110	IS81_BUTANE_DBRTP_V	Butane	40	3.920	4.934	10	320-V6	1.5	4.5	stream 512 = 8			1 pressure vessel; 1 valve	
111	IS81_PENTANE_DBRBP_L	Pentane	40	3.920	4.934	10	320-V6	1.5	4.5	stream 512 = 8			1 pressure vessel; 1 heat exchanger; 1 pump; 1 valve	
112	IS82_TOLUENE_PIPELINE_L	Toluene	56	30.754	31.768	41				12	560	41.7962	560m pipe (Ø0.3048m)	
113	IS83_H2_PIPELINE_V	Hydrogen	32	31.009	32.023	12				12	170	0.1723	170m pipe (Ø0.3048m)	
114	IS84_TOLUENE_REAC12_L	Toluene	122	28.716	29.729	50	322-R1/R2	2	14.8	stream 115 = 10			2 pressure vessels; 1 heat exchanger; 5 valves	Area A3 - 7,500m2
115	IS85_TMBZ_PIPELINE_L	TMBZ	155	4.900	5.914	5				6	260	37.7553	260m pipe (Ø0.1524m)	
116	IS86_TOLUENE_PIPELINE_L	Toluene	168	5.479	6.492	6				10	110	55.9354	110m pipe (Ø0.254m)	
117	IS87_TOLUENE_FSD_L	Toluene	163	4.900	5.914	315	380-V1	5.1	15.3	inlet stream = 8			1 pressure vessel; 1 heat exchanger; 2 valves; 1 pump	Area A1 - 24,800 m2
118	IS88_H2_REAC_V	Hydrogen	501	29.990	31.003	60	380-R1	5.3	2.7	stream 120 = 24			1 pressure vessel; 2 heat exchangers; 1 valve	
119	IS89_H2_PIPELINE_V	Hydrogen	32	29.490	30.503	13				8	408	0.5822	408m pipe (Ø0.2032m)	
120	IS90_H2_SEPTP_V	Hydrogen	40	27.540	28.553	40	380-V2	2.5	7.6	stream 124 = 18			1 pressure vessel; 1 valve	Area A1 - 24,800 m2

No.	Isolatable Sub-section ID	Representative Material	Operating Temp (°C)	Operating Press (barg)	Operating Press (bara)	Vol. (m^3)	Equipment			Pipe		Pipe Flow Rate (kg/s)	Note	Area
							Tank ID	Diameter (m)	Height (m)	Diameter (inch)	Length (m)			
121	IS90_AROMATICS_SEPBP_L	n-Octane	40	27.540	28.553	40	380-V2	2.5	7.6	stream 124 = 18			1 pressure vessel; 1 heat exchanger; 1 valve	
122	IS91_HEXANE_STP_V	Hexane	209	5.978	6.992	470	380-V3	4	37.2	stream 204 = 12, stream 225 = 6			1 pressure vessel; 1 valve	
123	IS91_TOLUENE_SBP_L	Toluene	209	5.978	6.992	470	380-V3	4	37.2	stream 204 = 12, stream 253 = 10, stream 248 = 26			1 pressure vessel; 2 heat exchangers; 1 valve	
124	IS92_ETHANE_SRTP_V	Ethane	40	5.194	6.208	40	380-V4	2.5	7.8	stream 212 = 14			1 pressure vessel; 1 valve	
125	IS92_BENZENE_SRBP_L	Benzene	40	5.194	6.208	40	380-V4	2.5	7.8	stream 212 = 14			1 pressure vessel; 1 heat exchanger; 2 pumps; 1 valve	
126	IS93_BUTANE_RSTP_V	Butane	105	0.490	1.503	755	431-V1	5.2	35.4	stream 101 = 8, stream 116 = 6			1 pressure vessel; 1 valve	Area A2 - 17,500m2
127	IS93_TOLUENE_RSBP_L	Toluene	105	0.490	1.503	755	431-V1	5.2	35.4	stream 101 = 8, stream 138 = 36			1 pressure vessel; 2 pumps; 3 valves	
128	IS94_TOLUENE_RSR_L	Toluene	56	0.098	1.111	120	431-V2	3.7	11.1	stream 110 = 10			1 pressure vessel; 1 heat exchanger, 2 pumps; 3 valves	
129	IS95_XYLENE_CT_L	Xylene	199	15.681	16.694	160	431-V3A/B	4.4	10.4	stream 159 = 6			2 pressure vessels; 4 valves	
130	IS96_XYLENE_PIPELINE_L	Xylene	218	7.125	8.138	5				10	100	116.0841	100m pipe (Ø0.254m)	
131	IS97_XYLENE_XSTP_V	Xylene	237	6.860	7.874	4,645	431-V4	8	92.4	stream 203 = 10, stream 239 = 16			1 pressure vessel; 1 valve	Area A2 - 17,500m2
132	IS97_XYLENE_XSBP_L	Xylene	237	6.860	7.874	4,645	431-V4	8	92.4	stream 163 = 8, stream 285 = 28			1 pressure vessel; 3 pumps; 1 valve	
133	IS98_PENTANE_KOD_L	Pentane	86	3.626	4.639	6	431-V14	1.5	3.1	inlet stream = 6			1 pressure vessel; 1 heat exchanger; 3 valves	
134	IS99_XYLENE_XSR_L	Xylene	227	5.586	6.600	315	431-V6	5.2	14.8	stream 229 = 24			1 pressure vessel; 2 pumps; 1 valve	
135	IS100_XYLENE_PFSD_L	Xylene	227	6.664	7.678	3	431-V7	0.5	15	stream 236 = 10			19 pressure vessel; 1 valve	
144	IS107_TMBZ_PIPELINE_L	TMBZ	155	7.037	8.050	1				6	80	37.7615	80m pipe (Ø0.1524m)	
145	IS108_TTMBZ_PIPELINE_L	TTMBZ	46	3.450	4.463	2				2	798	0.8054	798m pipe (Ø0.0508m)	
146	IS109_TOLUENE_PIPELINE_L	Toluene	38	0.008	1.021	3				6	170	31.9807	170m pipe (Ø0.1524m)	
147	IS110_TOLUENE_TANK_L	Toluene	38	0.005	1.018	1,475	432-TK1	12.5	12	stream 100 = 6			1 tank; 2 pumps; 1 valve	Area A1 - 24,800 m2

No.	Isolatable Sub-section ID	Representative Material	Operating Temp (°C)	Operating Press (barg)	Operating Press (bara)	Vol. (m^3)	Equipment			Pipe		Pipe Flow Rate (kg/s)	Note	Area
							Tank ID	Diameter (m)	Height (m)	Diameter (inch)	Length (m)			
148	IS111_TOLUENE_CT_L	Toluene	199	14.211	15.224	60	432-V1A/B	3.4	6.6	stream 109 = 6			2 pressure vessel; 5 valves; 1 heat exchanger	
149	IS112_TOLUENE_PIPELINE_L	Toluene	157	3.332	4.345	16				8	500	88.0907	500m pipe (Ø0.2032m)	
150	IS113_TOLUENE_PIPELINE_L	Toluene	66	3.234	4.247	8				6	440	0.2524	440m pipe (Ø0.1524m)	
151	IS114_BENZENE_BCTP_V	Benzene	152	0.686	1.699	860	432-V2	4.9	45.5	stream 203 = 18, stream 216 = 8			1 pressure vessel; 1 heat exchanger; 2 pumps; 1 valve	Area A1 - 24,800 m2
152	IS114_TOLUENE_BCBP_L	Toluene	152	0.686	1.699	860	432-V2	4.9	45.5	stream 203 = 18, stream 238= 36			1 pressure vessel; 2 pumps; 2 valves	
153	IS115_BENZENE_BCR_L	Benzene	59	0.098	1.111	285	432-V3	4.9	15	stream 210 = 12			1 pressure vessel; 2 pumps; 1 valve; 1 heat exchanger	
154	IS116_TOLUENE_TCTP_V	Toluene	232	4.508	5.522	1,135	432-V4	5.7	44.4	stream 249 = 8, stream 316 = 10			1 pressure vessel	
155	IS116_TOLUENE_TCBP_L	Toluene	232	4.508	5.522	1,135	432-V4	5.7	44.4	stream 249 = 8, stream 337 = 30			1 pressure vessel; 2 pumps; 1 valve	
156	IS117_TOLUENE_TCR_L	Toluene	168	0.098	1.111	105	432-V5	3.4	11.2	stream 309 = 10, stream 329 = 12			1 pressure vessel; 2 pumps; 2 valves; 1 heat exchanger	
158	IS119_DEBZ_ADC1_L	DEBZ	156	13.035	14.048	720	500-V1	7.4	16.7	inlet stream = 16, inlet stream = 8			1 pressure vessel; 4 valves; 2 pumps	Area A2 - 17,500m2
159	IS120_DEBZ_ADC2_L	DEBZ	156	13.035	14.048	720	500-V2	7.4	16.7	inlet stream = 16, inlet stream = 8			1 pressure vessel; 4 valves; 2 pumps	
160	IS121_XYLENE_RCTP_V	Xylene	148	0.294	1.307	2,225	500-V3	7.6	49	stream 412= 20, stream 545 = 10, stream 428 = 12			1 pressure vessel; 1 valve	
161	IS121_DEBZ_RCBP_L	DEBZ	148	0.294	1.307	2,225	500-V3	7.6	49	stream 412= 20, stream 545 = 10, stream 238 = 2			1 pressure vessel; 2 pumps; 1 heat exchanger; 1 valve	
162	IS122_XYLENE_RCSCSD_L	Xylene	150	0.392	1.405	130	500-V4	3.8	11.4	inlet stream = 16			1 pressure vessel; 1 valve	
163	IS123_XYLENE_RCR_L	Xylene	121	0.098	1.111	140	500-V5	3.8	12	stream 423 = 6, stream 449 = 2			1 pressure vessel; 1 heat exchanger; 2 pumps; 2 valves	
164	IS124_XYLENE_RCVD_L	Xylene	40	0.098	1.111	2	500-V6	0.9	3	stream 447= 6			1 pressure vessel; 1 heat exchanger; 1 valve	
165	IS125_XYLENE_ECTP_V	Xylene	146	0.196	1.209	790	500-V7	5.4	34.5	stream 310= 16, stream 319 = 8			1 pressure vessel; 1 valve	
166	IS125_DEBZ_ECBP_L	DEBZ	146	0.196	1.209	790	500-V7	5.4	34.5	stream 310= 16, stream 278 = 2			1 pressure vessel; 2 pumps; 1 heat exchanger; 2 valves	

No.	Isolatable Sub-section ID	Representative Material	Operating Temp (°C)	Operating Press (barg)	Operating Press (bara)	Vol. (m^3)	Equipment			Pipe		Pipe Flow Rate (kg/s)	Note	Area
							Tank ID	Diameter (m)	Height (m)	Diameter (inch)	Length (m)			
167	IS126_XYLENE_ECR_L	Xylene	121	0.098	1.111	60	500-V8	3	8	stream 313 = 12			1 pressure vessel; 1 valve; 1 heat exchanger; 2 pumps	
168	IS127_TOLUENE_FCTP_V	Toluene	117	0.196	1.209	345	500-V9	3.5	35.5	stream 324 = 6, stream 335 = 6			1 pressure vessel; 1 valve	
169	IS127_XYLENE_FCBP_L	Xylene	117	0.196	1.209	345	500-V9	3.5	35.5	stream 324= 6, stream 367 = 24			1 pressure vessel; 2 pumps; 2 heat exchangers; 1 valve	
170	IS128_TOLUENE_FCR_L	Toluene	66	0.098	1.111	45	500-V10	2.5	8.5	stream 327 = 8			1 pressure vessel; 1 heat exchanger; 2 pumps; 1 valve	
171	IS129_DEBZ_DRC_L	DEBZ	204	0.588	1.601	20	500-V11	1.4	12.5	stream 512 = 3, stream 537 = 16			1 pressure vessel; 1 valve	
172	IS130_DEBZ_TANK_L	DEBZ	35	0.001	1.015	2,000	500-TK1	14	13	inlet stream = 8			1 tank; 1 valve; 2 pumps	
173	IS131_DEBZ_TANK_L	DEBZ	35	0.001	1.015	3,860	500-TK2	17	17	inlet stream = 8			1 tank; 1 heat exchanger ; 2 pumps	
174	IS132_PXYLENE_TANK_L	Paraxylene	40	0.001	1.015	3,860	500-TK3A/B	17	17	inlet stream = 6			2 tanks; 2 pumps	
175	IS133_DEBZ_PSD_L	DEBZ	40	0.098	1.111	25	500-V12	2.2	6.6	inlet stream = 8, 6, 3			1 pressure vessel; 4 pumps; 1 heat exchanger; 1 valve	
176	IS134_BENZENE_TANK_L	Benzene	40	0.005	1.018	4,140	541-TK1	17.6	17	inlet stream = 10			1 tank	Area A1 - 24,800 m2
177	IS135_HEXANE_EDCTP_V	Hexane	174	1.470	2.483	765	541-V1	4.5	48	stream 270 = 10, stream 178 = 3			1 pressure vessel; 1 valve	
178	IS135_SULFO_EDCBP_L	Sulfolane	174	1.470	2.483	765	541-V1	4.5	48	Stream 107 = 6, stream 183 = 1, stream 193 = 3			1 pressure vessel; 4 pumps; 1 heat exchanger; 3 valves	
179	IS136_HEXANE_EDCR_L	Hexane	49	0.490	1.503	40	541-V2	2.5	8	stream 165 = 6			1 pressure vessel; 1 heat exchanger; 2 pumps; 1 valve	
180	IS137_BENZENE_PIPELINE_L	Benzene	40	3.391	4.404	2				4	230	13.5407	230m pipe (Ø0.1016m)	
181	IS138_BENZENE_RCTP_V	Benzene	174	-0.490	0.523	350	541-V3	3.7	32.3	stream 197 = 12, stream 216 = 4			1 pressure vessel; 1 valve	
182	IS138_SULFO_RCBP_L	Sulfolane	174	-0.490	0.523	350	541-V3	3.7	32.3	stream 305 = 10			1 pressure vessel; 2 pumps	Area A1 - 24,800 m2
183	IS139_TOLUENE_RCR_L	Toluene	38	-0.686	0.327	125	541-V4	3.6	11.9	stream 204 = 8			1 pressure vessel; 1 heat exchanger; 4 pumps; 2 valves)	

No.	Isolatable Sub-section ID	Representative Material	Operating Temp (°C)	Operating Press (barg)	Operating Press (bara)	Vol. (m^3)	Equipment			Pipe		Pipe Flow Rate (kg/s)	Note	Area
							Tank ID	Diameter (m)	Height (m)	Diameter (inch)	Length (m)			
184	IS140_SULFO_SS_L	Sulfolane	180	0.000	1.013	25	541-V7	2.1	6.4	inlet stream = 6			1 pressure vessel; 1 valve	
185	IS141_SULFO_TANK_L	Sulfolane	40	0.004900325	1.018	550	541-TK2	8.8	9	inlet stream = 4			1 pressure vessel; 2 pumps; 1 heat exchanger; 2 valves	
188	IS144_H2S_ARR_V	Hydrogen Sulfide	40	0.980	1.993	1	640-V3	0.75	2.3	stream 107 = 4			1 pressure vessel; 1 heat exchanger; 1 valve	Area C2 - 25,800m^2
189	IS145_H2S_SWSR_V	Hydrogen Sulfide	88	1.372	2.385	7	650-V3	1.4	4.2	stream 109 = 4			1 pressure vessel; 1 heat exchanger; 1 valve	
190	IS146_COND_TANK_L	n-Octane	40	0.000	1.013	43,400	800-TK1A-C	47	25	inlet stream = 36			1. 3 tanks (ID: 46.59m, H: 24.38m) 2. bund size 25,550m2	Tank Farm Areas
191	IS147_PXYLENE_TANK_L	Paraxylene	40	0.000	1.013	12,850	810-TK1A-E	31	17	inlet stream = 12			1. 5 tanks (ID: 31.06m, H: 16.45m) 2. Bund size 17,500m2	
192	IS148_BENZENE_TANK_L	Benzene	40	0.000	1.013	8,500	812-TK1A-D	26	16	inlet stream = 8			1. 4 tanks (ID: 26.21m, H: 15.24m) 2. Bund size 17,500m2	
194	IS150_KEROSENE_TANK_L	n-Nonane	40	0.000	1.013	49,100	820-TK1A,B	50	25	inlet stream = 10			1. 2 tanks (ID: 49.5m, H: 24.38m) 2. Bund size 17,500m2	
195	IS151_DIESEL_TANK_L	Dodecane	40	0.000	1.013	49,100	825-TK1A,B	50	25	inlet stream = 6			1. 2 tanks (ID: 49.5m, H: 24.38m) 2. Bund size 17,500m2	
196	IS152_NAPHTHA_TANK_L	Light n-Hexane	40	0.000	1.013	33,500	830-TK1A,B	44	22	inlet stream = 12			1. 2 tanks (ID: 43.68m, H: 21.34m) 2. Bund size 17,500m2	
198	IS154_FUEL_TANK_L	Dodecane	70	ATM	ATM	12,100	833-TK1A,B	31	16	inlet stream = 8			1. 2 tanks (ID: 31.06m, H: 16.45m) 2. Bund size 17,500m2	
199	IS155_PROPANE_TANK_V	Propane	40	12.672	13.685	4,850	840-TK1A,B	21	Ball Tank	inlet stream = 3			1. 2 tanks (ID: 21m, H: ball tank) 2. Bund size 3,700m2	
200	IS156_BUTANE_TANK_V	Butane	40	3.273	4.287	4,850	842-TK1A-D	21	Ball Tank	inlet stream = 4			1. 4 tanks (ID: 21m, H: ball tank) 2. Bund size 3,700m2	
201	IS157_LPG_TANK_V	LPG	40	12.672	13.685	1,770	841-TK1	15	Ball Tank	inlet stream = 4			1. 1 tank (ID: 15m, H: ball tank) 2. Bund size 3,700m2	
202	IS158_PENTANE_TANK_V	Pentane	40	ATM	ATM	4,850	843-TK1A,B	21	Ball Tank	inlet stream = 4			1. 2 tanks (ID: 21m, H: ball tank) 2. Bund size 3,700m2	
204	IS160_SONAPHTHA_TANK_L	Sour n-Hexane	40	ATM	ATM	17,320	850-TK1	35	18	inlet stream = 16			1. 1 tank (ID: 34.95m, H: 18.28m) 2. Bund size 21,800m2	
205	IS161_SWNAPHTHA_TANK_L	Sweet n-Hexane	40	ATM	ATM	23,850	851-TK1	38	21	inlet stream = 16			1. 1 tank (ID: 37.85m, H: 21.34m) 2. Bund size 21,800m2	
206	IS162_AROMATICS_TANK_L	n-Octane	40	ATM	ATM	20,420	431-TK1	38	18	inlet stream = 8			1. 1 tank (ID: 37.85m, H: 18.28m) 2. Bund size 21,800m2	

No.	Isolatable Sub-section ID	Representative Material	Operating Temp (°C)	Operating Press (barg)	Operating Press (bara)	Vol. (m^3)	Equipment			Pipe		Pipe Flow Rate (kg/s)	Note	Area
							Tank ID	Diameter (m)	Height (m)	Diameter (inch)	Length (m)			
211	IS167_BENZENE_TANK_L	Benzene	40.0000	0.005	1.018	2,060	432-TK2A/B	13.4	14.6	stream 244 = 4,4			1. 2 tanks (ID: 13.4m, H: 14.6m) 2. bund size 21,800m2	

APPENDIX D

Event Tree Calculations

Scenario	Release Rate	Base Frequency [/yr]	Immediate Ignition Probability	Delayed Ignition Probability	Total Ignition Probability	Pool Fire	Jet Fire	Fireball (BLEVE)	VCE (BLEVE)	VCE	Flash Fire	Toxic Dispersion
001_COND_pipe_B	229	2.27E-04	0.001	0.129	0.13	2.27E-07	-	-	-	-	-	-
001_COND_pipe_C	229	7.93E-05	0.001	0.129	0.13	7.93E-08	-	-	-	-	-	-
002_NAPHTHA_pipe_A	1.3428	2.22E-04	0.001	0.0035	0.0045	2.22E-07	-	-	-	-	-	-
002_NAPHTHA_pipe_B	1.3428	1.32E-04	0.001	0.0035	0.0045	1.32E-07	-	-	-	-	-	-
002_NAPHTHA_pipe_C	1.3428	6.60E-05	0.001	0.0035	0.0045	6.60E-08	-	-	-	-	-	-
003_100V018_A	0.833432792	5.00E-04	0.001	0.0015	0.0025	5.00E-07	-	-	-	3.00E-07	4.50E-07	-
003_100V018_B	20.8358198	2.15E-04	0.001	0.066	0.067	2.15E-07	-	-	-	5.68E-06	8.51E-06	-
003_100V018_C	123052.2527	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	3.10E-07	4.64E-07	-
004_100V009_A	2.852354689	7.10E-04	0.001	0.0087	0.0097	7.10E-07	-	-	-	-	-	-
004_100V009_B	71.30886722	3.05E-04	0.001	0.119	0.12	3.05E-07	-	-	-	-	-	-
004_100V009_C	71305.87392	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
005_100V005_A	0.442837838	3.25E-03	0.001	0.0009	0.0019	3.25E-06	3.25E-06	3.25E-06	1.17E-06	1.17E-06	1.76E-06	-
005_100V005_B	11.07094595	3.56E-04	0.001	0.03	0.031	3.56E-07	3.56E-07	3.56E-07	4.27E-06	4.27E-06	6.41E-06	-
005_100V005_C	156810.3987	6.00E-06	0.001	0.129	0.13	6.00E-09	6.00E-09	6.00E-09	3.10E-07	3.10E-07	4.64E-07	-
006_100V001_A	0.027410831	2.90E-04	0.001	0	0.001	-	2.90E-07	-	-	0.00E+00	0.00E+00	-
006_100V001_B	0.663101942	1.25E-04	0.001	0.0015	0.0025	-	1.25E-07	-	-	7.50E-08	1.13E-07	-
006_100V001_C	3137.031885	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
007_100V001_A	1.056147427	2.90E-04	0.001	0.0035	0.0045	2.90E-07	-	-	-	-	-	-
007_100V001_B	26.40368567	1.25E-04	0.001	0.066	0.067	1.25E-07	-	-	-	-	-	-
007_100V001_C	521700.2672	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
008_100V010_A	1.886172058	4.30E-04	0.001	0.0035	0.0045	4.30E-07	4.30E-07	4.30E-07	6.02E-07	6.02E-07	9.03E-07	-
008_100V010_B	47.15430144	1.85E-04	0.001	0.066	0.067	1.85E-07	1.85E-07	1.85E-07	4.88E-06	4.88E-06	7.33E-06	-
008_100V010_C	25612.27136	6.00E-06	0.001	0.129	0.13	6.00E-09	6.00E-09	6.00E-09	3.10E-07	3.10E-07	4.64E-07	-
009_100V004_A	1.399391535	1.00E-05	0.001	0.0035	0.0045	1.00E-08	1.00E-08	1.00E-08	1.40E-08	1.40E-08	2.10E-08	-
009_100V004_B	34.98478837	5.00E-06	0.001	0.066	0.067	5.00E-09	5.00E-09	5.00E-09	1.32E-07	1.32E-07	1.98E-07	-
009_100V004_C	558679.0887	6.00E-06	0.001	0.129	0.13	6.00E-09	6.00E-09	6.00E-09	3.10E-07	3.10E-07	4.64E-07	-
010_100V004_A	1.483433735	3.11E-03	0.001	0.0035	0.0045	3.11E-06	3.11E-06	3.11E-06	4.35E-06	4.35E-06	6.53E-06	-
010_100V004_B	37.08584338	2.96E-04	0.001	0.066	0.067	2.96E-07	2.96E-07	2.96E-07	7.81E-06	7.81E-06	1.17E-05	-
010_100V004_C	615961.7267	6.00E-06	0.001	0.129	0.13	6.00E-09	6.00E-09	6.00E-09	3.10E-07	3.10E-07	4.64E-07	-
011_100V007_A	1.265179851	3.74E-03	0.001	0.0035	0.0045	3.74E-06	3.74E-06	3.74E-06	5.24E-06	5.24E-06	7.85E-06	-
011_100V007_B	31.62949627	5.66E-04	0.001	0.066	0.067	5.66E-07	5.66E-07	5.66E-07	1.49E-05	1.49E-05	2.24E-05	-
011_100V007_C	23844.71598	6.00E-06	0.001	0.129	0.13	6.00E-09	6.00E-09	6.00E-09	3.10E-07	3.10E-07	4.64E-07	-
012_100V002_A	0.034971132	1.00E-05	0.001	0	0.001	-	1.00E-08	-	-	0.00E+00	0.00E+00	-
012_100V002_B	0.846072657	5.00E-06	0.001	0.0015	0.0025	-	5.00E-09	-	-	3.00E-09	4.50E-09	-
012_100V002_C	3992.741627	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
013_100V002_A	1.089236231	8.61E-03	0.001	0.0035	0.0045	8.61E-06	-	-	-	-	-	-
013_100V002_B	27.23090579	5.77E-04	0.001	0.066	0.067	5.77E-07	-	-	-	-	-	-
013_100V002_C	37582.19416	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
014_100V003_A	0.032842247	1.00E-05	0.001	0	0.001	-	1.00E-08	-	-	0.00E+00	0.00E+00	-
014_100V003_B	0.79618299	5.00E-06	0.001	0.0015	0.0025	-	5.00E-09	-	-	3.00E-09	4.50E-09	-
014_100V003_C	243.2404391	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
015_100V003_A	0.03861626	6.40E-04	0.001	0	0.001	6.40E-07	-	-	-	-	-	-
015_100V003_B	0.79618299	2.75E-04	0.001	0.0015	0.0025	2.75E-07	-	-	-	-	-	-

Scenario	Release Rate	Base Frequency [/yr]	Immediate Ignition Probability	Delayed Ignition Probability	Total Ignition Probability	Pool Fire	Jet Fire	Fireball (BLEVE)	VCE (BLEVE)	VCE	Flash Fire	Toxic Dispersion
015_100V003_C	243.2404391	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
016_100V006_A	0.706267867	1.08E-02	0.001	0.0015	0.0025	1.08E-05	-	-	-	-	-	-
016_100V006_B	17.65669667	4.78E-04	0.001	0.03	0.031	4.78E-07	-	-	-	-	-	-
016_100V006_C	58606.25641	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
017_110V008_A	1.703024895	1.50E-04	0.001	0.0035	0.0045	-	1.50E-07	-	-	2.10E-07	3.15E-07	-
017_110V008_B	42.57562238	6.50E-05	0.001	0.066	0.067	-	6.50E-08	-	-	1.72E-06	2.57E-06	-
017_110V008_C	15895.6349	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
018_110V001_A	1.633779323	6.40E-04	0.001	0.0035	0.0045	-	6.40E-07	-	-	8.96E-07	1.34E-06	-
018_110V001_B	40.84448306	2.75E-04	0.001	0.066	0.067	-	2.75E-07	-	-	7.26E-06	1.09E-05	-
018_110V001_C	29142.39595	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
019_110V006_A	1.280153108	5.00E-04	0.001	0.0035	0.0045	5.00E-07	-	-	-	-	-	-
019_110V006_B	32.00382771	2.15E-04	0.001	0.066	0.067	2.15E-07	-	-	-	-	-	-
019_110V006_C	696.9151969	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
020_Propane_pipe_A	5.2971	2.82E-04	0.001	0.012	0.013	2.82E-07	-	-	-	-	-	-
020_Propane_pipe_B	5.2971	1.68E-04	0.001	0.012	0.013	1.68E-07	-	-	-	-	-	-
020_Propane_pipe_C	5.2971	8.40E-05	0.001	0.012	0.013	8.40E-08	-	-	-	-	-	-
022_Butane_pipe_A	11.223	1.30E-03	0.001	0.03	0.031	1.30E-06	-	-	-	-	-	-
022_Butane_pipe_B	11.223	7.76E-04	0.001	0.03	0.031	7.76E-07	-	-	-	-	-	-
022_Butane_pipe_C	11.223	3.88E-04	0.001	0.03	0.031	3.88E-07	-	-	-	-	-	-
023_115V001_A	0.321744381	1.00E-05	0.001	0.0009	0.0019	-	1.00E-08	-	-	3.60E-09	5.40E-09	-
023_115V001_B	7.349096977	5.00E-06	0.001	0.012	0.013	-	5.00E-09	-	-	2.40E-08	3.60E-08	-
023_115V001_C	3214.214632	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
024_115V001_A	2.712235208	2.90E-03	0.001	0.0087	0.0097	2.90E-06	-	-	-	-	-	-
024_115V001_B	67.80588021	2.51E-04	0.001	0.119	0.12	2.51E-07	-	-	-	-	-	-
024_115V001_C	43266.44484	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
025_115V002_A	0.30417804	2.76E-03	0.001	0.0009	0.0019	-	2.76E-06	-	-	9.94E-07	1.49E-06	-
025_115V002_B	7.576668316	1.91E-04	0.001	0.012	0.013	-	1.91E-07	-	-	9.17E-07	1.38E-06	-
025_115V002_C	243.3278861	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
027_115V003_A	0.224720378	1.00E-05	0.001	0.0009	0.0019	-	1.00E-08	-	-	3.60E-09	5.40E-09	-
027_115V003_B	5.150986069	5.00E-06	0.001	0.012	0.013	-	5.00E-09	-	-	2.40E-08	3.60E-08	-
027_115V003_C	2522.373397	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
028_115V003_A	2.07546514	2.90E-03	0.001	0.0087	0.0097	2.90E-06	-	-	-	-	-	-
028_115V003_B	51.8866285	2.51E-04	0.001	0.119	0.12	2.51E-07	-	-	-	-	-	-
028_115V003_C	38650.03083	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
029_115V004_A	1.834832758	6.00E-03	0.001	0.0035	0.0045	6.00E-06	-	-	-	-	-	-
029_115V004_B	45.87081894	4.96E-04	0.001	0.066	0.067	4.96E-07	-	-	-	-	-	-
029_115V004_C	10404.90504	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
030_Propane_pipe_A	3.3091	1.12E-03	0.001	0.0087	0.0097	1.12E-06	-	-	-	-	-	-
030_Propane_pipe_B	3.3091	6.64E-04	0.001	0.0087	0.0097	6.64E-07	-	-	-	-	-	-
030_Propane_pipe_C	3.3091	3.32E-04	0.001	0.0087	0.0097	3.32E-07	-	-	-	-	-	-
031_120V001_A	2.106920784	7.10E-04	0.001	0.0087	0.0097	7.10E-07	-	-	-	-	-	-
031_120V001_B	52.67301961	3.05E-04	0.001	0.119	0.12	3.05E-07	-	-	-	-	-	-
031_120V001_C	3349.734965	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-

Scenario	Release Rate	Base Frequency [/yr]	Immediate Ignition Probability	Delayed Ignition Probability	Total Ignition Probability	Pool Fire	Jet Fire	Fireball (BLEVE)	VCE (BLEVE)	VCE	Flash Fire	Toxic Dispersion
032_120V002_A	2.123691841	1.50E-04	0.001	0.0087	0.0097	1.50E-07	-	-	-	-	-	-
032_120V002_B	53.09229602	6.50E-05	0.001	0.119	0.12	6.50E-08	-	-	-	-	-	-
032_120V002_C	30147.61468	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
033_120R001_A	2.086274079	1.50E-04	0.001	0.0087	0.0097	1.50E-07	-	-	-	-	-	-
033_120R001_B	52.15685197	6.50E-05	0.001	0.119	0.12	6.50E-08	-	-	-	-	-	-
033_120R001_C	110541.2538	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
034_120V003_A	1.978898155	1.50E-04	0.001	0.0035	0.0045	1.50E-07	-	-	-	-	-	-
034_120V003_B	49.47245388	6.50E-05	0.001	0.066	0.067	6.50E-08	-	-	-	-	-	-
034_120V003_C	50246.02447	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
035_120V004_A	1.964317692	1.50E-04	0.001	0.0035	0.0045	1.50E-07	-	-	-	-	-	-
035_120V004_B	49.1079423	6.50E-05	0.001	0.066	0.067	6.50E-08	-	-	-	-	-	-
035_120V004_C	43546.55454	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
036_120V005_A	1.923248108	7.20E-04	0.001	0.0035	0.0045	7.20E-07	-	-	-	-	-	-
036_120V005_B	48.0812027	3.10E-04	0.001	0.066	0.067	3.10E-07	-	-	-	-	-	-
036_120V005_C	40196.81958	1.20E-05	0.001	0.129	0.13	1.20E-08	-	-	-	-	-	-
037_120V006_A	1.810964392	1.00E-03	0.001	0.0035	0.0045	1.00E-06	-	-	-	-	-	-
037_120V006_B	45.27410979	4.30E-04	0.001	0.066	0.067	4.30E-07	-	-	-	-	-	-
037_120V006_C	87093.10909	1.20E-05	0.001	0.129	0.13	1.20E-08	-	-	-	-	-	-
038_KERO_pipe_B	43.0729	5.84E-05	0.001	0.066	0.067	5.84E-08	-	-	-	-	-	-
038_KERO_pipe_C	43.0729	2.92E-05	0.001	0.066	0.067	2.92E-08	-	-	-	-	-	-
039_130ME001_A	1.601712763	4.30E-04	0.001	0.0035	0.0045	4.30E-07	-	-	-	-	-	-
039_130ME001_B	40.04281907	1.85E-04	0.001	0.066	0.067	1.85E-07	-	-	-	-	-	-
039_130ME001_C	21069.0291	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
040_Dodecane_pipe_B	36.8651	1.13E-04	0.001	0.066	0.067	1.13E-07	-	-	-	-	-	-
040_Dodecane_pipe_C	36.8651	5.64E-05	0.001	0.066	0.067	5.64E-08	-	-	-	-	-	-
041_130V001_A	1.10869268	8.50E-04	0.001	0.0035	0.0045	8.50E-07	-	-	-	-	-	-
041_130V001_B	27.71731699	3.65E-04	0.001	0.066	0.067	3.65E-07	-	-	-	-	-	-
041_130V001_C	15792.89557	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
042_130R001_A	0.139436817	8.26E-03	0.001	0.0003	0.0013	-	8.26E-06	-	-	9.91E-07	1.49E-06	-
042_130R001_B	3.361973873	4.27E-04	0.001	0.0087	0.0097	-	4.27E-07	-	-	1.49E-06	2.23E-06	-
042_130R001_C	5111.49504	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
043_130R002_A	0.137395111	1.50E-04	0.001	0.0003	0.0013	-	1.50E-07	-	-	1.80E-08	2.70E-08	-
043_130R002_B	3.235451797	6.50E-05	0.001	0.0087	0.0097	-	6.50E-08	-	-	2.26E-07	3.39E-07	-
043_130R002_C	328.7825966	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
045_130V003_A	0.154189089	2.90E-03	0.001	0.0003	0.0013	-	2.90E-06	-	-	3.48E-07	5.22E-07	-
045_130V003_B	3.82514232	2.06E-04	0.001	0.0087	0.0097	-	2.06E-07	-	-	7.17E-07	1.08E-06	-
045_130V003_C	109.6890037	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
047_130V004_A	0.047444614	2.90E-04	0.001	0	0.001	-	2.90E-07	-	-	0.00E+00	0.00E+00	-
047_130V004_B	1.161124833	1.25E-04	0.001	0.0035	0.0045	-	1.25E-07	-	-	1.75E-07	2.63E-07	-
047_130V004_C	66.36304882	6.00E-06	0.001	0.119	0.12	-	6.00E-09	-	-	2.86E-07	4.28E-07	-
049_130V005_A	0.151702697	7.98E-03	0.001	0.0003	0.0013	-	7.98E-06	-	-	9.58E-07	1.44E-06	-
049_130V005_B	3.790888662	3.07E-04	0.001	0.0087	0.0097	-	3.07E-07	-	-	1.07E-06	1.60E-06	-
049_130V005_C	12.9294782	6.00E-06	0.001	0.03	0.031	-	6.00E-09	-	-	7.20E-08	1.08E-07	-

Scenario	Release Rate	Base Frequency [/yr]	Immediate Ignition Probability	Delayed Ignition Probability	Total Ignition Probability	Pool Fire	Jet Fire	Fireball (BLEVE)	VCE (BLEVE)	VCE	Flash Fire	Toxic Dispersion
050_Hydrogen_pipe_A	0.5491	3.66E-04	0.001	0.0015	0.0025	-	3.66E-07	-	-	2.20E-07	3.29E-07	-
050_Hydrogen_pipe_B	0.5491	2.30E-04	0.001	0.0015	0.0025	-	2.30E-07	-	-	1.38E-07	2.07E-07	-
050_Hydrogen_pipe_C	0.5491	1.15E-04	0.001	0.0015	0.0025	-	1.15E-07	-	-	6.90E-08	1.04E-07	-
051_130V006_A	0.083694612	5.37E-03	0.001	0	0.001	-	5.37E-06	-	-	0.00E+00	0.00E+00	-
051_130V006_B	2.091834754	2.26E-04	0.001	0.0087	0.0097	-	2.26E-07	-	-	7.86E-07	1.18E-06	-
051_130V006_C	4.919879363	6.00E-06	0.001	0.0087	0.0097	-	6.00E-09	-	-	2.09E-08	3.13E-08	-
052_130V007_A	0.016007704	1.50E-04	0.001	0	0.001	-	1.50E-07	-	-	0.00E+00	0.00E+00	-
052_130V007_B	0.39998767	6.50E-05	0.001	0.0009	0.0019	-	6.50E-08	-	-	2.34E-08	3.51E-08	-
052_130V007_C	17.83170428	6.00E-06	0.001	0.03	0.031	-	6.00E-09	-	-	7.20E-08	1.08E-07	-
053_130V007_A	1.483444517	5.37E-03	0.001	0.0035	0.0045	5.37E-06	-	-	-	-	-	-
053_130V007_B	37.08611293	2.26E-04	0.001	0.066	0.067	2.26E-07	-	-	-	-	-	-
053_130V007_C	26179.62371	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
054_130V008_A	0.052450262	1.40E-04	0.001	0	0.001	-	1.40E-07	-	-	0.00E+00	0.00E+00	-
054_130V008_B	1.311114888	6.00E-05	0.001	0.0035	0.0045	-	6.00E-08	-	-	8.40E-08	1.26E-07	-
055_130V008_A	1.476507072	2.90E-03	0.001	0.0035	0.0045	2.90E-06	-	-	-	-	-	-
055_130V008_B	36.91267681	2.06E-04	0.001	0.066	0.067	2.06E-07	-	-	-	-	-	-
055_130V008_C	6049.20816	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
056_130V009_A	0.341943153	8.61E-03	0.001	0.0009	0.0019	8.61E-06	-	-	-	-	-	-
056_130V009_B	8.548578819	5.77E-04	0.001	0.012	0.013	5.77E-07	-	-	-	-	-	-
056_130V009_C	15022.72373	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
057_Diesel_pipe_B	36.5027	3.12E-04	0.001	0.066	0.067	3.12E-07	-	-	-	-	-	-
057_Diesel_pipe_C	36.5027	1.56E-04	0.001	0.066	0.067	1.56E-07	-	-	-	-	-	-
059_Hydrogen_pipe_A	1.5447	6.74E-04	0.001	0.0035	0.0045	-	6.74E-07	-	-	9.44E-07	1.42E-06	-
059_Hydrogen_pipe_B	1.5447	4.01E-04	0.001	0.0035	0.0045	-	4.01E-07	-	-	5.61E-07	8.42E-07	-
059_Hydrogen_pipe_C	1.5447	2.01E-04	0.001	0.0035	0.0045	-	2.01E-07	-	-	2.81E-07	4.22E-07	-
060_130V011_A	0.018005856	2.76E-03	0.001	0	0.001	-	2.76E-06	-	-	0.00E+00	0.00E+00	-
060_130V011_B	0.450108198	1.46E-04	0.001	0.0009	0.0019	-	1.46E-07	-	-	5.26E-08	7.88E-08	-
060_130V011_C	10.20933765	6.00E-06	0.001	0.03	0.031	-	6.00E-09	-	-	7.20E-08	1.08E-07	-
061_130V012_A	0.018178608	2.90E-04	0.001	0	0.001	-	2.90E-07	-	-	0.00E+00	0.00E+00	-
061_130V012_B	0.454413357	1.25E-04	0.001	0.0009	0.0019	-	1.25E-07	-	-	4.50E-08	6.75E-08	-
061_130V012_C	1.040031493	6.00E-06	0.001	0.0035	0.0045	-	6.00E-09	-	-	8.40E-09	1.26E-08	-
062_200R001_A	0.055226333	7.98E-03	0.001	0	0.001	-	7.98E-06	-	-	0.00E+00	0.00E+00	-
062_200R001_B	1.320423252	3.07E-04	0.001	0.0035	0.0045	-	3.07E-07	-	-	4.30E-07	6.45E-07	-
062_200R001_C	111.1039364	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
063_200R001_A	0.38342069	7.98E-03	0.001	0.0009	0.0019	7.98E-06	-	-	-	-	-	-
063_200R001_B	9.585517246	3.07E-04	0.001	0.012	0.013	3.07E-07	-	-	-	-	-	-
063_200R001_C	5736.73366	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
064_200V003_A	0.070809466	1.00E-05	0.001	0	0.001	-	1.00E-08	-	-	0.00E+00	0.00E+00	-
064_200V003_B	1.614824844	5.00E-06	0.001	0.0035	0.0045	-	5.00E-09	-	-	7.00E-09	1.05E-08	-
064_200V003_C	564.2652033	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
065_200V003_A	2.766152471	1.50E-04	0.001	0.0087	0.0097	1.50E-07	-	-	-	-	-	-
065_200V003_B	69.15381179	6.50E-05	0.001	0.119	0.12	6.50E-08	-	-	-	-	-	-
065_200V003_C	181476.2448	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-

Scenario	Release Rate	Base Frequency [/yr]	Immediate Ignition Probability	Delayed Ignition Probability	Total Ignition Probability	Pool Fire	Jet Fire	Fireball (BLEVE)	VCE (BLEVE)	VCE	Flash Fire	Toxic Dispersion
066_200V004_A	0.064617584	2.76E-03	0.001	0	0.001	-	2.76E-06	-	-	0.00E+00	0.00E+00	-
066_200V004_B	1.615011857	1.46E-04	0.001	0.0035	0.0045	-	1.46E-07	-	-	2.04E-07	3.07E-07	-
066_200V004_C	7.523536044	6.00E-06	0.001	0.012	0.013	-	6.00E-09	-	-	2.88E-08	4.32E-08	-
067_200V005_A	0.181661144	1.00E-05	0.001	0.0003	0.0013	1.00E-08	-	-	-	-	-	-
067_200V005_B	4.269079794	5.00E-06	0.001	0.0087	0.0097	5.00E-09	-	-	-	-	-	-
067_200V005_C	9470.544595	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
068_200V005_A	1.796220168	3.46E-03	0.001	0.0035	0.0045	-	3.46E-06	-	-	4.84E-06	7.27E-06	-
068_200V005_B	44.9055042	4.46E-04	0.001	0.066	0.067	-	4.46E-07	-	-	1.18E-05	1.77E-05	-
068_200V005_C	168858.8561	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
069_200V006_A	1.675443113	1.50E-04	0.001	0.0035	0.0045	-	1.50E-07	-	-	2.10E-07	3.15E-07	-
069_200V006_B	41.88607783	6.50E-05	0.001	0.066	0.067	-	6.50E-08	-	-	1.72E-06	2.57E-06	-
069_200V006_C	10549.72861	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
070_200V006_A	1.753649532	5.51E-03	0.001	0.0035	0.0045	5.51E-06	-	-	-	-	-	-
070_200V006_B	43.84123829	2.86E-04	0.001	0.066	0.067	2.86E-07	-	-	-	-	-	-
070_200V006_C	11523.27663	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
071_200V007_A	1.015898494	1.50E-04	0.001	0.0035	0.0045	-	1.50E-07	-	-	2.10E-07	3.15E-07	-
071_200V007_B	25.39746236	6.50E-05	0.001	0.066	0.067	-	6.50E-08	-	-	1.72E-06	2.57E-06	-
071_200V007_C	349134.9447	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
072_200V007_A	0.040689498	3.46E-03	0.001	0	0.001	3.46E-06	-	-	-	-	-	-
072_200V007_B	0.980869692	4.46E-04	0.001	0.0015	0.0025	4.46E-07	-	-	-	-	-	-
072_200V007_C	3300.872049	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
073_200V008_A	0.654199012	3.74E-03	0.001	0.0015	0.0025	3.74E-06	-	-	-	-	-	-
073_200V008_B	16.3549753	5.66E-04	0.001	0.03	0.031	5.66E-07	-	-	-	-	-	-
073_200V008_C	27896.33398	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
074_200V009_A	0.869283322	1.50E-04	0.001	0.0015	0.0025	-	1.50E-07	-	-	9.00E-08	1.35E-07	-
074_200V009_B	21.73208305	6.50E-05	0.001	0.066	0.067	-	6.50E-08	-	-	1.72E-06	2.57E-06	-
074_200V009_C	77521.26881	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
076_200V010_A	0.638840878	6.07E-03	0.001	0.0015	0.0025	6.07E-06	-	-	-	-	-	-
076_200V010_B	15.97102194	5.26E-04	0.001	0.03	0.031	5.26E-07	-	-	-	-	-	-
076_200V010_C	14077.47092	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
077_230V001_A	1.764784281	5.51E-03	0.001	0.0035	0.0045	5.51E-06	-	-	-	-	-	-
077_230V001_B	44.11960703	2.66E-04	0.001	0.066	0.067	2.66E-07	-	-	-	-	-	-
077_230V001_C	31136.66861	1.20E-05	0.001	0.129	0.13	1.20E-08	-	-	-	-	-	-
078_300R001_A	0.010088986	2.90E-03	0.001	0	0.001	-	2.90E-06	-	-	0.00E+00	0.00E+00	-
078_300R001_B	0.251324342	2.06E-04	0.001	0.0009	0.0019	-	2.06E-07	-	-	7.42E-08	1.11E-07	-
078_300R001_C	14.36977116	6.00E-06	0.001	0.03	0.031	-	6.00E-09	-	-	7.20E-08	1.08E-07	-
079_300R002_A	0.00932409	1.50E-04	0.001	0	0.001	-	1.50E-07	-	-	0.00E+00	0.00E+00	-
079_300R002_B	0.231725354	6.50E-05	0.001	0.0009	0.0019	-	6.50E-08	-	-	2.34E-08	3.51E-08	-
079_300R002_C	14.87327718	6.00E-06	0.001	0.03	0.031	-	6.00E-09	-	-	7.20E-08	1.08E-07	-
080_300R003_A	0.008566807	1.50E-04	0.001	0	0.001	-	1.50E-07	-	-	0.00E+00	0.00E+00	-
080_300R003_B	0.212107014	6.50E-05	0.001	0.0009	0.0019	-	6.50E-08	-	-	2.34E-08	3.51E-08	-
080_300R003_C	15.84323012	6.00E-06	0.001	0.03	0.031	-	6.00E-09	-	-	7.20E-08	1.08E-07	-
081_300R004_A	0.007615963	2.76E-03	0.001	0	0.001	-	2.76E-06	-	-	0.00E+00	0.00E+00	-

Scenario	Release Rate	Base Frequency [/yr]	Immediate Ignition Probability	Delayed Ignition Probability	Total Ignition Probability	Pool Fire	Jet Fire	Fireball (BLEVE)	VCE (BLEVE)	VCE	Flash Fire	Toxic Dispersion
081_300R004_B	0.188506419	1.46E-04	0.001	0.0003	0.0013	-	1.46E-07	-	-	1.75E-08	2.63E-08	-
081_300R004_C	15.3644752	6.00E-06	0.001	0.03	0.031	-	6.00E-09	-	-	7.20E-08	1.08E-07	-
082_300V001_A	0.00942947	5.51E-03	0.001	0	0.001	-	5.51E-06	-	-	0.00E+00	0.00E+00	-
082_300V001_B	0.233874922	2.86E-04	0.001	0.0009	0.0019	-	2.86E-07	-	-	1.03E-07	1.54E-07	-
082_300V001_C	22.31703053	6.00E-06	0.001	0.066	0.067	-	6.00E-09	-	-	1.58E-07	2.38E-07	-
083_300V001_A	1.069184019	6.07E-03	0.001	0.0035	0.0045	6.07E-06	-	-	-	-	-	-
083_300V001_B	26.72960048	5.26E-04	0.001	0.066	0.067	5.26E-07	-	-	-	-	-	-
083_300V001_C	51418.26936	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
084_300V002_A	0.017198001	5.37E-03	0.001	0	0.001	-	5.37E-06	-	-	0.00E+00	0.00E+00	-
084_300V002_B	0.429913886	2.26E-04	0.001	0.0009	0.0019	-	2.26E-07	-	-	8.14E-08	1.22E-07	-
084_300V002_C	9.841854311	6.00E-06	0.001	0.012	0.013	-	6.00E-09	-	-	2.88E-08	4.32E-08	-
085_300V002_A	1.643492763	1.50E-04	0.001	0.0035	0.0045	1.50E-07	-	-	-	-	-	-
085_300V002_B	41.08731906	6.50E-05	0.001	0.066	0.067	6.50E-08	-	-	-	-	-	-
085_300V002_C	16181.15234	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
086_300V003_A	0.046749994	5.51E-03	0.001	0	0.001	-	5.51E-06	-	-	0.00E+00	0.00E+00	-
086_300V003_B	1.148032309	2.86E-04	0.001	0.0035	0.0045	-	2.86E-07	-	-	4.00E-07	6.01E-07	-
086_300V003_C	60.61233826	6.00E-06	0.001	0.119	0.12	-	6.00E-09	-	-	2.86E-07	4.28E-07	-
087_300V003_C	36671.77774	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
088_300V004_A	0.0899357	2.76E-03	0.001	0	0.001	-	2.76E-06	-	-	0.00E+00	0.00E+00	-
088_300V004_B	2.204976795	1.46E-04	0.001	0.0087	0.0097	-	1.46E-07	-	-	5.08E-07	7.62E-07	-
088_300V004_C	103.6537227	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
089_300V004_C	35856.84934	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
090_300V005_A	0.085182614	5.10E-04	0.001	0	0.001	5.10E-07	-	-	-	-	-	-
090_300V005_B	2.043673443	3.05E-04	0.001	0.0087	0.0097	3.05E-07	-	-	-	-	-	-
090_300V005_C	158.2029759	1.20E-05	0.001	0.129	0.13	1.20E-08	-	-	-	-	-	-
091_300V006_A	1.798246889	1.50E-04	0.001	0.0035	0.0045	-	1.50E-07	-	-	2.10E-07	3.15E-07	-
091_300V006_B	44.95617222	6.50E-05	0.001	0.066	0.067	-	6.50E-08	-	-	1.72E-06	2.57E-06	-
091_300V006_C	134669.3491	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
092_300V006_C	212445.3655	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
093_300V007_A	1.720600251	7.98E-03	0.001	0.0035	0.0045	7.98E-06	-	-	-	-	-	-
093_300V007_B	43.01500628	3.07E-04	0.001	0.066	0.067	3.07E-07	-	-	-	-	-	-
093_300V007_C	15824.49788	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
094_300V007_A	1.800762154	9.90E-04	0.001	0.0035	0.0045	-	9.90E-07	-	-	1.39E-06	2.08E-06	-
094_300V007_B	45.01905386	4.25E-04	0.001	0.066	0.067	-	4.25E-07	-	-	1.12E-05	1.68E-05	-
094_300V007_C	17284.88859	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
095_300V008_A	2.926816466	8.60E-04	0.001	0.0087	0.0097	8.60E-07	-	-	-	-	-	-
095_300V008_B	73.17041166	3.70E-04	0.001	0.119	0.12	3.70E-07	-	-	-	-	-	-
095_300V008_C	5274.22459	1.20E-05	0.001	0.129	0.13	1.20E-08	-	-	-	-	-	-
096_320R001_A	0.024022379	5.51E-03	0.001	0	0.001	5.51E-06	-	-	-	-	-	-
096_320R001_B	0.592427222	2.86E-04	0.001	0.0015	0.0025	2.86E-07	-	-	-	-	-	-
096_320R001_C	30.39249204	6.00E-06	0.001	0.066	0.067	6.00E-09	-	-	-	-	-	-
097_320V001_A	0.03213927	2.76E-03	0.001	0	0.001	-	2.76E-06	-	-	0.00E+00	0.00E+00	-
097_320V001_B	0.781644415	1.46E-04	0.001	0.0015	0.0025	-	1.46E-07	-	-	8.76E-08	1.31E-07	-

Scenario	Release Rate	Base Frequency [/yr]	Immediate Ignition Probability	Delayed Ignition Probability	Total Ignition Probability	Pool Fire	Jet Fire	Fireball (BLEVE)	VCE (BLEVE)	VCE	Flash Fire	Toxic Dispersion
097_320V001_C	58.79689608	6.00E-06	0.001	0.119	0.12	-	6.00E-09	-	-	2.86E-07	4.28E-07	-
098_320V001_A	2.244189798	2.76E-03	0.001	0.0087	0.0097	2.76E-06	-	-	-	-	-	-
098_320V001_B	56.10474494	1.46E-04	0.001	0.119	0.12	1.46E-07	-	-	-	-	-	-
098_320V001_C	52022.64075	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
099_Xylene_pipe_A	121.2112	3.75E-04	0.001	0.129	0.13	3.75E-07	-	-	-	-	-	-
099_Xylene_pipe_B	121.2112	1.64E-04	0.001	0.129	0.13	1.64E-07	-	-	-	-	-	-
099_Xylene_pipe_C	121.2112	8.20E-05	0.001	0.129	0.13	8.20E-08	-	-	-	-	-	-
100_320V002_A	0.047251642	1.50E-04	0.001	0	0.001	-	1.50E-07	-	-	0.00E+00	0.00E+00	-
100_320V002_B	1.118945607	6.50E-05	0.001	0.0035	0.0045	-	6.50E-08	-	-	9.10E-08	1.37E-07	-
100_320V002_C	2889.811535	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
101_320V002_A	1.546687883	5.00E-04	0.001	0.0035	0.0045	5.00E-07	-	-	-	-	-	-
101_320V002_B	38.66719709	2.15E-04	0.001	0.066	0.067	2.15E-07	-	-	-	-	-	-
101_320V002_C	454305.9881	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
102_320V003_A	0.049465942	1.50E-04	0.001	0	0.001	-	1.50E-07	-	-	0.00E+00	0.00E+00	-
102_320V003_B	1.15379092	6.50E-05	0.001	0.0035	0.0045	-	6.50E-08	-	-	9.10E-08	1.37E-07	-
102_320V003_C	687.2498205	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
103_320V003_A	1.498781411	3.11E-03	0.001	0.0035	0.0045	-	3.11E-06	-	-	4.35E-06	6.53E-06	-
103_320V003_B	37.46953526	2.96E-04	0.001	0.066	0.067	-	2.96E-07	-	-	7.81E-06	1.17E-05	-
103_320V003_C	101744.2472	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
104_320V004_A	0.047070086	1.50E-04	0.001	0	0.001	-	1.50E-07	-	-	0.00E+00	0.00E+00	-
104_320V004_B	1.17663573	6.50E-05	0.001	0.0035	0.0045	-	6.50E-08	-	-	9.10E-08	1.37E-07	-
104_320V004_C	11.79331096	6.00E-06	0.001	0.03	0.031	-	6.00E-09	-	-	7.20E-08	1.08E-07	-
105_320V004_A	1.384784286	2.76E-03	0.001	0.0035	0.0045	-	2.76E-06	-	-	3.86E-06	5.80E-06	-
105_320V004_B	34.61960714	1.44E-04	0.001	0.066	0.067	-	1.44E-07	-	-	3.80E-06	5.70E-06	-
105_320V004_C	1686.919298	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
106_Benzene_pipe_A	0.5409	3.02E-04	0.001	0.0015	0.0025	-	3.02E-07	-	-	1.81E-07	2.72E-07	-
106_Benzene_pipe_B	0.5409	1.32E-04	0.001	0.0015	0.0025	-	1.32E-07	-	-	7.92E-08	1.19E-07	-
106_Benzene_pipe_C	0.5409	6.60E-05	0.001	0.0015	0.0025	-	6.60E-08	-	-	3.96E-08	5.94E-08	-
107_Toluene_pipe_B	41.9685	1.04E-04	0.001	0.066	0.067	1.04E-07	-	-	-	-	-	-
107_Toluene_pipe_C	41.9685	5.20E-05	0.001	0.066	0.067	5.20E-08	-	-	-	-	-	-
108_320V005_A	0.070281739	1.50E-04	0.001	0	0.001	-	1.50E-07	-	-	0.00E+00	0.00E+00	-
108_320V005_B	1.6363627	6.50E-05	0.001	0.0035	0.0045	-	6.50E-08	-	-	9.10E-08	1.37E-07	-
108_320V005_C	428.566833	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
109_320V005_A	1.60091647	2.76E-03	0.001	0.0035	0.0045	2.76E-06	-	-	-	-	-	-
109_320V005_B	40.02291176	1.44E-04	0.001	0.066	0.067	1.44E-07	-	-	-	-	-	-
109_320V005_C	62578.43726	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
110_320V006_A	1.038284877	1.50E-04	0.001	0.0035	0.0045	-	1.50E-07	-	-	2.10E-07	3.15E-07	-
110_320V006_B	25.95712193	6.50E-05	0.001	0.066	0.067	-	6.50E-08	-	-	1.72E-06	2.57E-06	-
110_320V006_C	5275.421365	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
111_320V006_A	1.087610329	3.11E-03	0.001	0.0035	0.0045	3.11E-06	-	-	-	-	-	-
111_320V006_B	27.19025822	2.96E-04	0.001	0.066	0.067	2.96E-07	-	-	-	-	-	-
111_320V006_C	5761.787529	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
112_Toluene_pipe_B	41.7962	1.12E-04	0.001	0.066	0.067	1.12E-07	-	-	-	-	-	-

Scenario	Release Rate	Base Frequency [/yr]	Immediate Ignition Probability	Delayed Ignition Probability	Total Ignition Probability	Pool Fire	Jet Fire	Fireball (BLEVE)	VCE (BLEVE)	VCE	Flash Fire	Toxic Dispersion
112_Toluene_pipe_C	41.7962	3.92E-05	0.001	0.066	0.067	3.92E-08	-	-	-	-	-	-
113_Hydrogen_pipe_A	0.1723	1.21E-04	0.001	0.0003	0.0013	-	1.21E-07	-	-	1.45E-08	2.18E-08	-
113_Hydrogen_pipe_B	0.1723	3.40E-05	0.001	0.0003	0.0013	-	3.40E-08	-	-	4.08E-09	6.12E-09	-
114_322R012_A	3.2889678	3.33E-03	0.001	0.0087	0.0097	3.33E-06	-	-	-	-	-	-
114_322R012_B	82.22419501	3.91E-04	0.001	0.119	0.12	3.91E-07	-	-	-	-	-	-
114_322R012_C	36490.50705	1.20E-05	0.001	0.129	0.13	1.20E-08	-	-	-	-	-	-
116_Toluene_pipe_A	55.935	1.01E-04	0.001	0.119	0.12	-	1.01E-07	-	-	4.81E-06	7.21E-06	-
116_Toluene_pipe_B	55.935	4.40E-05	0.001	0.119	0.12	-	4.40E-08	-	-	2.09E-06	3.14E-06	-
116_Toluene_pipe_C	55.935	2.20E-05	0.001	0.119	0.12	-	2.20E-08	-	-	1.05E-06	1.57E-06	-
117_380V001_A	1.415658221	3.25E-03	0.001	0.0035	0.0045	3.25E-06	-	-	-	-	-	-
117_380V001_B	35.39145553	3.56E-04	0.001	0.066	0.067	3.56E-07	-	-	-	-	-	-
117_380V001_C	216077.6565	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
118_380R001_A	0.051820341	5.37E-03	0.001	0	0.001	5.37E-06	-	-	-	-	-	-
118_380R001_B	1.273241096	2.26E-04	0.001	0.0035	0.0045	2.26E-07	-	-	-	-	-	-
118_380R001_C	57.34403008	6.00E-06	0.001	0.119	0.12	6.00E-09	-	-	-	-	-	-
119_Hydrogen_pipe_A	0.5822	3.73E-04	0.001	0.0015	0.0025	-	3.73E-07	-	-	2.24E-07	3.36E-07	-
119_Hydrogen_pipe_B	0.5822	1.63E-04	0.001	0.0015	0.0025	-	1.63E-07	-	-	9.78E-08	1.47E-07	-
119_Hydrogen_pipe_C	0.5822	9.16E-05	0.001	0.0015	0.0025	-	9.16E-08	-	-	5.50E-08	8.24E-08	-
120_380V002_A	0.075341494	1.50E-04	0.001	0	0.001	-	1.50E-07	-	-	0.00E+00	0.00E+00	-
120_380V002_B	1.850260454	6.50E-05	0.001	0.0035	0.0045	-	6.50E-08	-	-	9.10E-08	1.37E-07	-
120_380V002_C	86.97261107	6.00E-06	0.001	0.119	0.12	-	6.00E-09	-	-	2.86E-07	4.28E-07	-
121_380V002_C	26232.09046	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
122_380V003_A	0.101938031	1.50E-04	0.001	0.0003	0.0013	-	1.50E-07	-	-	1.80E-08	2.70E-08	-
122_380V003_B	2.433823902	6.50E-05	0.001	0.0087	0.0097	-	6.50E-08	-	-	2.26E-07	3.39E-07	-
122_380V003_C	7810.063471	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
123_380V003_A	0.107109884	5.37E-03	0.001	0.0003	0.0013	5.37E-06	-	-	-	-	-	-
123_380V003_B	2.559590915	2.26E-04	0.001	0.0087	0.0097	2.26E-07	-	-	-	-	-	-
123_380V003_C	8548.615392	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
124_380V004_A	0.065097047	1.50E-04	0.001	0	0.001	-	1.50E-07	-	-	0.00E+00	0.00E+00	-
124_380V004_B	1.543554768	6.50E-05	0.001	0.0035	0.0045	-	6.50E-08	-	-	9.10E-08	1.37E-07	-
124_380V004_C	298.3338678	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
125_380V004_A	1.654747237	3.46E-03	0.001	0.0035	0.0045	-	3.46E-06	-	-	4.84E-06	7.27E-06	-
125_380V004_B	41.36868092	4.46E-04	0.001	0.066	0.067	-	4.46E-07	-	-	1.18E-05	1.77E-05	-
125_380V004_C	32597.13577	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
126_431V001_A	0.019370459	1.50E-04	0.001	0	0.001	-	1.50E-07	-	-	0.00E+00	0.00E+00	-
126_431V001_B	0.465440639	5.30E-04	0.001	0.0009	0.0019	-	5.30E-07	-	-	1.91E-07	2.86E-07	-
126_431V001_C	2140.616327	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
127_431V001_A	1.223956228	1.13E-03	0.001	0.0035	0.0045	1.13E-06	-	-	-	-	-	-
127_431V001_B	30.5989057	5.30E-04	0.001	0.066	0.067	5.30E-07	-	-	-	-	-	-
127_431V001_C	563930.7269	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
128_431V002_A	0.865659669	3.74E-03	0.001	0.0015	0.0025	3.74E-06	-	-	-	-	-	-
128_431V002_B	21.64149173	5.66E-04	0.001	0.066	0.067	5.66E-07	-	-	-	-	-	-
128_431V002_C	95186.47228	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-

Scenario	Release Rate	Base Frequency [/yr]	Immediate Ignition Probability	Delayed Ignition Probability	Total Ignition Probability	Pool Fire	Jet Fire	Fireball (BLEVE)	VCE (BLEVE)	VCE	Flash Fire	Toxic Dispersion
129_431V003_A	2.310388972	5.80E-04	0.001	0.0087	0.0097	5.80E-07	-	-	-	-	-	-
129_431V003_B	57.7597243	2.50E-04	0.001	0.119	0.12	2.50E-07	-	-	-	-	-	-
129_431V003_C	105161.4682	1.20E-05	0.001	0.129	0.13	1.20E-08	-	-	-	-	-	-
130_Xylene_pipe_A	116.08	9.14E-05	0.001	0.129	0.13	9.14E-08	-	-	-	-	-	-
130_Xylene_pipe_B	116.08	4.00E-05	0.001	0.129	0.13	4.00E-08	-	-	-	-	-	-
130_Xylene_pipe_C	116.08	2.00E-05	0.001	0.129	0.13	2.00E-08	-	-	-	-	-	-
131_431V004_A	0.126067702	1.50E-04	0.001	0.0003	0.0013	-	1.50E-07	-	-	1.80E-08	2.70E-08	-
131_431V004_B	3.134827781	5.30E-04	0.001	0.0087	0.0097	-	5.30E-07	-	-	1.84E-06	2.77E-06	-
131_431V004_C	104276.7326	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
132_431V004_A	0.126067702	1.20E-03	0.001	0.0003	0.0013	1.20E-06	-	-	-	-	-	-
132_431V004_B	3.134827781	5.15E-04	0.001	0.0087	0.0097	5.15E-07	-	-	-	-	-	-
132_431V004_C	104276.7326	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
133_431V014_A	0.990230385	3.04E-03	0.001	0.0015	0.0025	3.04E-06	-	-	-	-	-	-
133_431V014_B	24.75575963	2.66E-04	0.001	0.066	0.067	2.66E-07	-	-	-	-	-	-
133_431V014_C	3163.417832	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
134_431V006_A	0.105853821	8.50E-04	0.001	0.0003	0.0013	8.50E-07	-	-	-	-	-	-
134_431V006_B	2.499659157	3.65E-04	0.001	0.0087	0.0097	3.65E-07	-	-	-	-	-	-
134_431V006_C	5982.152395	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
135_431V007_A	1.529697858	3.30E-04	0.001	0.0035	0.0045	3.30E-07	-	-	-	-	-	-
135_431V007_B	38.24244646	1.55E-04	0.001	0.066	0.067	1.55E-07	-	-	-	-	-	-
135_431V007_C	1873.863765	1.14E-04	0.001	0.129	0.13	1.14E-07	-	-	-	-	-	-
146_Toluene_pipe_B	31.9807	6.80E-05	0.001	0.066	0.067	6.80E-08	-	-	-	-	-	-
146_Toluene_pipe_C	31.9807	3.40E-05	0.001	0.066	0.067	3.40E-08	-	-	-	-	-	-
147_432T001_A	196.4488706	3.34E-03	0.001	0.129	0.13	3.34E-06	-	-	-	-	-	-
147_432T001_B	2182.765229	4.60E-04	0.001	0.129	0.13	4.60E-07	-	-	-	-	-	-
147_432T001_C	1193773.81	5.00E-06	0.001	0.129	0.13	5.00E-09	-	-	-	-	-	-
148_432V001_A	2.160204723	3.33E-03	0.001	0.0087	0.0097	3.33E-06	-	-	-	-	-	-
148_432V001_B	54.00511807	3.91E-04	0.001	0.119	0.12	3.91E-07	-	-	-	-	-	-
148_432V001_C	38579.45188	1.20E-05	0.001	0.129	0.13	1.20E-08	-	-	-	-	-	-
149_Toluene_pipe_A	88.091	4.57E-04	0.001	0.119	0.12	4.57E-07	-	-	-	-	-	-
149_Toluene_pipe_B	88.091	2.00E-04	0.001	0.119	0.12	2.00E-07	-	-	-	-	-	-
149_Toluene_pipe_C	88.091	1.00E-04	0.001	0.119	0.12	1.00E-07	-	-	-	-	-	-
150_Toluene_pipe_A	0.2524	4.02E-04	0.001	0.0009	0.0019	4.02E-07	-	-	-	-	-	-
150_Toluene_pipe_B	0.2524	1.76E-04	0.001	0.0009	0.0019	1.76E-07	-	-	-	-	-	-
150_Toluene_pipe_C	0.2524	8.80E-05	0.001	0.0009	0.0019	8.80E-08	-	-	-	-	-	-
151_432V002_A	0.024542495	3.46E-03	0.001	0	0.001	-	3.46E-06	-	-	0.00E+00	0.00E+00	-
151_432V002_B	0.596004548	4.46E-04	0.001	0.0015	0.0025	-	4.46E-07	-	-	2.68E-07	4.01E-07	-
151_432V002_C	3324.37236	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
152_432V002_A	0.026745052	9.90E-04	0.001	0	0.001	9.90E-07	-	-	-	-	-	-
152_432V002_B	0.651000839	4.25E-04	0.001	0.0015	0.0025	4.25E-07	-	-	-	-	-	-
152_432V002_C	3987.633993	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
153_432V003_A	0.9349768	3.46E-03	0.001	0.0015	0.0025	-	3.46E-06	-	-	2.08E-06	3.11E-06	-
153_432V003_B	23.37442001	4.46E-04	0.001	0.066	0.067	-	4.46E-07	-	-	1.18E-05	1.77E-05	-

Scenario	Release Rate	Base Frequency [/yr]	Immediate Ignition Probability	Delayed Ignition Probability	Total Ignition Probability	Pool Fire	Jet Fire	Fireball (BLEVE)	VCE (BLEVE)	VCE	Flash Fire	Toxic Dispersion
153_432V003_C	226897.0431	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
154_432V004_A	0.08094266	1.00E-05	0.001	0	0.001	-	1.00E-08	-	-	0.00E+00	0.00E+00	-
154_432V004_B	1.979135028	5.00E-06	0.001	0.0035	0.0045	-	5.00E-09	-	-	7.00E-09	1.05E-08	-
154_432V004_C	14908.43804	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
155_432V004_A	0.08094266	8.50E-04	0.001	0	0.001	8.50E-07	-	-	-	-	-	-
155_432V004_B	1.979135028	3.65E-04	0.001	0.0035	0.0045	3.65E-07	-	-	-	-	-	-
155_432V004_C	14908.43804	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
156_432V005_A	0.010365036	3.60E-03	0.001	0	0.001	3.60E-06	-	-	-	-	-	-
156_432V005_B	0.254000921	5.06E-04	0.001	0.0009	0.0019	5.06E-07	-	-	-	-	-	-
156_432V005_C	300.7384203	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
158_500V001_A	2.316128507	1.27E-03	0.001	0.0087	0.0097	-	1.27E-06	-	-	4.42E-06	6.63E-06	-
158_500V001_B	57.90321267	5.45E-04	0.001	0.119	0.12	-	5.45E-07	-	-	2.59E-05	3.89E-05	-
158_500V001_C	511210.8267	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
159_500V002_A	2.316128507	1.27E-03	0.001	0.0087	0.0097	-	1.27E-06	-	-	4.42E-06	6.63E-06	-
159_500V002_B	57.90321267	5.45E-04	0.001	0.119	0.12	-	5.45E-07	-	-	2.59E-05	3.89E-05	-
159_500V002_C	511210.8267	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
160_500V003_A	1.134403286	1.50E-04	0.001	0.0035	0.0045	-	1.50E-07	-	-	2.10E-07	3.15E-07	-
160_500V003_B	28.36008215	6.50E-05	0.001	0.066	0.067	-	6.50E-08	-	-	1.72E-06	2.57E-06	-
160_500V003_C	1580316.232	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
161_500V003_C	1595600.878	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
162_500V004_A	0.625939934	1.50E-04	0.001	0.0015	0.0025	1.50E-07	-	-	-	-	-	-
162_500V004_B	15.64849835	6.50E-05	0.001	0.03	0.031	6.50E-08	-	-	-	-	-	-
162_500V004_C	92079.7723	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
163_500V005_A	0.835477732	3.60E-03	0.001	0.0015	0.0025	3.60E-06	-	-	-	-	-	-
163_500V005_B	20.8869433	5.06E-04	0.001	0.066	0.067	5.06E-07	-	-	-	-	-	-
163_500V005_C	103005.0818	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
164_500V006_C	1610.399196	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
165_500V007_A	0.949389701	1.50E-04	0.001	0.0015	0.0025	-	1.50E-07	-	-	9.00E-08	1.35E-07	-
165_500V007_B	22.91069463	6.50E-05	0.001	0.066	0.067	-	6.50E-08	-	-	1.72E-06	2.57E-06	-
165_500V007_C	562633.4492	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
166_500V007_A	1.131300049	3.60E-03	0.001	0.0035	0.0045	-	3.60E-06	-	-	5.04E-06	7.56E-06	-
166_500V007_B	28.28250123	5.06E-04	0.001	0.066	0.067	-	5.06E-07	-	-	1.34E-05	2.00E-05	-
166_500V007_C	567920.4827	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
167_500V008_A	0.676682034	3.46E-03	0.001	0.0015	0.0025	3.46E-06	-	-	-	-	-	-
167_500V008_B	16.91705085	4.46E-04	0.001	0.03	0.031	4.46E-07	-	-	-	-	-	-
167_500V008_C	44145.03504	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
168_500V009_A	0.990739383	1.50E-04	0.001	0.0015	0.0025	-	1.50E-07	-	-	9.00E-08	1.35E-07	-
168_500V009_B	24.76848458	6.50E-05	0.001	0.066	0.067	-	6.50E-08	-	-	1.72E-06	2.57E-06	-
168_500V009_C	253558.7182	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
169_500V009_A	1.169591348	6.07E-03	0.001	0.0035	0.0045	6.07E-06	-	-	-	-	-	-
169_500V009_B	29.2397837	5.26E-04	0.001	0.066	0.067	5.26E-07	-	-	-	-	-	-
169_500V009_C	255096.7091	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
170_500V010_A	0.690936571	3.46E-03	0.001	0.0015	0.0025	3.46E-06	-	-	-	-	-	-

Scenario	Release Rate	Base Frequency [/yr]	Immediate Ignition Probability	Delayed Ignition Probability	Total Ignition Probability	Pool Fire	Jet Fire	Fireball (BLEVE)	VCE (BLEVE)	VCE	Flash Fire	Toxic Dispersion
170_500V010_B	17.3147003	4.46E-04	0.001	0.03	0.031	4.46E-07	-	-	-	-	-	-
170_500V010_C	35283.44364	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
171_500V011_A	0.027543453	1.50E-04	0.001	0	0.001	-	1.50E-07	-	-	0.00E+00	0.00E+00	-
171_500V011_B	0.684992212	6.50E-05	0.001	0.0015	0.0025	-	6.50E-08	-	-	3.90E-08	5.85E-08	-
171_500V011_C	115.615974	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
172_500T001_A	200.4021077	3.34E-03	0.001	0.129	0.13	-	3.34E-06	-	-	1.72E-04	2.59E-04	-
172_500T001_B	2226.690085	4.60E-04	0.001	0.129	0.13	-	4.60E-07	-	-	2.37E-05	3.56E-05	-
172_500T001_C	1618839.615	5.00E-06	0.001	0.129	0.13	-	5.00E-09	-	-	2.58E-07	3.87E-07	-
173_500T002_A	215.9994181	5.81E-03	0.001	0.129	0.13	-	5.81E-06	-	-	3.00E-04	4.50E-04	-
173_500T002_B	2399.993534	4.81E-04	0.001	0.129	0.13	-	4.81E-07	-	-	2.48E-05	3.72E-05	-
173_500T002_C	3124360.457	5.00E-06	0.001	0.129	0.13	-	5.00E-09	-	-	2.58E-07	3.87E-07	-
174_500T003_A	215.2609649	5.70E-03	0.001	0.129	0.13	5.70E-06	-	-	-	-	-	-
174_500T003_B	2391.788499	5.00E-04	0.001	0.129	0.13	5.00E-07	-	-	-	-	-	-
174_500T003_C	3110637.29	1.00E-05	0.001	0.129	0.13	1.00E-08	-	-	-	-	-	-
175_500V012_A	0.789322574	4.16E-03	0.001	0.0015	0.0025	-	4.16E-06	-	-	2.50E-06	3.74E-06	-
175_500V012_B	19.73306434	7.46E-04	0.001	0.03	0.031	-	7.46E-07	-	-	8.95E-06	1.34E-05	-
175_500V012_C	20139.92126	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
176_541T001_A	217.2768283	2.50E-03	0.001	0.129	0.13	-	2.50E-06	-	-	1.29E-04	1.94E-04	-
176_541T001_B	2414.186981	1.00E-04	0.001	0.129	0.13	-	1.00E-07	-	-	5.16E-06	7.74E-06	-
176_541T001_C	3373803.552	5.00E-06	0.001	0.129	0.13	-	5.00E-09	-	-	2.58E-07	3.87E-07	-
177_541V001_A	0.036638546	1.50E-04	0.001	0	0.001	-	1.50E-07	-	-	0.00E+00	0.00E+00	-
177_541V001_B	0.888436269	6.50E-05	0.001	0.0015	0.0025	-	6.50E-08	-	-	3.90E-08	5.85E-08	-
177_541V001_C	4607.008702	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
178_541V001_C	4067	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
179_541V002_A	0.758351853	3.46E-03	0.001	0.0015	0.0025	3.46E-06	-	-	-	-	-	-
179_541V002_B	18.95879633	4.46E-04	0.001	0.03	0.031	4.46E-07	-	-	-	-	-	-
179_541V002_C	24089.29928	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
180_Benzene_pipe_B	13.5407	2.30E-04	0.001	0.03	0.031	-	2.30E-07	-	-	2.76E-06	4.14E-06	-
180_Benzene_pipe_C	13.5407	1.15E-04	0.001	0.03	0.031	-	1.15E-07	-	-	1.38E-06	2.07E-06	-
181_541V003_C	387.4920163	6.00E-06	0.001	0.129	0.13	-	6.00E-09	-	-	3.10E-07	4.64E-07	-
183_541V004_A	0.458022933	4.30E-03	0.001	0.0009	0.0019	4.30E-06	-	-	-	-	-	-
183_541V004_B	11.45057333	8.06E-04	0.001	0.03	0.031	8.06E-07	-	-	-	-	-	-
183_541V004_C	101167.272	6.00E-06	0.001	0.129	0.13	6.00E-09	-	-	-	-	-	-
188_640V003_A	0.020324326	2.76E-03	0.001	0	0.001	-	2.76E-06	-	-	0.00E+00	0.00E+00	2.76E-03
188_640V003_B	0.508303181	1.46E-04	0.001	0.0015	0.0025	-	1.46E-07	-	-	8.76E-08	1.31E-07	1.46E-04
188_640V003_C	2.664143678	6.00E-06	0.001	0.0087	0.0097	-	6.00E-09	-	-	2.09E-08	3.13E-08	5.94E-06
189_650V003_A	0.022050606	2.76E-03	0.001	0	0.001	-	2.76E-06	-	-	0.00E+00	0.00E+00	2.76E-03
189_650V003_B	0.551459491	1.46E-04	0.001	0.0015	0.0025	-	1.46E-07	-	-	8.76E-08	1.31E-07	1.46E-04
189_650V003_C	19.20517424	6.00E-06	0.001	0.03	0.031	-	6.00E-09	-	-	7.20E-08	1.08E-07	5.81E-06
190_800T001_A	205.6996442	7.50E-03	0.001	0.129	0.13	7.50E-06	-	-	-	-	-	-
190_800T001_B	2285.551602	3.00E-04	0.001	0.129	0.13	3.00E-07	-	-	-	-	-	-
190_800T001_C	28461818.15	1.50E-05	0.001	0.129	0.13	1.50E-08	-	-	-	-	-	-
191_810T001_A	214.3273638	1.25E-02	0.001	0.129	0.13	1.25E-05	-	-	-	-	-	-

Scenario	Release Rate	Base Frequency [/yr]	Immediate Ignition Probability	Delayed Ignition Probability	Total Ignition Probability	Pool Fire	Jet Fire	Fireball (BLEVE)	VCE (BLEVE)	VCE	Flash Fire	Toxic Dispersion
191_810T001_B	2381.415153	5.00E-04	0.001	0.129	0.13	5.00E-07	-	-	-	-	-	-
191_810T001_C	10303430.92	2.50E-05	0.001	0.129	0.13	2.50E-08	-	-	-	-	-	-
192_812T001_A	213.2147647	1.00E-02	0.001	0.129	0.13	-	1.00E-05	-	-	5.16E-04	7.74E-04	-
192_812T001_B	2369.052941	4.00E-04	0.001	0.129	0.13	-	4.00E-07	-	-	2.06E-05	3.10E-05	-
192_812T001_C	6926891.35	2.00E-05	0.001	0.129	0.13	-	2.00E-08	-	-	1.03E-06	1.55E-06	-
194_820T001_A	205.6996442	5.00E-03	0.001	0.129	0.13	5.00E-06	-	-	-	-	-	-
194_820T001_B	2285.551602	2.00E-04	0.001	0.129	0.13	2.00E-07	-	-	-	-	-	-
194_820T001_C	32199891.04	1.00E-05	0.001	0.129	0.13	1.00E-08	-	-	-	-	-	-
195_825T001_A	216.5318352	5.00E-03	0.001	0.129	0.13	5.00E-06	-	-	-	-	-	-
195_825T001_B	2405.90928	2.00E-04	0.001	0.129	0.13	2.00E-07	-	-	-	-	-	-
195_825T001_C	34317975.32	1.00E-05	0.001	0.129	0.13	1.00E-08	-	-	-	-	-	-
196_830T001_A	186.9473009	5.00E-03	0.001	0.129	0.13	5.00E-06	-	-	-	-	-	-
196_830T001_B	2077.192232	2.00E-04	0.001	0.129	0.13	2.00E-07	-	-	-	-	-	-
196_830T001_C	20443130.42	1.00E-05	0.001	0.129	0.13	1.00E-08	-	-	-	-	-	-
198_831T001_A	185.5088505	5.00E-03	0.001	0.129	0.13	5.00E-06	-	-	-	-	-	-
198_831T001_B	2061.20945	2.00E-04	0.001	0.129	0.13	2.00E-07	-	-	-	-	-	-
198_831T001_C	8208274.933	1.00E-05	0.001	0.129	0.13	1.00E-08	-	-	-	-	-	-
199_840T001_C	2152193.39	4.00E-06	0.001	0.129	0.13	-	-	4.00E-09	2.06E-07	2.06E-07	3.10E-07	-
200_842T001_C	2558253.293	8.00E-06	0.001	0.129	0.13	8.00E-09	-	8.00E-09	4.13E-07	4.13E-07	6.19E-07	-
201_841T001_C	15225.85694	2.00E-06	0.001	0.129	0.13	-	-	-	-	1.03E-07	1.55E-07	-
202_843T001_C	14165.1482	4.00E-06	0.001	0.129	0.13	-	-	-	-	2.06E-07	3.10E-07	-
204_850T001_A	176.8004877	2.50E-03	0.001	0.129	0.13	2.50E-06	-	-	-	-	-	-
204_850T001_B	1964.449863	1.00E-04	0.001	0.129	0.13	1.00E-07	-	-	-	-	-	-
204_850T001_C	10569403.55	5.00E-06	0.001	0.129	0.13	5.00E-09	-	-	-	-	-	-
205_851T001_A	184.4629315	2.50E-03	0.001	0.129	0.13	2.50E-06	-	-	-	-	-	-
205_851T001_B	2049.588128	1.00E-04	0.001	0.129	0.13	1.00E-07	-	-	-	-	-	-
205_851T001_C	14371215.56	5.00E-06	0.001	0.129	0.13	5.00E-09	-	-	-	-	-	-
206_431T001_A	186.6856079	2.50E-03	0.001	0.129	0.13	2.50E-06	-	-	-	-	-	-
206_431T001_B	2074.284532	1.00E-04	0.001	0.129	0.13	1.00E-07	-	-	-	-	-	-
206_431T001_C	13391482.18	5.00E-06	0.001	0.129	0.13	5.00E-09	-	-	-	-	-	-
211_432T002_C	1678752.492	1.00E-05	0.001	0.129	0.13	1.00E-08	-	-	-	-	-	-

APPENDIX F

PENGERANG ENERGY COMPLEX
PROJECT CO-ORDINATION AND INTERFACE MANAGEMENT PLAN

1. GENERAL

1.1 Purpose
The purpose of this Coordination and Interface Management Plan is to define the guidelines and principle for the management and control of the interfaces in the Pengerang Energy Complex Project (Project). This plan is to describe how to manage, coordinate and control the interfaces among the Owner, Main Contractor, and Service Providers for successful project performance.

1.2 Scope
This plan is applicable to Main Contractor's scope of work and the Owner's execution requirements for the coordination and interface management. The parties will commit to a regular structured process including meetings and exchange of documentation such as signs, construction, inspection and test related data, and scheduling information to ensure complete and consistent understanding of the significance of each interface, and also that gap management can be effected to the benefit of all parties. The identified interfaces over the fence are as follows:

	Service Providers
Pipelines to and from Main Storage Tanks and Terminal	Dialog/PID
Electricity Power Supply	TNB
Raw Water	Johor Corporation
Treated Waste Water	Johor Corporation
Storm Water	Johor Corporation
LNG	Gas Supplier

Please see Attachment 1.

Under the coordination of the Owner, each service provider shall identify, scope, plan, cooperate, check and verify with each other the precise details of the interface item, and obtain all relevant information and documentation related thereto to achieve understanding, continuity and compatibility in terms of its operating, control and safeguarding philosophy, system functionality, HSE, physical and schedule interference potential, and operating integrity of all installations and systems with the interface.

The Main Contractor shall ensure its familiarity with the design and installed condition for the interface item, and its respective boundary conditions such that the design intent of the system affected by the interface is consistently upheld across the interface in accordance with the Project Specifications.

2. DEFINITIONS

Project : Pengerang Energy Complex Project
Owner : Pengerang Energy Complex Sdn Bhd
Main Contractor : Marie Tecnimont
Service Providers : parties providing utilities, pipeline and other services to the Project, as identified above

3. CO-ORDINATION AND INTERFACE COMMUNICATION

The Coordination and Interface Meeting will be held according to the agreed timetable among the Owner, Main Contractor and Service Providers. The purpose of the meetings is:
to provide all parties with a scheduled update of all interface related issues:

- to discuss outstanding issues.
- to schedule and agree upon problem resolution.
- to record decisions on resolved issues.

Within one month from the commencement of the Main Contract, a Coordination and Interface Kick-off Meeting will be held between the Owner, the Main Contractor and all Service Providers. The Coordination and Interface Kick-Off Meeting will be followed by discipline coordination and interface meeting during early project stage in order to set-up interface scope definition and standardization by discipline. Thereafter the following meetings will be held:

- Monthly Meetings : between the Owner, Main Contractor and Service Providers during engineering stage at the Project office, or via video conference.
- Weekly Meetings : between the Main Contractor and Service Providers during construction stage at construction site. The Owner has the right to participate in such meetings.

In case of need, visits to home offices of the Main Contractor and Service Providers for clarification purpose can be agreed and arranged.

4. ROLES AND RESPONSIBILITIES

4.1 Owner
The Owner is responsible for overseeing and coordinating the Interface management process of all contract packages and ensuring that interface issues are coordinated, documented and resolved.
The responsibilities of the Owner include:
Appoint a Project Interface Coordinator having authority suitable to manage the co-ordination and interface activities of the Project.
Oversee and coordinate the Interface Management Process.
Facilitate communication between the Main Contractor and Service Providers.
Direct and indirect support and involvement in the identification and resolution of interface issues.
Chair or organize the kick-off meeting for co-ordination and interfaces kick-off and the scheduled interface meetings as necessary. The co-ordination and interface kick-off meeting shall be held within one month from the commencement date of the Main Contract.
Monitor performance and effectiveness of Coordination and Interface Management.
Interfacing and coordinating with all Service Providers and confirming that interface issues are identified, documented and resolved as agreed.
Actively maintain and improve the details in the co-ordination and interface management plan to successfully execute the completion of the interfaces and avoid any possible conflict.

4.2 Main Contractor
The Main Contractor shall appoint an Interface Coordinator having the necessary authority from its organization to agree upon resolution to any possible issue.
The duties of the Main Contractor include:
Ensure that interfaces are identified, registered and reported.
Appoint an Interface Coordinator.
Participate to the co-ordination and interface kick-off meeting and to the scheduled coordination and interface meetings. The co-ordination and interface kick-off meeting shall be held within one month from the commencement date of the Main Contract.
Report the status of selected interface issues and activities on a timely basis.

Actively co-operate to develop the schedule details required to enable the construction of the interfaces without delays to any parties.
Be proactive in identifying and coordinating interfaces

4.3 Main Contractor's Interface Co-ordinator
The CONTRACTOR's Interface Coordinator is responsible for managing all interface matters and coordinate with Interface Coordinators of the Owner and the Service Providers in accordance with the following:

Home office activity

- Responsible for overseeing the Interface Process within their Organization and confirming that Interface Issues are identified, documented, and resolved as agreed.
- Ensuring that Interfaces are identified, registered, and reported.
- Create, implement, manage, and adjust , as necessary, the Coordination and Interface Management process
- Ensure the accurate status of Interface deliverables and Interface Issues are reported in a timely manner.
- Co-ordinate and review Project Schedule to reflect performance of Interfaces, Interface Issues, and deliverables.
- Identify and report the Critical Interface Issues to the Owner's Interface Coordinator in a timely manner.
- Seek assistance and support from the Owner's Interface Coordinator as required to resolve Interface Issues.
- Participate as an active member of the Interface Management Team.

Site office activity

- The Interface Coordinator will be relocated to construction site as a Field Interface Coordinator during the Construction phase and is responsible for managing all interface matter and coordinate with Interface Coordinators of the Owner and the Service Providers at construction site.
- Facilitate communication and coordination with the Owner's Interface Coordinator and interface coordinator of the Service Providers for Construction activities.
- Identify and report the Critical Interface Issues for Construction activities between the Service Providers to the Owner's Interface Coordinator in a timely manner.
- Identify, communicate and correct any perceived contradiction between the construction execution and any interface agreement established.
- Participate as an active member of the Construction Interface Management Team.
- Participate in regular Interface Coordination Meeting which is comprised of the Interface Coordinators of the Owner and Service Providers to discuss, execute, and/or resolve interfaces Issues.
- Call or participate in unscheduled interface meeting among the Owner and the Service Providers as appropriate.

5. COORDINATION AND INTERFACE ORGANIZATION

5.1 Overall Coordination and Interface Organization
The Owner will set up the organization chart and appoint the main personnel involved in the interface activities among all Service Providers before the commencement of the Project.

6. COORDINATION AND INTERFACE MANAGEMENT SYSTEM

The Coordination and Interface Management System is the set of procedures and tools for the effective handling of interfaces in the Project. This system will be set up before the commencement of the Project.
The purpose of the Coordination and Interface Management System is:

- During the home office phase : to ensure the design consistency of Interface Points as developed by detail engineering.
- During the site phase : to follow-up the sequence of works at Interface Points for construction, pre-commissioning and commissioning in order to minimize the interferences among the Main Contractor and the Service Providers.

7. INTERFACE ISSUE RESOLUTION

7.1 General
The Owner is in charge of co-ordinating the interface issues between the Main Contractor and the Service Providers. The Owner is in charge to coordinate and define new interfaces as well as to solve any dispute related to the new or already identified Interfaces. In case, notwithstanding the Main Contractor's efforts, no agreement is reached, the Owner shall consult the Owner's Interface Coordinator, to allow the Owner to issue a resolution and provide a direction to the Main Contractor, as appropriate.
All the interface issues shall be recorded by the Main Contractor in writing.

7.2 Exchange of Information
During detail engineering, each Interface has to be provided with further information as required for its full definition. An Interface involves at least two parties for which they have to ensure that the information associated with the Interface is consistent for both parties.
The distribution of documentation for review and the exchange of major information regarding the Interface will be recorded and logged to ensure proper follow-up is carried out.

ATTACHMENT 1
PEC INTERFACE SCHEDULE

PENGERANG ENERGY COMPLEX SDN BHD

Environmental Policy Statement

PEC has been conceived as a World Class processor of Condensates to competitively produce Oil Products and Aromatics Products to satisfy growing need and demand for such products in South East Asia and North Asia, providing both long term employment and opportunity for the community whilst minimising possible negative impact on the eco system and social infrastructure.

PEC will base its operations in Pengerang, Johor State, Malaysia and will utilise latest generation proven technology from recognised Global providers offering optimised production, safety, waste, environmental performance and utilities consumption.

PEC will work closely with State and Central Government organisations to ensure that it's activities and actions are consistent with mandated objectives whilst also compatible with Global Guidelines.

PEC is committed to responsible HSE and Social Performance management through both the Construction and Operations phases of its activities, and to positive inclusion of the local community.

PEC's policy is to conduct its business in a manner that is compatible with the balanced environmental and economic needs of the communities in which it operates. It is committed to continuous efforts to improve environmental performance throughout its operations.

PEC will achieve this through commitment to:

- Comply with all applicable environmental laws and regulations (WB Guidelines, Malaysian regulations) and apply recognized international standards where laws and regulations do not exist;
- Manage environmental risks by identifying and assessing environmental hazards, implementing and monitoring controls, and assigning specific risk owners;
- Review regularly the environmental impact of plant activities, endeavour to reduce overall environmental impact and prevent waste using best practice techniques;
- Involve employees in company's environmental programme and provide necessary training to enable them to discharge their responsibilities;
- Sustain a programme of continual improvement in environmental performance by setting targets, implementing improvement programs and monitoring progress;
- Work with key suppliers to encourage them to develop environmental best practice;
- Improve the sustainability of operations and resource efficiency by reducing resource consumption and waste generation
- Communicate with the public on environmental matters and share company's experience with others to facilitate improvements in industry performance;

These aims and objectives are fully supported by the Owners and Management of PEC



Chong Ying Haur
Director, Pengerang Energy Complex Sdn Bhd
Date: 21 Jun 2019

MALAYSIAN REGULATORY PERMITTING APPROVAL PROCEDURE

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1. PURPOSE

The purpose of this procedure is to provide general guideline for EPCC/EPCM Contractors in the application of relevant permits, licenses and approvals.

It defines how EPCC/EPCM Contractor shall submit and obtain the relevant permits, licenses and approvals required for the Project, in order to ensure a smooth commissioning and start-up as well as successfully meeting Provisional Acceptance (PA) requirement of the constructed facilities.

2. SCOPE

This procedure is applicable to all Regulatory Authorities at federal, state and district levels.

3. REFERENCE DOCUMENTS

Main reference documents to be referred to when EPCC/EPCM Contractor submit permitting applications are:

- Occupational Safety and Health Act 1994.
- Factories and Machinery Act 1967.
- The Petroleum (Safety Measures) Act 1984
- Environmental Quality Act 1974
- Uniform Building By-Laws 1984
- Street, Building and Drainage Act 1974.

4. ACRONYMS

The acronyms used in this document have the meaning defined below:

FEED	Front-End Engineering Design
AELB	Atomic Energy Licensing Board (or LPTA; Lembaga Perlesenan Tenaga Atom)
ASME	American Society of Mechanical Engineers
BOMBA	Fire and Rescue Services Department (Jabatan Perkhidmatan Bomba dan Penyelamat)
BS	British Standard

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CAAM	Civil Aviation Authority of Malaysia
CIDB	Construction Industry Development Board
CIMAH	Control of Major Accident Hazard
CUSTOMS	Royal Customs & Excise Department (or Jabatan Kastam & Eksais Di Raja Malaysia)
CCC	Certificate of Completion and Compliance
DID	Department of Irrigation and Drainage (or JPS; Jabatan Pengairan & Saliran)
DOE	Department of Environment (or JAS; Jabatan Alam Sekitar)
DOSH	Department of Occupational Safety and Health
DWP	Department Working Procedure
EC	Energy Commission (EC) / Suruhanjaya Tenaga (ST)
EPC	Engineering, Procurement and Construction
HAZOP	Hazard and Operability
HSE	Health, Safety and Environment
IWK	Indah Water Konsortium Sdn. Bhd.
IM	Immigration Department Malaysia
JKKP	Jabatan Keselamatan & Kesihatan Pekerjaan (see also DOSH)
MS	Malaysian Standard
OSC	One Stop Center
PFD	Process Flow Diagram
PSP	Principal Submitting Person
PTS	PETRONAS Technical Standard
P&ID	Piping and Instrumentation Diagram
RLO	Regulatory Liaison Officer
TNB	Tenaga Nasional Berhad
SIRIM	Standard and Industrial Research Institute of Malaysia
ST	Suruhanjaya Tenaga (see also EC)
UBBL	Uniform Building By-Law 1984

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5. RESPONSIBILITIES

The EPCC/EPCM Contractor shall appoint a Regulatory Liaison Officer (RLO) who shall represent the Contractor for any regulatory permitting related matters.

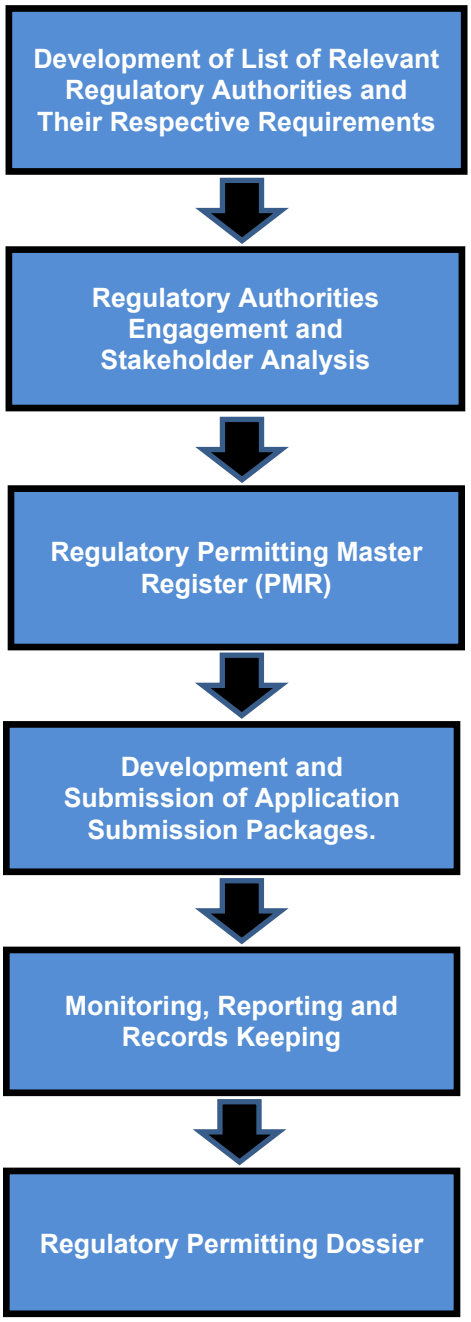
The EPCC/EPCM Contractor's responsibilities shall include but not limited to the following:

- To prepare a regulatory permitting plan which include the submissions schedule of various permits, licenses and approvals applications.
- To liaise and engage with Regulatory Authorities for any information and clarifications required.
- To verify that the relevant documentations for submission to Regulatory Authorities are prepared according to the submissions requirements and submitted according to the planned submission dates.
- To follow-up on the approval status from the relevant Regulatory Authorities.
- To maintain proper records pertaining to the regulatory correspondences, permits, licenses and approvals.
- To establish and maintain good relationship with all Regulatory Authorities.
- To properly plan, prepare and coordinate for Regulatory Authorities' inspections required and to close-out any comments and findings timely for the purpose of acquiring permits, licenses and approvals.
- To pay any fees related to application processing, inspections, and issuance of permits, licenses and approvals.
- To properly close-out any notices issued by Regulatory Authorities and make full payment for any fines due to offences committed.

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6. PERMITTING APPLICATION SUBMISSION AND APPROVAL PROCESS

In general, the permitting application submission and approval process flow is as shown below:



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6.1 Development and Submission of Application Submission Packages.

EPCC/EPCM Contractor shall develop application submission packages which consist of relevant drawings and technical documents and obtain necessary endorsement from Owner and/or Principal Submitting Person (PSP) as required for the submission to the respective Regulatory Authorities. It is important that drawing and technical documents are developed in accordance to specific format required by respective Regulatory Authorities.

Regulatory authorities generally require submission to be done by Principal Submitting Person (PSP). In some cases, drawings and technical documents are to be endorsed by professional engineers (PE) registered with the Board of Engineers, Malaysia.

Other services from town planner, architect, mechanical and electrical consultant, fire safety consultant and others may need to be procured by EPCC/EPCM Contractor in the development of the required drawings and technical documents.

6.1.1 Submission of Application Submission Packages

Upon completion of the application submission packages, EPCC/EPCM Contractor shall submit the applications timely to ensure that approvals are obtained prior to the commencement of specific works.

6.2 Regulatory Permitting Dossier

6.2.1 EPCC/EPCM Contractor shall keep and log all records pertaining to application submission packages, approvals and correspondences. These documents shall be part of final dossier submitted to the Owner at the end of the Project.

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7. APPENDIX 1 - LIST OF MAIN REGULATORY AUTHORITIES AND REQUIREMENTS

A.1. ATOMIC ENERGY LICENSING BOARD (AELB)

A.1.1. Overview

A.1.1.1. License shall be obtained from AELB for import, storage, transportation and usage of radioactive materials.

A.1.1.2. License for import and transportation shall also be obtained from DCA and CUSTOMS.

A.1.1.3. It is important that the scope of regulatory approval for AELB is identified during early stage of design. The scope for importation, transportation, storage either during transit or at site, installation and operation shall be explicitly defined to Overseas Vendor, Local Vendor, Owner or EPCC/EPCM Contractor.

A.1.1.4. Handling of radioactive material shall be undertaken by a person qualified by the AELB. Only with the availability of such a person will a license be issued to import radioactive material. This license is only valid to import, transport and install the radioactive devices. The license shall be available during transportation to the site from the receiving ports.

A.1.1.5. All usage of nuclear instrumentation such as for level instrument requires AELB license and the Owner or operator of the plant shall have approved Radiation Protection Officer (RPO) and Radiation Protection Program in place. Owner shall have a qualified RPO to perform this. RPO of Owner shall be licensed for only the plant he is employed with as cross company representative is not allowed.

A.1.1.6. EPCC/EPCM Contractor to appoint Approved AELB consultant to perform submission for the radioactive licenses and the Radiation Protection Program.

A.1.2. Radioactive Material Installation

A.1.2.1. List of radioactive materials or equipment, drawing details, manufactures source, packaging and transportation certificates shall be submitted.

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A.1.3. Radioactive Level Installation

A.1.3.1. The radioactive level of any item or equipment shall be submitted for approval e.g. X-Ray machines.

A.1.3.2. The licenses have to be held by a competent Radiation Protection Officer (RPO) registered with AELB and employed by either Owner or EPCC/EPCM Contractor.

A.1.4. Operational License

A.1.4.1. During operation of the plant, the Owner shall maintain this license for its personnel.

A.1.5. Safety Inspection

A.1.5.1. AELB officers shall inspect the safety implementation to see whether everything is in accordance with approved plans, specifications and pre-established guidelines that cover handling, storage and usage of radioactive materials.

A.2. CONSTRUCTION INDUSTRY DEVELOPMENT BOARD (CIDB)

A.2.1. Overview

A.2.1.1. CIDB is governing an act namely Malaysian Construction Industry Development Act 1994 (Act 520).

A.2.2. Importation of Construction Materials

A.2.2.1. All construction materials or products listed in Schedule 4 of the Construction Industry Development Act 1994 (Act 520) are required to obtain Certificate of Standards Compliance (PPS) from CIDB. Materials or products are referred to the following categories:

- Manufactured in the country of origin and imported to Malaysia for use
- Manufactured domestically, then exported and reimported back to Malaysia.

A.2.2.2. Ministry of International Trade and Industry (MITI) ruled, with effective from 31 January 2014, the importation of following products shall have Certificate of Approval (COA) obtainable from CIDB.

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- Hot-Rolled Carbon Steel Coil, Strip and Plate
- Coated Steel
- Pipes and Tubes

- Alloy Steel Products
- Structures and Parts of Structure of Iron and Steel
- Iron Products
- Wire rods, bars and Wires
- Stainless steel Pipes
- Aluminium products

- Low-E glass products – require conformance with the standard EN 1096 Pt. 4 (for hard-coat products) and MS 1135/ MS 2397/MS 1498 (for soft-coat products), with effective from 01 January 2015.
- All products of aluminium composite panel for exterior and interior walls – require conformance with the standard MS 2571:2014, with effective from 01 July 2015.
- Fire clay products – require conformance with the standard MS 2578:2014, with effective from 01 October 2015

A.2.2.3. The guidelines and application forms are accessible at CIDB website.

A.2.2.4. Green Card Training for Construction Personnel

A.2.2.5. CIDB Green Card is an integrated programme involving the registration and accreditation of construction personnel, to enhance safety levels at construction work sites. Construction workers who register are automatically covered by a special insurance scheme that covers the construction personnel against death and accidents.

A.2.2.6. All personnel working at construction site shall be registered and obtain their green card before entering the site. Registration may be done at CIDB Headquarters, regional offices or branches.

A.2.2.7. The green card registration form (Form UPP-1-Pin.1/2014) is accessible at CIDB website.

A.3. ROYAL CUSTOMS & EXCISE DEPARTMENT

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A.3.1. Approval for Jetty Legal Landing Place

A.3.1.1. No goods imported by sea or transported by water from any place in Malaysia shall be landed except at Legal Landing Place, which means any place which has been prescribed as a legal place for the landing and shipping of goods.

A.3.2. Manufacturing Warehouse License

A.3.2.1. Licensed manufacturing warehouse (LMW) is a premise licensed under section 65A of the Customs Act 1967 and is directly control by Royal Malaysian Customs. It is control by way of documentation and subject to all customs rules and regulations. Licensed manufacturing warehouse is a facility provided for export-oriented companies.

A.3.2.2. Application for LMW shall be submitted to the nearest Customs offices and subjected to the stipulated guidelines and procedures. Those approved LMV manufacturing companies are given waiver to all raw materials, components as well as machineries that are directly used in the manufacturing of their products.

A.3.3. Where the plant operation involved custody transfer of raw and product materials across ports, free zones or Custom Controlled Area, the requirement of Custom shall be followed. Detail requirement shall be finalized with the office in-charge and may include the followings,

- Submission of the custody flow system together with relevant site plan, piping plan, P & ID and PFD.
- Requirement for bonded areas or non-bonded areas.
- Excise license requirement if applicable.
- Requirement for SIRIM approved Tank, Pipeline and Metering System Calibration Table.
- Payment of deposit by Owner before loading or unloading of the products.

A.3.4. Custom procedures shall also be complied when dealing with importation of procured item from overseas. The procurement disciplines shall coordinate with Custom directly.

A.3.5. Where tax exemption for certain equipment is applied for, approval from MITI and Treasury Department shall be obtained first for declaration to Custom during trans-

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shipment. Dedicated personnel from Owner and procurement disciplines shall work together for the data gathering, application, appeal for rejected application and follow-up.

A.4. DEPARTMENT OF CIVIL AVIATION (CAAM)

A.4.1. Plant Height Approval

If the location of the site is within 15 km to the nearest aerodrome, CAAM shall be consulted to verify the requirement for visual aids of tall structures. International Civil Aviation Organization (ICAO) recommendation shall be used as guide with some discussion with the CAAM officer. In General, any structure beyond 45 meters and above from sea level shall be declared to CAAM by submitting CAAM. OCL1 form for CAAM to response requirement on Marking and Aircraft Warning Light.

Information to be given includes;

- Site location plan, elevation and section of tall structures.
- Exact Cassini Coordinate and MRT Global coordinate of the proposed structure.
  Cassini Coordinate can be calculated from the survey drawing.
  MRT Global Coordinate is usually obtained from Mapping Department with certain fees.
- Coverage of 45m radius to the adjacent tallest structures.
- Proposed tower marking of 7 alternate red and white band. For structures which are difficult to be painted or banded, an alternative means shall be approved by CAAM.

A.4.2. Aircraft Warning Light Approval

A.4.2.1. If required, Aircraft Warning Lights OL/APL1 form shall be submitted for approval.

A.4.2.2. Schematic diagram of the aircraft warning lighting fittings is required for submission. CAAM normally requested the fittings to be powered by emergency power supply as back up from the normal electrical power supply.

A.4.2.3. Tall Construction equipment and cranes used during construction shall also comply with this requirement. Construction Manager shall ensure that equipment / cranes used at site comply with the requirement.

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A.5. DEPARTMENT OF ENVIRONMENT (DOE)

A.5.1. Overview

A.5.1.1. Environmental Quality Act 1974 requires industrial activities to obtain various approvals or to notify the Director General of Environmental Quality prior to project implementation. This includes:

- Environmental Impact Assessment reports (for prescribed activities only)
- Preliminary Site Evaluation (PAT), for non-prescribed activities
- Written notification for installation of Air Pollution Control System (APCS) Incinerator/Thermal Oxidizer, Fuel Burning Equipment (FBE), chimney/stacks and Continuous Emission Monitoring System (CEMS)
- License to use and occupy (for prescribed premises)

A.5.2. Environmental Impact Assessment (EIA) For Prescribed Activities

A.5.2.1. If the proposed project is categorized as a prescribed activity, an EIA report shall be submitted to the Director General of DOE before the proposed project could be considered for approval by the relevant federal and/or state Regulatory Authorities. The project is not allowed to proceed until approval of the DEIA report has been obtained.

A.5.2.2. The EIA report shall be prepared by registered EIA consultants, and shall in accordance with the guidelines prescribed by the DOE and other relevant guidelines published by other agencies. 'A Handbook of Environmental Impact Assessment Guidelines' has been published to assist project proponents understand the objectives of EIA, procedures to carrying out EIA studies and guidelines on preparation of EIA reports.

A.5.2.3. There are two EIA procedures, namely Preliminary EIA and the Detailed EIA.

A.5.3. Preliminary Site Evaluation (PAT) For Non-Prescribed Activities

A.5.3.1. Regardless of whether a proposed industrial activity is to be sited within an industrial estate or otherwise, it should be developed and managed with environmental sound control measures. In considering the suitability, the proposed site is evaluated in terms of its compatibility with respect to the gazetted structure or local plans, surrounding land-use, provisions of buffer zones, the capacity of the area to receive

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additional pollution load, and waste management requirements.

A.5.3.2. A PAT may be prepared by completing a form, **BORANG AS PAT 1-12** which is accessible via DOE website.

A.5.4. Notification for A New Source of Sewage Discharge or Release

A.5.4.1. The Environmental (Sewage) Regulations 2009 specify that 'no person shall, without prior written notification to the Director General, discharge or release or permit the discharge or release of sewage onto or into any soil, or into any inland waters or Malaysian water.'

A.5.4.2. The written notification to the DOE shall be in the form as specified in the First Schedule of the regulation which is accessible via DOE website.

A.5.5. Notification Related to Industrial Effluent

A.5.5.1. The Environmental (Industrial Effluent) Regulations 2009 specify that 'no person shall, without prior written notification to the Director General;

- Carry out any work on any premises that may result in a new source of discharge of industrial effluent or mixed effluent;
- Construct on any land, building or facility designed or used for a purpose that may cause the land or building or facility to result in a new source of discharge of industrial effluent or mixed effluent;
- Make or cause or permit to be made any change of, to, or in any plant, machine, or equipment used or installed at the premises that causes a material change in the quantity or quality of the discharge or release from an existing source; or
- Carry out upgrading work of an existing industrial effluent treatment system that may result in a material change in the quantity or quality of the discharge or release.'

A.5.5.2. The written notification to carry out any work, construction, or upgrading, or to make any change shall be submitted to the DOE (Johor) in the form as specified in the **Second Schedule** of the regulations, which is accessible via DOE website.

A.5.5.3. An owner or occupier of premise shall design and construct the industrial effluent treatment system to collect and treat the industrial effluent or mixed effluent

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generated within the premises in strict compliance with the specifications as specified in the Guidance Document on the Design and Operation of Industrial Effluent Treatment.

A.5.5.4. The owner or occupier of the premises shall appoint a Professional Engineer to undertake the design and supervision of the construction of the Industrial Effluent Treatment System.

A.5.6. Notification Related to Gaseous Emission

A.5.6.1. The Environmental (Clean Air) Regulations 2014 specify that 'an owner or occupier of a premise shall not, without giving prior written notification to the Director General:

- Carry out any changes in operation of his premises;
- Carry out any work on any premises that may result in a source of emission;
- Construct on any land, any building or premises designed or used for a purpose that may result in a new source of emission;
- Make, cause, or permit to be made of, to, or in any plant, machine, or equipment used or installed at the premises that causes a material change in the quantity or quality of emission for an existing source; or
- Carry out any changes or modifications to an existing air pollution control system.

A.5.6.2. The written notification is applicable to:

- Fuel Burning Equipment (FBE) such as furnace, boiler, fireplace, oven, retort, or any other apparatus, device, mechanism, stack, chimney of structure used in connection with the burning of any combustible material
- Air Pollution Control System (APCS); which means any facilities designed and constructed for the purpose of preventing or reducing the potential emission that causes air pollution, and includes the extraction system, control equipment and chimney.
- Continuous Emission Monitoring System (CEMS).
- Chimney/Stacks
- Incinerator/ Thermal Oxidizer (TOx)

A.5.6.3. The written notification shall be submitted to the DOE not less than thirty (30) days

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before the commencement of such work using prescribed forms as the following:

- Form AS-PUB-N-APB, for FBE
- Form AS-PUB-N-BAGFILTER, for bag-filter
- Form AS-PUB-N-ESP, for electrostatic precipitator (ESP)
- Form AS-PUB-N-SCRUBBER, for scrubber
- Form AS-PUB-N-SPRAYBOOTH, for spray booth
- Form CEMS/APPLICATION/2015, for CEMS

A.5.7. Environmental Requirement on Scheduled Wastes

A.5.7.1. The Environmental (Scheduled Wastes) Regulations 2005 requires waste generators to:

- Determine whether their wastes are classified under scheduled waste or otherwise. First Schedule of the regulations list all scheduled wastes, which divided into 5 categories.
- Store, recover and treat within the premise of the waste generator. However, waste generator may store scheduled wastes for 180 days or less after its generation provided that the quantity of scheduled wastes accumulated on-site shall not exceed 20 tons.
- Maintain and update an inventory of scheduled wastes generated, treated and disposed of.

A.6. DEPARTMENT OF OCCUPATIONAL SAFETY AND HEALTH (DOSH)

A.6.1. The relevant statutory acts to be complied with for DOSH are

- The Factories and Machinery Act 1967
- The Petroleum (Safety Measures) Act 1984.
- Occupational Safety and Health Act 1994
- Code of Practice for Safe Working in Confined Space

A.6.2. The Factories and Machinery Act is for the control of factories with respect to matters relating to the safety, health and welfare of persons and for the registration and inspection of machinery. Various regulations of the Act e.g. the pressure vessel

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regulations are to be complied with.

A.6.3. The Petroleum (Safety Measures) Act is an act to consolidate laws relating to safety in the transportation, storage and utilization of petroleum or petroleum products.

A.6.4. The Occupational Safety and Health Act 1994 and its regulations govern the following matters that are relevant to all projects;

- Employers' Safety and Health General Policy Statements
- Control of Industrial Major Accident Hazard (CIMAH) Regulations
- Safety and Health Committee Regulations
- Classification, Packaging and Labelling of Hazardous Chemicals
- Use and Standard of Exposure of Chemicals Hazardous to Health
- Safety and Health Officer Regulations
- Safety and Health Order
- Accident Notification

Safe Working in a Confined Space is a code of practice prepared by DOSH which outlines detail information for formulating a confined space program such as permit to work system, training, rescue procedure, control measures and duties of designated persons e.g. EPCC/EPCM CONTRACTOR and supervisor. DOSH approval and authorization requirements are depicted in detail at www.dosh.gov.my.

A.7. DRAINAGE AND IRRIGATION DEPARTMENT (DID)

A.7.1. Drainage System Approval

A.7.1.1. DID approval shall be obtained for drainage connection to the public main drain before starting construction. DID drainage plan approval shall be obtained for Local Council to approve Infrastructure Plan. Plant drainage system showing invert levels, direction of flow, storm water calculation and all details and connection to public drain shall be submitted together. All designed for the system shall adhere to DID regulations. Typical DID comments include:

- Minimum 900mm culvert crossing under public road.
- Rubbish traps to be provided at final discharge to public drain.

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- Complete Storm water drainage calculation

A.7.1.2. Silt traps shall be provided during construction. Rubbish trap at final discharge to the public drain shall also be provided.

A.7.2. Pipeline Reserve

A.7.2.1. JPS approval shall be sought for pipeline routes that cross drainage reserves or natural drainage channels. Pipeline routing and survey drawings where pipeline crosses the channels shall be submitted to JPS and approval shall be obtained prior to start of construction.

A.7.3. Erosion and Sedimentation Control Plan (ESCP)

A.7.3.1. Soil erosion and sedimentation has been identified as one of the most significant impact during initial stage of the Project. As such, it is important that the magnitude of soil erosion and sediment output is estimated accurately so that prediction of downstream impacts can be carried out more effectively.

A.8. ENERGY COMMISSION (EC) / SURUHANJAYA TENAGA (ST)

A.8.1. Overview

A.8.1.1. The Energy Commission is a statutory body responsible for regulating the energy sector particularly the electricity supply and piped gas supply industries in Peninsular Malaysia and Sabah. The Commission ensures that the supply of electricity and piped gas to consumers is secure, reliable, safe and at reasonable prices.

A.8.1.2. The Commission's responsibilities are enshrined by the Energy Commission Act 2001 and the subsequent amendments and regulations:

- Electricity Supply Act 1990 (Amendment) 2001
- Gas Supply Act 1993 (Amendment) 2001
- Licensee Supply Regulations 1990 (Amendment) 2002
- Electricity Regulations 1994 (Amendment) 2003
- Gas Supply Regulations 1997 (Amendment) 2000
- Electricity Supply (Compounding of Offences) Regulations 2001
- Gas Supply (Compoundable Offences) Order 2006

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- Efficient Management of Electrical Energy Regulations 2008.

A.8.2. Notification

A.8.2.1. Below are required notifications to the Energy Commission.

- Approval for temporary electrical equipment installation
- Inspection & testing of transformers, generators, protective relay and switchgears
- Transformers
- Generator sets
- Installation License for generator.

A.8.3. License

A.8.3.1. Gas Supply Regulations provides the following licences which can be issued under section 11 Act 501:

- Import into Regasification Terminal Licence
- Regasification Licence
- Shipping Licence
- Transportation Licence
- Distribution Licence
- Retail Licence
- Private Gas Licence
- License of competent person commissioning gas lines and permits to operate gas piping

A.8.3.2. Electricity Regulations 1994 (and amendment 2003) requires the following licenses

- Power Generation and Distribution License (Public License)
- Installation Registration (Transformers and Generators)
- License of competent person responsible for, commissioning, operation & control of PENGERANG HV equipment

A.9. FIRE AND RESCUE DEPARTMENT (BOMBA)

A.9.1. Overview

A.9.1.1. The requirements of firefighting and fire protection facilities are outlined in the

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Uniform Building By-Laws (UBBL) 1984. Apart from the UBBL, BOMBA also will be guided with code of practices such as NFPA, BS, MS, AS, ASHRAE and Multinational Companies Standards such as PTS. In addition, BOMBA also have additional requirements which shall be dealt with on a case by case basis.

A.9.2. Temporary Facilities

A.9.2.1. The following shall be submitted to BOMBA State Office for approval if necessary.

- Site Plans
- Building Plans
- Sections and elevations show fire-fighting system for temporary facilities.

Note that temporary facilities shall be accessible by fire trucks.

A.9.3. Plot Plan Approval

A.9.3.1. The plot plan showing set back from boundaries, distance between buildings and access ways for fire trucks have to be submitted for approval.

A.9.3.2. This plan shall be submitted to BOMBA State together with the application for Architectural Approval. On the plot plan access and hydrant for fire trucks and hydrant to be coloured in yellow and red respectively.

A.9.4. Architectural Approval

A.9.4.1. Prior to BOMBA submission, all BOMBA requirements shall be discussed first with the officer in charge. The listing of BOMBA requirements shall be incorporated on the key / location plan drawing.

A.9.4.2. The submissions and approval by BOMBA shall be applied to either the Federal BOMBA or State BOMBA depending on the complexity of the plant.

A.9.4.3. Project criteria for Federal BOMBA submission and approval include:

- The plant is considered a 'Mega Project' exceeding RM500 millions of investment.
- The plant is considered as a national interest to the country.

A.9.4.4. Project disciplines engineers are expected to be knowledgeable on these BOMBA practices as some of the requirements are peculiar to BOMBA only.

A.9.4.5. All building and process structure architectural plans, elevations and sections, and

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layout plans are to be submitted. These drawings shall indicate all fire-fighting/protection facilities and the requirements of BOMBA and to be coloured in red. Firefighting/protection philosophy including a brief description of the fire protection system shall also be submitted. All architectural plans shall be endorsed by a civil (professional) engineer.

A.9.4.6. During the architectural submission, the firefighting/protection philosophy shall be discussed with BOMBA and agreed before proceeding with the M & E submissions as per Section A2.4 below.

A.9.5. Mechanical and Electrical (M&E) Design Approval

A.9.5.1. The following are documents shall be submitted to BOMBA as soon as they are completed:

- Fire-fighting piping and instrumentation (P&ID) drawings
- Fire-fighting equipment layout and details
- Fire-fighting system schematic and details
- Fire damper layout
- Fire alarm and detection system architectural drawing
- Fire alarm system layout and details
- Fire Detection system layout and details
- Electrical emergency lighting and exit sign layout
- Public address system layout
- BOMBA intercom system layout
- Design calculations such as all hydraulic calculations, battery calculations, total flooding system calculation, ventilation calculation etc.

A.9.5.2. All drawings and calculation shall be endorsed by appropriate Professional Engineer (PE). Fire-fighting plans shall be endorsed by Mechanical PE whereas Electrical PE shall endorse all Instrumentation and Electrical Plans.

A.9.6. Buildings and Fire Fighting/Protection Construction Approval

A.9.6.1. Owner shall assist EPCC/EPCM Contractor to notify BOMBA that the plant has been constructed as per the submitted drawings and meet all the relevant Malaysian regulations and the Uniform Building By-Laws 1984 (UBBL).

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A.9.6.2. BOMBA shall then be requested to inspect the construction of buildings and installation of firefighting and protection services of the entire plant, upon which they will test the fire protection facilities.

A.9.6.3. Procedures to call for inspection shall be as follows:

- Submission of blue form certifying the system has been installed based on approved drawings and UBBL.
- Payment of all fees.
- Form A certification for sprinkler system if applicable
- Form B certification for fixed installation and fire alarm
- Hydro test and NDT records are not required to be submitted to BOMBA. However, BOMBA may require a Professional Engineer to certify that hydro test has been carried out as per code. Separate hydro test per each section is acceptable. However, non-hydro tested joints shall be 100% X-rayed. The Professional Engineer's representative shall witness the test and keep copies of test records for inspection.

A.9.6.4. It is vital that only one-time inspection to be planned for the particular inspection requested. It is important to eliminate unsatisfactory findings as such findings may lead to subsequent inspection.

A.9.6.5. To achieve the above, the Construction Manager shall ensure that the area / plant / buildings to be inspected have been completed in every respect such as the followings;

- All fixed fire protection system has been tested satisfactorily
- All building finishes have been completed.
- All access road and drainage are completely done.
- The condition at site shall look as if the plant is ready for occupation by the OWNER.
- Construction cranes, workers, debris and rubbish shall be cleared up from site.

A.9.7. Witness of Testing and CCC Support Letter

A.9.7.1. Representative from BOMBA shall witness the operational testing of the fire- fighting system such as monitors, deluge, hydrants, alarm panels, detectors, sprinklers, etc. BOMBA will also checks that all buildings are built as per the approved architectural drawings e.g. with respect to fire doors/partitions, escape routes etc.

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A.9.7.2. Upon satisfactory completion of inspection and operational testing, BOMBA will issue a clearance letter to Principal Submitting Person (PSP) stating that the fire- fighting facilities are acceptable and recommend issuance of CCC.

A.9.8. Incident Command System (ICS)

A.9.8.1. Incident Command System is a recent requirement where BOMBA require the Owner of major plant to setup the Incident Command System for the Plant. The ICS and schedule of implementation of the ICS shall be discussed and agreed with the BOMBA at both district and state level. Recommendation letter for Full CCC may not be released if Owner fails to comply with the requirement. It is therefore important that notice to the Owner is made during the Construction stage so the Owner can prepare the documentation ahead of plant start-up.

A.9.9. Fuel Gas Reticulation System Approval

A.9.9.1. Fuel gas system P & IDs, Piping General Arrangement drawings, material specification and calculations are to be submitted for approval if required.

A.10. LOCAL CIVIL WORKS AUTHORITY (LOCAL COUNCIL)

A.10.1.1. The main regulatory requirements enforced by Local Council are those outlined in the Uniform Building By-Laws 1984, Street and Drainage Act 1976, Town & Country Planning Act 1976, and other Malaysian standards.

A.10.1.2. With the establishment of One Stop Centre (OSC) Committee in 2007, EPCC/EPCM Contractor (and their consultants) will spend less time and efforts to obtain 'No Objection' or consent from each of the committee member who represents all of the Regulatory Authorities in the planning approval and building plan approval. The Planning Approval, in particular, is subject to 'No Objection' letter to the commencement of project issued by certain vital Regulatory Authorities i.e. DOE as the two are responsible on the impact to the environment and sewerage system respectively. As such, EPCC/EPCM Contractor has to liaise directly with them in order to obtain such information. EPCC/EPCM Contractor may also liaise with these Regulatory Authorities to ensure that any related submission is not messed out.

A.10.1.3. Prior to commencement of physical works at site, Owner is to apply to the Local Council via OSC for a Development Order (DO). The application for the DO has to be

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undertaken by a registered town planner.

A.10.1.4. Normally it takes about 38 working days for OSC to process the application of DO before an approval is granted. The approval of the DO by the Local Council is subject to the approval of the EIA report.

A.10.2. Permit for Temporary Construction Facilities (TCF)

A.10.2.1. Temporary facilities, if any, will require approval and permits for utilization. The submissions shall include layout plan of temporary facilities including lay-down areas and storage yards, architectural drawings of all temporary buildings, including sheds, car-parks, EPCC/EPCM Contractor's offices, utilities, drainage, sewerage facilities and fire-fighting facilities. Temporary facilities shall also be accessible by fire trucks.

A.10.2.2. Submitting procedures shall be finalized based on discussion with the officer in charge in each particular Local Council

A.10.2.3. Form for the Application of Temporary Permit for Construction Works shall be submitted to Local Council prior to setting-up of TCF. Local Council will then process the form and determine the amount of fees to be paid based on the quantity of the TCF / total area occupied by the TCF.

A.10.2.4. EPCC/EPCM Contractor(s) shall be responsible for any documentation, drawings or fees that might be required by Local Council, nonetheless, Permitting Personnel will offer his assistance during the said processes so as to avoid any delays.

A.10.3. Permit for Earthwork and Site Preparation

A.10.3.1. Early works such as Earthwork and Site Preparation requires prior application to the Local Council for approval. Normally, submission and approval of DO has to be obtained prior to submission and application for Earthwork and Site Preparation. Nevertheless, OWNER can apply for an early works waiver request to proceed with Earthwork while DO application is being made. Submission for Earthwork and Site Preparation has to be made to Local Council Planning and Engineering Department. The submissions shall include layout plan of earthwork, temporary access road and construction drainage.

A.10.3.2. The Local Council's approval is subjected to the approval of the DEIA report submitted to DOE. Owner will prepare the DEIA report and submission.

A.10.4. Planning Approval for Construction of Permanent Facilities

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A.10.4.1. Approval has to be obtained from Local Council to locate a particular building or installation in a particular area. This is to ensure that the necessary infrastructure is available or will be available at the time when the installation is completed.

A.10.4.2. Buffer zone, set back from boundaries, distance between buildings and access ways and other considerations e.g. traffic movement, earthworks and public utilities shall be considered. Local Council will then consult all relevant Regulatory Authorities that require input for planning before giving the approval. In particular, the consent from the DOE will also be required prior approval.

A.10.4.3. Planning approval shall be obtained before the relevant departments of Local Council (Building, Engineering, Architectural, Infrastructure, Planning, Recreation, and Environment etc.) consider submissions for approval. When these departments peruse the submission they will also consult other relevant Regulatory Authorities such as BOMBA, DOE, DOSH to obtain official clearances.

A.10.4.4. For an EPC contract which is fast track, it is critical that the Permit Controller liaise directly with the technical agencies to obtain no objection letter from them in parallel to shorten the approving activities.

A.10.5. Piling and Soil Investigation

A.10.5.1. Piling Layout Plans & Soil improvement plan, if any, shall be submitted to Local Council before commencement of piling or soil improvement work. Submission under category ‘earthwork’ can be made if it is critical to perform piling works earlier due to monsoon season or other reason before finalization of building/structure drawings.

A.10.6. Building Plan Approval (Architectural Drawings) and Infrastructure Approval

A.10.6.1. Building plan and structure architectural plan and infrastructure plan as listed below shall be submitted to Local Council for approval prior to start of construction. These drawings shall be coloured as per requirement stipulated by the Local Council and signed by professional engineer and the Owner. Processing fees are also to be paid based on UBBL schedule of fees.

A.10.6.2. The submission package shall include the following document and accompanied with

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Form A of the UBBL.

- Building and Structure Plan shall comprise of;
  - Overall plot plan with indication by red colour for the particular submission inclusive of key and location plan and listing of the equipment. This drawing normally originated from Piping Discipline.
  - Architectural Plans, Section and Elevation for the building and structures.
  - Architectural Details such as doors, windows etc.
- Infrastructure Plans shall include;
  - Civil General Arrangement Drawing showing roads, drainage and other services for all areas.
  - Civil works detailing such as fencing, gates, road signage, road markings, septic tanks details etc.
  - Landscaping or Surface finishing plan.
  - Street lighting plan.
  - Effluent Treatment Plant (ETP) system including plan for the reticulation from waste sources, the plan section and elevation, P&ID and related ETP capacity calculation.
  - Oily Water and waste water layout plan and details.
  - Storm water system including plan for the Storm water reticulation, and design calculation for overall storm water system.
  - Water supply system including reticulation layout, schematic and one- day storage demand calculation.
  - Electrical Power supply main single line diagram.

A.10.6.3. The submitting procedure is as follows:

- Use of local authority prescribed form for submission.
- Number of sets required to be submitted typically, 8 set including 1 linen set are required.
- All drawings shall be coloured based on authority's standard requirement. If not available, colour codes shall be based on project's Civil Department Working procedure DWP-CV-01.
- All drawings shall have 'Bahasa Malaysia' title block showing the project description, The Owner, The PSP and EPCC/EPCM Contractor responsible.
- All drawings and standard forms shall be endorsed by the Professional Engineer. Owner's representative shall also sign and endorse the plan.

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- All submission drawings shall be folded to special A4 folding and binder with listing of drawings.
- All drawings shall be consistently in the same size where possible.
- Plan processing fees shall also be prepared based on the UBBL scale of fees.
- Payment shall be made upon submission.
- Reduced A3 sets for the complete submission drawings if required.
- Site photos of the empty plot if required.
- Land title, latest receipt of tax assessment etc. if required.
- Perspective coloured drawing / pictures for the proposed plant if required.
- Form A of the UBBL.

A.10.6.4. Structural Drawings and Calculations

Structural drawings and calculations certified by a Professional Engineer including calculations for foundations are to be submitted to Local Council for their records prior to the application for Certificate of Completion and Compliance (CCC).

A.10.7. Commencement of Construction

A.10.7.1. No construction of any permanent work shall commence at site without prior approval from the Local Council. The approval shall be obtained by Owner prior to issue of Approved for Construction (AFC) drawings.

A.10.7.2. Construction works that commenced without approval from Local Council is liable to fine enforceable by the Local Council as per UBBL or Street, Building and Drainage Act.

A.10.7.3. As the CCC already took effect Permitting Officer/Engineer shall submit duly-filled and signed form G1 – G21 upon completion of each scope of work. Refer to Certificate of Completion and Compliance item for further details of submission of these forms.

A.10.8. Supervision of Construction

A.10.8.1. It is the requirement of Malaysia Law that the construction of the Plant shall be supervised by the relevant professional engineers or consultant who endorsed the documentation for submission to the Regulatory Authorities. The professional engineers are responsible to ensure that the Plant is built in accordance with design documents, which have been approved by the Regulatory Authorities. The required

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supervision to be done by the professional engineers is as follows:

- The Professional Civil engineer shall supervise the civil and structural works.
- The Professional Mechanical Engineer shall supervise the mechanical works.
- The Professional Electrical Engineer shall supervise the electrical works and instrumentation works.
- The relevant Professional Engineer shall appoint a Site Supervisor to ensure that the Construction is carried out according to the approved design documents.

A.10.9. Inspection During Construction

A.10.9.1. During construction, officials from Regulatory Authorities are not normally present, unless there are complaints from third parties or there is a requirement for inspection/witness required by regulations.

A.10.10. Information to Regulatory Authorities

A.10.10.1. In order to keep Local Council officials well informed of the activities at site, it is recommended that a presentation is made to Local Council when a major milestone is achieved, under the coordination of the supervisors of the Professional Engineer.

A.10.10.2. During the course of construction, it is necessary to inspect certain phases of the works as outlined in the relevant sections. The respective professional engineers (Principal Submitting Person / PSP) shall inspect the works to confirm that construction has been carried out according to the submitted plans before issuing CCC.

A.10.11. Regulatory Authorities Inspections

A.10.11.1. Upon completion of all buildings and structures, Construction Manager shall inform Permitting Officer/Engineer accordingly and request PSP to issue CCC.

A.10.11.2. In order to obtain the CCC, compliance and support letter for CCC from other local Regulatory Authorities having jurisdiction are also necessary. Representatives from the various Regulatory Authorities shall be invited to inspect the plant to confirm that the construction has been done in accordance with the approved document. The approved drawings with the stamp of the relevant authority shall be available at the site during the time of inspections. The inspections from other Regulatory Authorities shall be done separately, each Regulatory Authorities at separate time, prior to Local

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Council inspections.

A.10.11.3. The critical Regulatory Authorities are:

- BOMBA
- EC or TNB
- Building department and engineering department of the Local Council
- DOSH
- DOE
- DID

A.10.11.4. In the issuance of CCC, Form F/F1 shall be used and filled up by the Professional Engineer. Each form F and F1 to be issued shall be in 4 copies as follows:

- Original copy to be addressed to the Owner
- Second copy to be retained by the PSP
- Third copy to be sent to the relevant local authority
- Fourth copy to be sent to the Board of Architect Malaysia

A.10.12. Certificate of Completion and Compliance (CCC)

A.10.12.1. CF was replaced by CCC on 12 April 2007 and it is issued by PSP (professional architect, professional engineer or building draughtsman allowed by Architect Act to issue a CCC for buildings not exceeding two-storey and an area less than 300 square meters) whereas previously it was issued by Local Council upon receipt of Form E (UBBL). The main reason of CCC implementation is to enable Owner to move into their premises as soon as possible without compromising their safety.

A.10.12.2. CCC will only address the technical aspects and as long as these are complied with and there is no apparent threat to safety, then it can be issued.

A.10.12.3. Even though CCC is issued by PSP but Local Council still have its own roles to play which includes receive, process and approve planning permission and building plans. Others include authorize site inspections on their own initiative or act on complaints to check work in progress, issue a notice if there is breach or divergence and failure to rectify it, issue a notice in writing to the PSP not to issue the CCC if breach and divergence are not rectified There is no change to the responsibility or liability on the PSP as under the old system the PSP was already fully liable and responsible for the entire project even though the Local Council approved it and issued CFO for it.

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A.10.12.4. Prior to issuance of CCC, twenty-one (21) certification forms need to be endorsed along the entire construction process (each form needs to be verified by professionals and EPCC/EPCM Contractor).

A.10.12.5. PSP shall ensure that all the certification forms (Forms G) are duly filled and certified as they form part of CCC. It is advisable to ensure that CIDB-registered EPCC/EPCM Contractor and licensed tradesmen (Electrician and Plumber) are well informed of their obligations as early as possible from time of tender and award of works, and their respective certification is obtained immediately upon satisfactory completion of their scope of works. It is not wise to leave such certifications to the end of the project or when PSP is about ready to issue CCC. CCC can only be issued by the PSP after the following have been secured:

- All certifications by the respective parties (professionals, EPCC/EPCM Contractor and licensed tradesmen based on prescribed 'Form Gs' under the Matrix of Responsibility (Form G1 – G21): and Clearances from the following Regulatory Authorities:
- Tenaga Nasional Berhad (TNB): confirmation of electricity supply
- Sewerage Service Department (IWK): confirmation of connection to sewerage treatment plant or mains
- BOMBA: Clearance for active fire-fighting system
- DOSH: Where applicable
- Relevant Regulatory Authorities / Public Work on Road and drainage
- Department of Irrigation and Drainage (DID), If applicable
- TELEKOM, If applicable

- G Forms are to be completed and submitted along with Form F/F1 to Local Council upon completion of all works.

A.11. STANDARD & INDUSTRIAL RESEARCH INSTITUTE OF MALAYSIA (SIRIM)

A.11.1. Overview

A.11.1.1. SIRIM endorsement is required when requested Owner to perform SIRIM endorsement for custody transfer purposes. It will include;

Tank Calibration and Pipeline Calibration

✓ The identification for the tank and pipeline require calibration shall be discussed with

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Owner, Custom and SIRIM accordingly. Calibration job shall be done by certified Surveyor and performed according to SIRIM approved calibration procedure.

Metering System Calibration

- ✓ All custody meters shall be the SIRIM approved type. Provision for periodic calibration shall also be provided as required by SIRIM.

Truck Weight Scale

- ✓ Vendor shall obtain approval for Truck weighing Scales, for installation, calibration and testing.

A.12. TENAGA NASIONAL BERHAD (TNB)

A.12.1. Overview

A.12.1.1. The procedures applicable for approval for electrical power supply is governed by the Electricity Supply Act 1990 and respective Electricity Supply (Regulations) 1994 and amendment made thereof.

A.12.2. Temporary Facilities Electrical Approval

A.12.2.1. The determination whether a temporary power is sourced from TNB or from Generator set shall be evaluated by the Electrical Discipline with discussion with TNB. The scope of obtaining temporary power is best to be handled by the Temporary Facilities Sub- EPCC/EPCM Contractor. This is so because the Temporary Facilities Sub-EPCC/EPCM Contractor will always have Registered Electrical EPCC/EPCM Contractor locally with connection with the local TNB or ST Office. This scope of work by the Sub-EPCC/EPCM Contractor shall be specified during the bidding stage including the registration of installation and competent personnel to control the installation depending on the voltage level received.

A.12.2.2. If the power supply is to be generated from Generator set exceeding 5 kW, the installation has to be approved by ST. If TNB supply is obtained at 11 kV and above, the installation has to be registered with ST.

A.12.2.3. Normally the following has to be prepared by Electrical Discipline to form the submission package:

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- location plan
- plot plan showing location of substation
- single line diagrams
- installed maximum demand load and normal operating loads
- date required
- duration of electric supply
- generator set detail drawing if generator set is used above 5 kW.

A.12.2.4. Form A together with the above documents shall be submitted for approval.

A.12.3. Permanent Facilities Electrical Approval

A.12.3.1. The following documents/drawings need to be submitted at the beginning of design activities to ascertain that TNB will be able to provide the infrastructure necessary for energization of the Owner main intake substation on time. Upon receipt of the information, TNB will evaluate and advise the project on the best mode of power supply to the plant. Detail discussion between the Owner, EPCC/EPCM Contractor and TNB has to take place to confirm all arrangement which may involve land acquisition for TNB substation, mode of contribution, deposit, schedule and other relevant issue.

- Location and Site Plan.
- Main single line diagram showing the equipment fault level, the metering system and the protection scheme.
- Initial load requirements.

A.12.4. Permanent Facilities Electrical Approval

A.12.4.1. The following drawings/documents need to be submitted for approval before starting the installation works:

- Form A
- Overall layout plans
- Main single line diagram.
- LV Distribution single line diagram.
- Substation layout.

A.12.5. Registration of Competent Person

A.12.5.1. All works of Subcontractor shall be under the respective supervision of competent person registered with ST.

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- Any electrical wiring in an installation which receives low voltage (less than 1000 VAC, single phase) shall be under direct supervision of minimum a Registered Wireman with single phase Restriction. For low voltage three phase shall be under direct supervision of a Wireman with Three Phase Restriction. Upon completion of wiring or rewiring or an extension work, the Wireman shall certify the Supervision and Completion Certificate in Form G and Testing Certificate in Form H.
- For High Voltage category (more than 1000 VAC) the installation shall be tested by an Electrical Services Engineer employed on full time basis by Electrical Services EPCC/EPCM Contractor, and who shall certify the Test Certificate Form H for the installation.
- Registered Electrical EPCC/EPCM Contractor shall perform the works.

A.12.6. Registration of Electrical Installation

A.12.6.1. The installation receiving 11kV and above shall be registered with ST using Form ST (KE) 9. Original form shall be obtained from local ST office for the purpose of submission.

A.12.7. Application to Install Wiring

A.12.7.1. The registered electrical EPCC/EPCM Contractor has to submit Form A for formal wiring application to TNB and ST together with the single line diagram and load details, duly endorsed by a professional electrical engineer. After the application has been approved, the wiring and installation work of electrical system in the plant can then proceed.

A.12.8. Supervision of Installation

A.12.8.1. For large power consumer, the Registered Electrical Services Engineer or his representative shall supervise the installation of the wiring and equipment. Supervision and Completion Certificate, Form G, shall be submitted to TNB or power supply company such as CUF and JBEG after the electrical installation work has been completed.

A.12.9. Testing of Electrical Works (HV) Above 1000 VAC

A.12.9.1. On completion of the electrical works, the testing and commissioning of the installation such as the main switchgear, transformers, bus bars, HV cables and the

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calibration/testing and setting of protection relays shall be carried out by a registered electrical services engineer.

A.12.10. Registered Electrical Services Engineer

A.12.10.1. The Registered Electrical Services Engineer is an independent party engaged by the electrical EPCC/EPCM Contractor and shall possess the relevant competency certificate for electrical testers, issued by ST. The registered electrical services engineer shall produce and submit a test certificate (Form H) and results to ST and power supply EPCC/EPCM Contractor or TNB after the required tests are carried out.

A.12.11. Testing of Electrical Works (LV)

A.12.11.1. The rest of the testing on wiring and LV cables shall be done by the Electrical EPCC/EPCM Contractor and shall be endorsed by a competent Wireman with the relevant competency certificates. The electrical EPCC/EPCM Contractor shall produce and submit a test certificate (Form H) and results to TNB after the required tests have been carried out.

A.12.12. Energisation

A.12.12.1. No energisation shall take place until the Supervision and Completion Certificate (Form G) and Testing Certificate (Form H) is given to either TNB or power supply-company and ST.

A.12.12.2. The presence of a registered electrical services engineer or his representative is required at site during the energisation of electricity supply by TNB or power supply-company. The representative from TNB or power supply-company needs to be present to energize the electricity supply for the first time.

A.12.12.3. In many cases where the energisation takes place long before the plant is handed over to the OWNER, EPCC/EPCM Contractor or the custodian of the substation shall appoint the registered electrical services engineer to perform inspection on regular basis according to the Act.

A.12.12.4. The registered electrical services engineer has to submit details of electrical installation to ST. They will advise the Owner regarding the number of persons required and the type of competency required for the operation and maintenance of

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the electrical system of the plant. A fee, which will be determined by ST, shall be paid for the issue of the certificate of registration or renewal.

A.12.13. No Objection Letter

A.12.13.1. After having reviewed the abovementioned documents and drawings, TNB or power supply OWNER shall issue a Clearance Letter for the overall Installation/wiring to Local Council.

A.12.13.2. Permission to construct substation is obtained from Local Council after meeting the TNB requirements.

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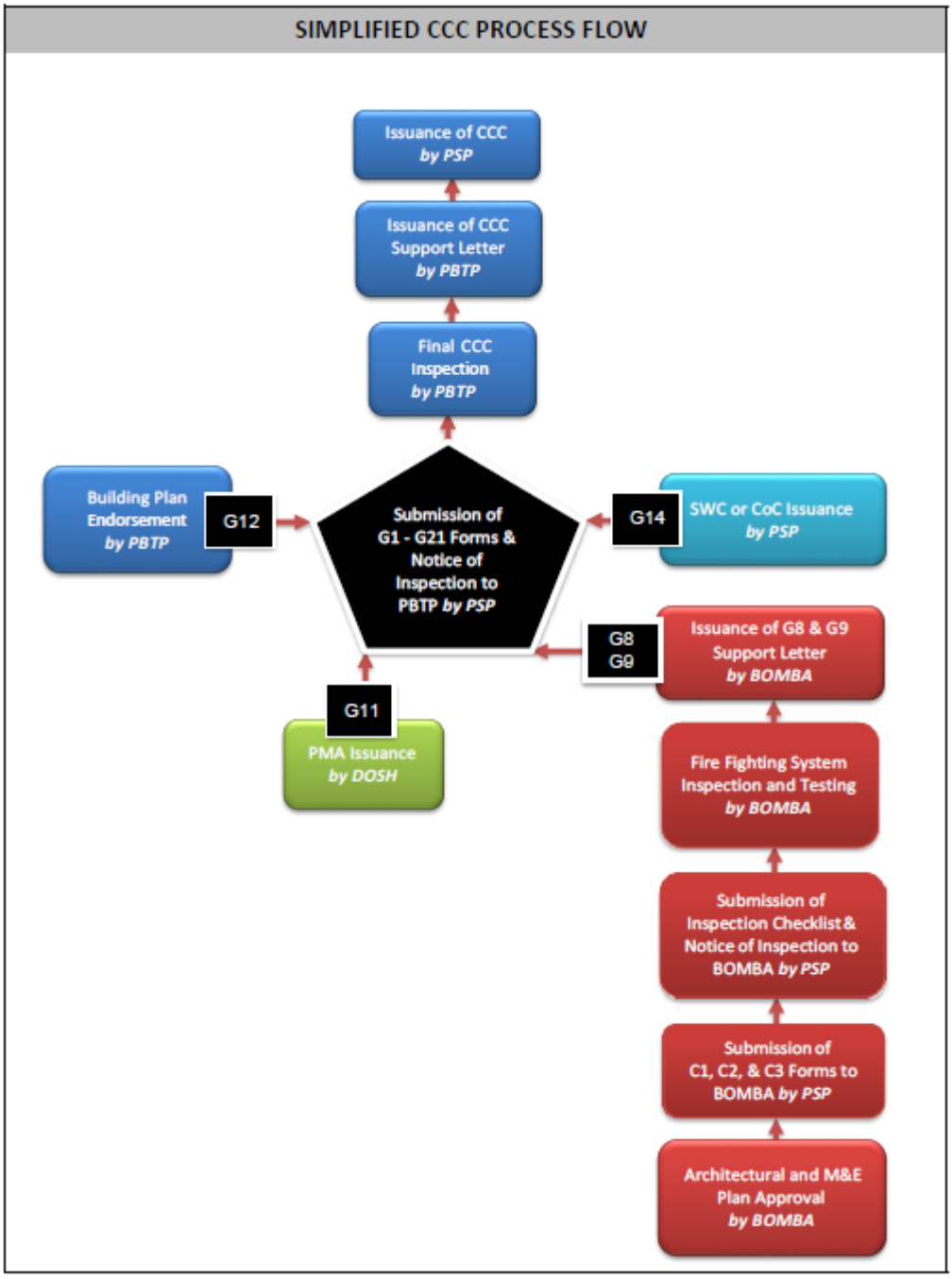
8. APPENDIX 2 – OVERALL REGULATORY PERMITTING PROJECT TIMELINE

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9. APPENDIX 3 – SIMPLIFIED CCC PROCESS FLOW



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PROJECT SPECIFICATION

PRELIMINARY SITE HSE PLAN

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INTRODUCTION

1.1 Scope

The Site HSE Manual form parts of the CONTRACTOR's HSE Management System

CONTRACTOR will identify and adhere to all applicable Local Regulatory and International Standards regarding HSE - Relevant local and federal, Malaysian LAW, Relevant Johor's State Enactment and applicable international laws and regulations - and will require SUBCONTRACTORS to do the same for their own activities.

CONTRACTOR shall also comply at all times with the requirements, as set forth by the OWNER in its Health, Safety and Environment Management System ("HSEMS"), policies, Pengerang Energy Complex Sdn Technical Standards (PTS), WORKSITE HSE requirements, OWNER‟s Zero Tolerance Rules ("ZeTo"), Mandatory Control Framework (MCF) and any special instructions and all requirements stipulated in the CONTRACT.

SUBCONTRACTORS and Vendors will be required to demonstrate understanding of, and compliance with, all HSE procedures, rules and regulations.

Where required, the activities described in this document are detailed in separate specific procedures, Plans and programs.

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1.2 Purpose

The purpose of this document is to be the principal support instrument to manage all relates HSE matters during the project execution phase.

The execution of the plan requires a continuous active input from, CONTRACTOR, SUBCONTRACTORs, other parties involved, including OWNER who have specific knowledge of the local situation and conditions. CONTRACTOR's role is to manage the "Project" HSE program and to coordinate the actions of all parties involved to ensure a concerted effort to achieve the maximum HSE performance level.

The Site HSE Plan (this document) defines the activities to be carried out within the boundaries of the construction site and temporary facilities/laydown areas during the execution stage (refer to Appendix 6 for a Draft of HSE Program).

It is a working document subject to ongoing review, and possible revision, during the lifetime of the project.

The Site HSE Plan shall apply to all construction, pre-commissioning and commissioning activities to be carried out by personnel working on the project, and also to any person assigned to or visiting the project during the construction phase.

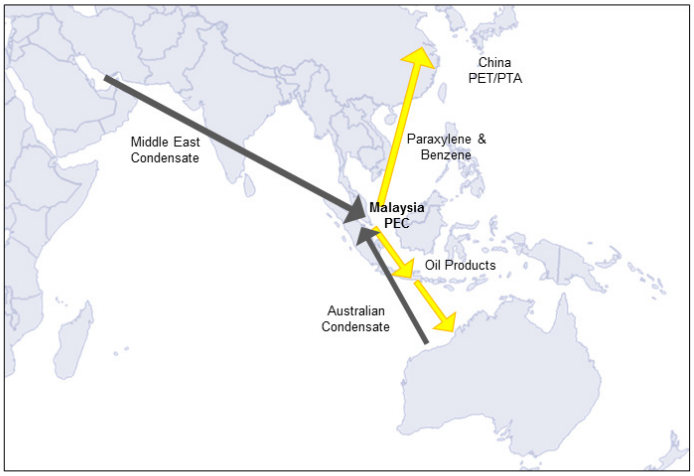
1.3 Project description

Pengerang Energy Complex is one of the largest and most competitive Aromatics Plants in the World, to be located in the strategic Pengerang Refinery and Petrochemicals hub in Johor, Malaysia, at the tip of the Malaysian Peninsula and directly opposite the City State of Singapore, sharing its attributes as a central trading hub and deepwater port.
Pengerang in Johor State, Malaysia has been selected as the location for the proposed PEC Aromatics development because of its central location between the core sources of Condensate, the Middle East and Australia, and its easy access to the end user markets in China.

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Pengerang Energy Complex – The PEC Proposition

World Scale (6.5MMTPA) Greenfield Integrated Condensate Splitter & Aromatics Complex Located in Johor, Malaysia



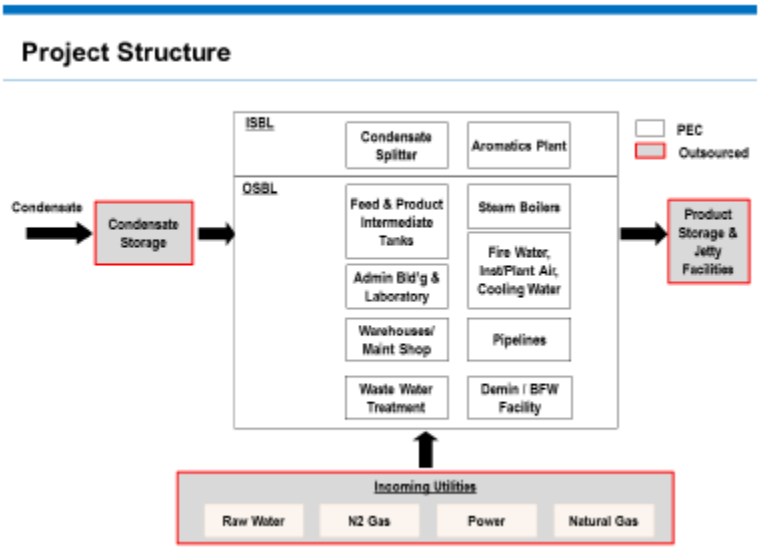
Critical Success Factors

- Central location
- Comprehensive logistics support
- Low cost of production
- Readily available feedstock
- Strong product demand
- Latest technology

Building On Long Term High Value Forecast Aromatics Demand / Supply Gap In China

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The Project will be structured as follows:



2. ABBREVIATIONS AND DEFINITIONS

ALARP As low as reasonably possible

AME Approved Medical Examiners refer to registered medical practitioners approved by PENGERANG ENERGY COMPLEX to carry out health assessment for Fitness to Work for the Company's employees.

CONTRACTOR Tecnimont S.p.a

CPC Chemical Protective Clothing

DOE Department of Environment

DOSH Department of Occupational Safety and Health

LOWER TIER SUBCONTRACTOR means any person or company of any tier, including but not limited to, suppliers or vendors of MATERIALS, suppliers of SUBCONTRACTOR's EQUIPMENT and erection contractors, having a contract with SUBCONTRACTOR or a LOWER TIER SUBCONTRACTOR for the performance of any part of the WORKS.

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NIOSH National Institute of Occupational Safety and Health

OHD Occupational Health Doctor is a medical practitioner who has post graduate qualification in Occupational Health and is registered as an Occupational Health Doctor by DOSH

OWNER Pengerang Energy Complex Sdn BHD (PEC) which includes its representative, successors, nominees and permitted assigns and shall where the context so admits and requires, also include its employees, agents and designated representative.

PROJECT Pengerang Energy Complex Sdn BHD (PEC) Project in the State of Johor, Malaysia.

SUBCONTRACTOR means the person or persons, firm or company named as such in the Subcontract Agreement, who has undertaken to execute the WORKS under this SUBCONTRACT and includes the SUBCONTRACTOR's legal or nominated representatives, personnel, successors, SUBCONTRACTORs d permitted assignee.

For other definitions and acronyms please refer to Appendix 3 of this document.

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3. LEADERSHIP AND COMMITMENT

3.1 Commitment

CONTRACTOR's management (director, project, site and constructions managers, department and functional managers) is committed to execute the Plant in a manner that is uncompromising on issues of health, safety, the environment, and security.

Senior management of CONTRACTOR will personally practice HSE leadership, demonstrate visible commitment to the project's HSE policy and strategic objectives, and provide resources to foster a project culture that embraces and accepts nothing but optimal HSE behavior.

The management is committed to executing the construction activities with an emphasis on the necessary care to protect the environment, the prevention of pollution and continual improvement of the project environmental performance.

The CONTRACTOR's management is committed to never, for whatsoever reason, let that cost, schedule, and quality concerns could prevail over HSE requirements of the Project.

Moreover, CONTRACTOR's management is committed to:

Comply with the requirements of all applicable HSE laws and standards.

Pursue continuous improvement of the HSE management system and the HSE performances on site.

Perform training programs and promote the awareness of the personnel at every level to work in a safe and environmentally responsible manner.

Assure the co-operation with Public Authorities, OWNER, Suppliers, Local Communities and other stakeholders on HSE issues.

Require SUBCONTRACTORs to manage the environmental issues in an appropriate way, consistently with the requirements of CONTRACTOR's and OWNER HSE management system.

3.2 Site Philosophy

The following principle and concepts apply to the site and are the base of our HSE program:

- All accidents are preventable.

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- No economy or any other consideration comes before Safety.
- A safe site is a productive site
- Every employee has the responsibility and is empowered to take the necessary corrective actions to create an environment free from recognized hazards.
- No accident and/or damage to the environment can be justified.
- Zero accident is achievable through continuous improvement practices, commitment and delegation

4. POLICY AND OBJECTIVE

4.1 HSE Policy

HSE Policies are the references for Tecnimont and HQC HSE Management systems (ref. to Appendix 1).

All employees and CONTRACTORs are required to be committed to and perform their duties according to HSE Policy and any individual policy on HSE.

CONTRACTOR and any SUBCONTRACTORS thereof are required to adhere to the CONTRACTOR Project HSE Policy and to the other Project CONTRACTOR Policies specifically prepared for the project (Appendix 1).

4.2 Project and Corporate HSE Policy, distribution and publicizing

Signed copy of the Project HSE Policy shall be affixed on strategic places of site offices and other relevant site premises where it can be well visible to all employees.

The principles of the HSE policy will be exposed to all employees during the HSE orientation section at the arrival on site, and during other relevant trainings and meetings.

Copy of the policy is distributed to the OWNER and all SUBCONTRACTORs.

Copy of the HSE Policy, if necessary or requested, is distributed to other interested parties (Public Authorities, Citizens' Associations, etc.).

4.3 Objectives

- Strive to eliminate all occupational injuries and illnesses;

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- Achieving Zero Accidents and Zero Incidents;
- Promote HSE objectives as a constant value while executing work;
- Enhance employee awareness and involvement in our health, environmental, and safety program implementation;
- Meet each governmental authority's HSE legal requirements and strive to continually exceed OWNER expectations;
- Prove to OWNER that CONTRACTOR is dedicated to safety excellence;
- Increase employees' consistent use of safe practices in their daily work activities;
- Optimize the use of continuous improvement practices as the basis for Zero Accident Performance initiatives;
- Achieve superior results that ensure HSE principles are correctly implemented to protect all the parties involved, employees, and investors from exposures, physical, fiscal, and legal;
- Implement a training program that support the achievement of personal competency in relation to HSE;
- Ensure that safety concerned can be raised and addressed at all level of the organization;
- Ensure that the HSE goals are the prime consideration in the project execution;
- Continually monitor and improve the HSE performance;
- Ensure that all personnel employed on the project are competed to carry out the designated task safely;
- Guarantee an effective environmental protection minimizing the negative environmental aspects and achieving a Zero environmental incident on the project;
- Select SUBCONTRACTORs that are committed to "Zero Accidents Performance"; and
- Insure that all our employees return home at the end of the workday in sound physical condition.

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4.4 Key Performance Indicator

In order to implement the HSE Policy and the objectives to be achieved they have to be assessed on a monthly basis. CONTRACTOR shall define a list of key Performance Indicators (KPI) to be recorded and monitored.

Here below in the table the KPI list and targets.

DESCRIPTION	TARGET	NOTE
Number of fatality	0	-
Lost Time Injury Frequency Rate LTIF	<0.07	LTIx 200k/WH PTD
Total recordable injuries rate TRIR	<0.30	TRCx 200k/WH PTD
Number of observation reported eve 250 worked man-hours	>1:250 MH	UA/UC submitted on monthly basis
Total training hours/total man-hours worked (TTH/TMW)	1,60%	TTH/TMW % (PTD) Total training hours including TBT (10 min) & STARRT (5 min)

5. SITE HSE ROLES AND RESPONSIBILITIES

5.1 HSE Organization

The Site HSE team is the central point of reference through which the CONTRACTOR will implement the project's HSE Management System

CONTRACTOR will appoint an HSE Manager who shall be responsible for ensuring that all activities on the WORKSITE are conducted in a safe and secure manner. The HSE Manager shall report directly to the CONTRACTOR's Site Manager.

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The minimum qualification required for the HSE Manager(s) is the Department of Occupational Safety and Health ("DOSH") Safety & Health Officer ("SHO") certification and registration, as required under the Occupational Safety and Health (Safety and Health Officer) Regulation of 1997 (or equivalent / higher, local or international HSE certification approved by OWNER) with minimum 10 years of HSE experience in major Onshore / Oil & Gas Projects.

CONTRACTOR shall appoint adequate number of HSE Supervisors and HSE Officers, who are responsible for enforcement of the HSE requirements at WORKSITE. The HSE Supervisors will report to the HSE Manager and the HSE Officers will report to the HSE Supervisors respectively.

The minimum qualification required for the HSE Supervisor(s) is the Department of Occupational Safety and Health ("DOSH") Safety & Health Officer ("SHO") certification and registration, as required under the Occupational Safety and Health (Safety and Health Officer) Regulation of 1997 or an international HSE certification approved by OWNER with a minimum of 3-5 years of HSE experience in major Onshore / Oil & Gas Projects.

The minimum qualification required for the HSE Officer(s) is National Institute of Occupational Safety and Health ("NIOSH") Certificate Program for Safety & Health Officer or international HSE certification approved by OWNER, with a minimum of 1-2 years of HSE experience in major Onshore Oil & Gas Projects.

OWNER reserves the right to interview and approve the HSE Manager(s), HSE Supervisor(s) and HSE Officer(s) allocated for carrying out the specific activities or request allocation of more HSE Manager(s), HSE Supervisor(s) and/or HSE Officers, if indeed, require.

For the CONTRACTOR HSE site organization chart please refer to the Appendix 2 of this document.

5.2 SUBCONTRACTORS HSE Team Capacity

SUBCONTRACTORS must employ and mobilize at site an adequate number of HSE Supervisor(s) and HSE Officer(s), acceptable to CONTRACTOR. The number and professional experience of above-mentioned personnel shall be as a minimum in accordance with how stated in chapter 5.1.

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Number of employees at site (direct + indirect)	N. HSE Supervisor(s)	Site Safety Supervisor(s)
< 100	**1 (Full time)**	**-----**
100-200	**1 (Full time)**	**1 (Full time)**
200-300	**1 (Full time)**	**2 (Full time)**
300-400	**1 (Full time)**	**3 (Full time)**
400-500	**1 (Full time)**	**4 (Full time)**
500-600	**1 (Full time)**	**5 (Full time)**
600-700	**2 (Full time)**	**5 (Full time)**
800-900	**2 (Full time)**	**6 (Full time)**
Over 900	**2 (Full time)**	**6+1 additional every 100 employees**

All HSE personnel shall be dedicated full time to HSE activities.

SUBCONTRACTORS shall submit detailed CVs of the proposed HSE Supervisor(s) and HSE Officer(s) before the mobilization to site for CONTRACTOR approval.

CV's will be permanently filed in the Site HSE CONTRACTOR archive and made available on OWNER request.

5.3 Responsibility and Competency

Project Director/Project Manager

Roles and responsibilities:

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- He takes overall responsibility for Project HSE requirements and for the achievement of Project HSE objectives as per HSE Policy and Commitments.
- Assurance that HSE Management System is implemented throughout all phases of the Project.
- Assurance that Project personnel take ownership of the HSE Management System.
- Assurance that suitably competent HSE personnel are assigned to the Project.
- Assurance that sufficient resources, human and material are allocated for all HSE requirements.
- To monitory the project HSE performances.

Site Manager

Roles and responsibilities:

- Assurance that HSE Management System is implemented at site.
- Ensure the implementation of the HSE policy and the HSE Plan on Site.
- Assurance of prompt investigation and reporting in case of incidents.
- Ensure that all relevant HSE requirements are well known and implemented by the site personnel, and that all delegations of responsibility and authority concerning HSE (from himself to other field management personnel) are fully understood and appreciated.
- Ensure that all HSE procedures and instructions are well implemented.
- Participate at the HSE meeting periodically organized by CONTRACTOR and OWNER.
- To provide safe construction equipment, tools and Personnel Protective Equipment in sufficient number for the CONTRACTOR employees involved and for the work to be performed.
- Held and chair the Monthly HSE Committee Meeting

Construction Manager

Roles and Responsibilities:

- Assist the Site Manager in planning and implement the HSE Program

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- Ensure that all facilities are:
- Built in accordance with construction HSE standards.
- Maintained to standards or corrected in order to meet operating and HSE requirements.
- To perform and co-ordinate construction work in the safest manner.
- Conduct regular HSE inspections and Audits on the area of competence to ensure that all SUBCONTRACTORs are aware of and comply with the HSE requirements.
- Verify that inspection and audit follow up actions are fully and timely taken.
- Participate in the investigation of incident and accident.
- Promote corrective actions in case unsafe acts or conditions.

Site HSE Manager

The Site HSE Manager takes the following roles responsibilities:

- Assist the site manager in the general supervision of the HSE program.
- Audit and control of due implementation of HSE Management System.
- Planning, participating and reporting HSE Audits.
- Monitoring the implementation of the HSE program.
- Assist Construction Manager, Supervisors and foremen in promoting a Safety prevention spirit within their respective work groups, according to the approved safety programs.
- Conduct periodical inspection on site, and direct appropriate corrective action.
- Prepare inspection reports for the Site Manager for his review and action.
- Conduct the investigation in case of accidents, incidents and near misses, and forward the reports to Site Manager for submission to OWNER and-or concerned authorities.
- Attend with the Project Manager to safety committee meetings

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- Perform all the remaining miscellaneous work relating to safety, traffic, fire, environment protection and sanitary matters.
- Collaborate closely with OWNER's Representative with regard to HSE.
- Provide feedback on performance and assist CONTRACTOR Supervision to plan and coordinate the work to effectively implement all HSE requirements.
- Verify the adequacy and application of the Site HSE Plan and all related procedures, to the preparing any revisions;
- To update the HSE documentation during all the construction phases when deemed necessary.
- To check that SUBCONTRACTORS, perform their activities in accordance with all the HSE applicable procedures, regulation and standards, promoting all necessary action to ensure that the said procedures and regulations are observed;
- To organize, plan and participate to periodical HSE walk around, Inspections and Audits on site, prepare all the relevant reports, action plans; verify the follow up and the timely execution of the corrective action.
- To organize, coordinate and directly participate in the HSE Training activities on site.
- To organize and participate to all relevant site HSE Meetings, prepare the relevant MOM
- To coordinate the PTW procedure;
- To keep accident records, identifying the areas to which prevention must be addressed;
- Lead and coordinate the activities off the Site HSE Committee (composed by all CONTRACTOR and SUBCONTRACTORs HSE Representative)
- To lead and coordinate the site emergency response team and fire prevention/fighting team, organizing training and emergency drill mock activities.
- To prepare the HSE section of the construction monthly progress report and other periodical report.

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- To prepare and update the Site HSE Statistics, verify the performance versus the Project and corporate HSE Objective, Targets and performance indicators; propose recovery plan in case of deficiencies.

HSE Supervisor/Officer

The HSE Officer/Supervisor reports to the Site HSE Manager.

Roles and responsibilities:

- Participate in monitoring the HSE activities including auditing, sampling and inspection.
- Inspect the construction area daily
- To be responsible for the training of new hires and all levels of personnel on HSE matters, with a specific attention to particularly hazardous tasks.
- Participate in the investigation of all incidents, accidents and near misses.
- Take action and report immediately to the Site HSE Manager in case of dangerous actions and/or situations.
- To be of constant advisor on the field for any problem related to HSE for all the personnel.
- To participate to the toolbox meeting held by the foremen and support them during this activity
- To verify on daily basis the correct use of PPE by all the personnel
- To participate to the Safety committee meeting
- To actively participate in the investigation of all incidents accidents and near messes
- To ensure that Fire Fighting and Safety equipment is regularly inspected and serviced.

Superintendents and Supervisors

Roles and responsibilities:

- Participate in the CONTRACTOR’s and OWNER’s scheduled work area audits or inspections and implement and document required corrective actions.

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- Be familiar with and enforce HSE rules, regulations, and laws and document all actions taken to ensure compliance with those.

- Attend, actively participate in, and consistently demonstrate strong leadership at weekly Toolbox Safety Meetings.

- Actively participate in pre-job planning activities. Specifically, Job Hazard Analysis' (JHA) and Job Safety Analysis.

- Shall be thoroughly familiar with this procedure and with their individual responsibilities regarding its implementation and enforcement.

- Supervisor shall ensure that only competent persons are assigned work tasks. This includes ensuring the worker has the skills, physique and knowledge to safely execute the work task.

Employee

Roles and responsibilities:

Employees must:

- Know, understand and comply with the health, safety and environmental requirements as applicable to the work they perform.

- Conduct inspection of their Equipment prior to use.

- Participate in JHA, toolbox talk, emergency drills and all safety initiatives.

- Support a zero incident and injury culture.

- Wear appropriate PPE in accordance with CONTRACTOR/OWNER requirements

- Report to their Supervisor any equipment malfunction that may affect the safe operation of the equipment.

All employees have the RIGHT and obligation TO STOP ANY WORK that they believe is unsafe.

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6. STANDARDS AND SPECIFICATIONS

The following laws, regulation, codes, standards and specifications will be applied in order of priority in this Project:

- HSE laws and regulation of the place;
- HSE related local community and municipal Regulations and Codes;
- OWNER's and contractual specification, Standards, Procedures;
- CONTRACTOR's TCM-PRS01 HSE Manual rev.4, Plans, Programs, Procedures and work practices;
- SUBCONTRACTOR's and Vendor's method statements.

6.1 ZETO RULES and GUIDELINES

OWNER's Zeto Rules shall apply to all employees, CONTRACTOR, SUBCONTRACTORS and LOWER TIER SUBCONTRACTOR's personnel working at the worksite.

"ZeTo" means Zero Tolerance and is intended by OWNER/CONTRACTOR to be a principle to ensure all activities are carried out in a safe manner and any non-compliance shall not to be tolerated.

CONTRACTOR, SUBCONTRACTORS and LOWER TIER SUBCONTRACTOR's shall adopt the ZeTo Rules in order to reduce HSE risk associated with the work to a level ALARP.

Refer to Appendix 4 "OWNER ZeTo rules".

7. COMMUNICATIONS

7.1 Language

Project publications and general communication notices on site will be printed or presented in both English and Bahasa Malaysia.

CONTRACTOR shall develop procedures and instructions to ensure effective communications are in place to deal with any multi-lingual personnel employed at WORKSITE who do not understand and/or cannot communicate in either Bahasa Melayu or English languages. In order to guarantee an easy verbal communication on site, an adequate number of bilingual staff will be employed in the worked area.

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This will facilitate the communication between the work force and all other parties involved.

All HSE training and education for the local workforce, including training material and booklets, will be translated in local language.

The minutes of meeting when necessary will be produced bilingual.

7.2 Communication mediums Meetings

CONTRACTOR recognizes that its HSE objectives can only be achieved with effective communication.

CONTRACTOR will utilize numerous mediums to educate, raise HSE awareness, motivate and stimulate participation. These may include:

TOP-DOWN	BOTTOM-UP
• Induction training, • Safety fliers • Safety news • Bulletins and posters • Tool box meetings, • Tailgate meetings • Monthly HSE meetings • HSE Meetings between the management and employees' representatives, • Internal communications • Display of information on notice boards, • Specific meetings or courses	• Suggestions by sheets or by computer to the HSE Office, • Non conformity reports about unsafe act and condition • Training demands, • Tool box meetings, • Meetings on HSE between the Management and employees' representatives, • Submission of reports

CONTRACTOR shall provide a prominent HSE performance scoreboard at the entrance to the Site displaying, amongst other things, the number of man-hours worked since the last reportable incident and name of SUB-CONTRACTOR with the best HSSE record, in line with OWNER's objective to promote safety awareness and safe working practices amongst all employees.

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The CONTRACTOR shall install the above at each site office. The HSE Performance Scoreboard shall be of acceptable material and shall contain the following information as a minimum (in English and Bahasa Malaysia):

Name of CONTRACTOR _____

Date (Start of Work) _____

HSE Targets for This Project _____

Best Achievement (Manhours, Year) _____

Current Manhours Achieved (Manhours, Year) _____

Date of Last Loss Time Incident _____

Total Number of Loss Time Incidents to-date _____

All lettering in the HSE Performance Scoreboard shall be of suitable sizes and shall be visible from at least 10 meters distance.

7.3 HSE Meetings

CONTRACTOR will conduct and/or participate to the following HSE meetings as a minimum:

1. Kick off HSE Meeting

   Attended by: SUBCONTRACTOR's and CONTRACTOR Management

   Chaired/conducted by: Site Manager

   Timing: As required

2. Safety Task Analysis Risk Reduction Talk (STARRT)

Attended by: All SUBCONTRACTOR's and CONTRACTOR's workers

Chaired/conducted by: Supervisor

Timing: Weekly

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3. Tailgate Meeting (Tool Box Meetings)

   Attended by: All SUBCONTRACTOR's and CONTRACTOR's workers

   Chaired/conducted by: Supervisor

   Timing: Daily –Weekly

4. Discipline supervisor's meeting

   Attended by: All SUBCONTRACTOR's and CONTRACTOR's discipline Supervisors

   Chaired/conducted by: CONTRACTOR's Superintendent/Supervisor

   Timing: Weekly

5. HSE coordination meetings

   Attended by: All SUBCONTRACTOR's and CONTRACTOR's HSE Managers/Representative

   Chaired/conducted by: CONTRACTOR's HSE Manager

   Timing: Weekly

6. HSE Committee Review meeting

   Attended by: All the members of the HSE Committee

   Chaired/conducted by: CONTRACTOR's Site Manager

   Timing: Monthly

For more detailed information, refer to CONTRACTOR's document: Project Specification - Construction HSE Meetings.

7.4 Records and Reports

HSE communication is retained and transmitted in written records and reports.

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A project HSE monthly report will be produced. The HSE report will address HSE progress, incidents, issues requiring attention, look-ahead items, and status for the period of agreed upon HSE performance measurements.

The CONTRACTOR will issue a Monthly Activity Report containing both statistics and narrative comments.

The information regarding HSE matters will contain as a minimum the following:

- A table of all incidents and their immediate and underlying causes;
- A table of all HSE and Security observations at Site and a description of corrective action taken to rectify the shortfall;
- HSE and Security lagging and leading indicators;
- A summary of HSE activities, government visits, management visits and HSE audits describing problem areas and corrective actions, if any
- A summary of HSE Training provided;
- Number of CONTRACTOR and SUBCONTRACTOR personnel; total man-hours worked on a monthly and cumulative basis;
- Photo of main/critical activities
- Graph and Statistics dates as TRC (Total Recordable Cases); LTI's (Lost Time Injuries); MTC (Medical Treatment Cases); First Aid Cases; Near Misses; HSE Inspections; HSE Induction/Trainings; other HSE activities; HSE Statistics, HSE Observation (progressive tabulation).

The report shall be issued within five (5) working days from the last Friday of each month.

SUBCONTRACTORS shall support CONTRACTOR with all the necessary information and data in due time in order to allow a timing preparation of the reports.

HSE records will be retained by the CONTRACTOR HSE Manager or by the SUBCONTRACTORs or both.

The retention period will be established for each type of record in accordance with local laws where applicable, OWNEROWNER and CONTRACTOR specific instruction.

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In general, the minimum retention period is the Job duration with some exception like Accident/ Incident/Near Missis records, First Aid register that will have a retention period virtually indefinitely.

8. RISK MANAGEMENT

8.1 General Risk Identification and Evaluation

Management techniques shall be adopted so that potential hazards are identified and evaluated prior to execution, thereby enabling either substitution or adoption of control techniques. These hazards may be identified at any stage of the project e.g. existing drawings, site survey investigations, constructability reviews, or emerge during the construction or commissioning phases.

Once potential hazards are identified, the risk to health and safety must be assessed. The assessment shall characterize the risk in terms of severity and probability.

Knowledge gained through previous activities, resource studies, engineering studies, and other relevant project evaluations will provide the basis for periodic assessment of the potential magnitude and likelihood of the occurrence of identified hazards.

Hazard assessments will be conducted to determine the level of risks, which can be summarized as:

- Intolerable
- Incorporate risk reduction measures
- Improve through HSE MS procedures

The worst-case consequences of each identified hazard will be assessed and a rank assigned. Effects are characterized as representing high, medium, or low risk or severity of consequences.

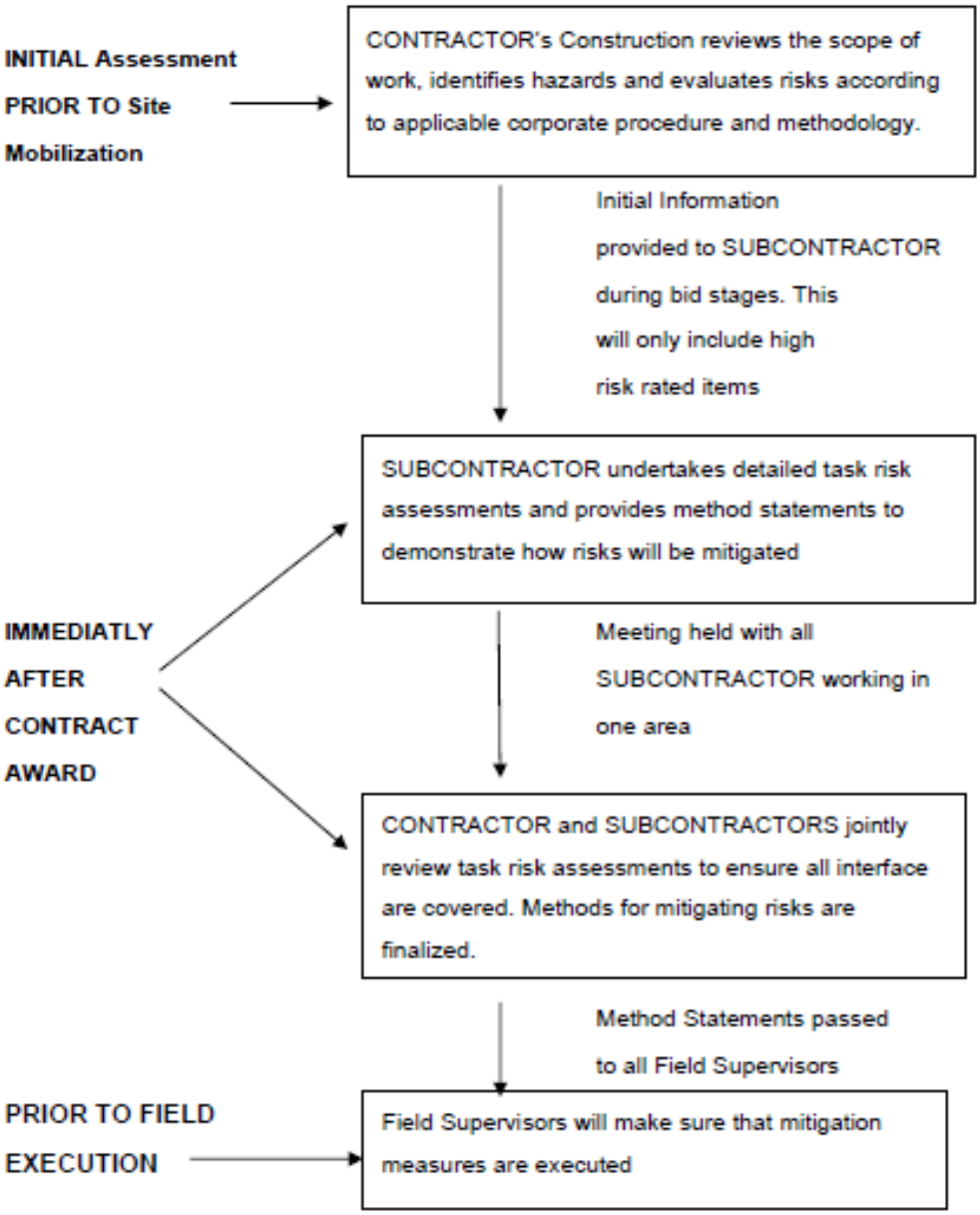
Where required by the risk assessment, a method statement shall be developed which at best would eliminate the risk or as a minimum, would contain the risk to an AFARP level.

CONTRACTOR will provide a Project Specification - HSE Site Risk Management Procedure in agreement with OWNER contractual requirement and CONTRACTOR's standards.

Risk assessment and preparation of Work Method Statements shall be undertaken in accordance with the following Risk management flow chart:

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RISK MANAGEMENT FLOW CHART



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8.2 Job Hazard Analysis (JHA)

Job Hazard Analysis (JHA) is a systematic process to evaluate a major phase (examples are steel erection, pipe fabrication or installation).

A team composed of contract individuals knowledgeable with the work scope and lead by a competent person performs the review in advance the activity.

JHA is used to identify, analyze, understand and mitigate potential hazards associated with repetitive or potentially hazardous work operations engaged in over a period of time.

SUBCONTRACTOR shall provide for approval CONTRACTOR with an initial JHA covering all the activities in his scope of work before starting the operation on site.

CONTRACTOR and SUBCONTRACTOR will revise if necessary the JHA according to the evolution of the works.

8.3 Job Safety Analysis (JSA) and work Method Statement

Job Safety Analysis is a systematic process to evaluate a specific work activity. (Examples would be erecting the structural steel for a fin fan, or fabricating or installing the cooling tower pipe spools)

A team composed of contract workers and supported by the supervisor conducts the in review in advance of the work activity.

SUBCONTRACTORs are required, at list for all critical activities, to make work Method Statement, preparation schemes to review the work at hand, the approach to be taken, the proper tools and safety requirements necessary.

CONTRACTOR recognizes the importance of safety instruction by supervision upon work assignment and adopts the principles and application of Job Safety Analysis (JSA) as a project policy.

JSA is used as an awareness tool intended to reinforce and ensure CONTRACTOR Supervisors, and those of our SUBCONTRACTORs, execute the supervisory responsibility to analyze each work assignment for hazards and to give sound safety instruction to employees given the work assignments.

Job safety analyses are prepared by the SUBCONTRACTORs as a contractual obligation and reviewed by the CONTRACTOR team.

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SUBCONTRACTOR shall apply the HSE Site Risk Management Procedure.

8.4 Safety Task Analysis Risk Reduction Talk (STARRT)

The "Safety Task Analysis Risk Reduction Talk" (STARRT) is a process that utilizes employees to identify and resolve environmental, safety, and health hazards associated with a task prior to its being performed.

CONTRACTOR will provide a Project Specification Safety Task Analysis Risk Reduction Talk (STARRT) instruction in agreement with OWNER contractual requirement and CONTRACTOR standard.

The STARRT is an analysis of work tasks, conducted by team leaders and involving the employees in the identification and correction of hazards.

The process also encourages feedback from employees to provide continuous improvement to the SUBCONTRACTOR and Project safety processes.

The STARRT will also consider and include the impact that planned work tasks may have on other SUBCONTRACTORS or work groups.

The procedure applies to all critical activities (such as; Works at height; confined spaces; critical lift etc).

8.5 Permit To Work (PTW)

CONTRACTOR shall comply with the PTW System, which will be prepared by OWNER and issued to the CONTRACTOR and all OTHER CONTRACTORS and shall cover all activities on the PENGERANG SITE. The typical activities, where the PTW System will apply, as a minimum, are:

- Work at height;
- Confined space entry;
- Rock blasting;
- Electrical isolation & re-activation;
- Welding / cutting / machining;
- Painting and surface blasting;

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- Excavation;
- Piling;
- Heavy lifting;
- Scaffolding erection;
- Radiography work;
- Critical lifting as follows:

• Lifting over live process facilities or equipment;

• Personnel transfer using lifting equipment;

• Coordinated lift whereby the weight of load exceeds the maximum lifting capacity of one of the lifting appliances e.g. using of multiple cranes;

• Lifting of special load structure e.g. boiler, compressor, pressure vessels or reactor;

• Lifting load of weight of more than 80% of rated capacity of the lifting equipment at the specified working radius and boom angle in accordance with the crane load chart;

• Lifting more than 10 tons in close proximity of live process equipment.

- Hot work (during COMMISSIONING and at locations near flammable materials).

CONTRACTOR/SUBCONTRACTORS will need to comply with the OWNER's PTW System, as given to them by OWNER.

The CONTRACTOR’s procedure Project Specification - Permit to Work Procedure will be issued in accordance with OWNER procedure and will provide details and forms to be utilized.

9. TRAINING AND EDUCATION

CONTRACTOR will provide a detailed Project Specification HSE Training Program in agreement with OWNER contractual requirement and CONTRACTOR standard.

This program will be revised and updated periodically to reflect and incorporate just in time safety training that may arise from work execution issues.

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The training embraces the following:

- Mandatory safety training as indicated by local authorities
- Safety Orientation Courses
- Job Specific HSE Training
- Weekly safety talks (Toolbox meeting)

9.1 HSE Orientation

All Project personnel must successfully complete the OWNER's and CONTRACTOR's HSE coordinated orientation session prior to obtaining site access credentials.

The content of the HSE orientation module will include but is not limited to the following item according to OWNER and CONTRACTOR's HSE requirements:

– Project OWNER's and CONTRACTOR's HSE Policy.

– Admission to the project, Site entry/ID cards/Security.

– Clothing and Personal Protective Equipment (PPE).

– Critical activity training:

- Working in confined space
- Working at height
- Lifting and rigging
- Chemical handling

– Smoking policy.

– Misconducts:

- Drug and alcohol policy
- Gambling

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- Fighting
- Theft
- Sexual harassment

– Security rules for the WORKSITE and the PENGERANG SITE.

– OWNER's Zeto Rules

– Prohibited items.

– Environmental issues.

– Waste management issues.

– Environmental spill response.

– Communications.

– Transport within the project and traffic regulations for the WORKSITE and PENGERANG SITE.

– Defensive drive principles, inside and outside the project area.

– Accidents, incidents, unsafe situations and actions reporting

– Medical and First Aid facilities

– Emergency response plan

– Housekeeping

– Noise at work

– Stop work policy

– HSE incentive and promotion

– Consequence management, including option of dismissal, for noncompliance to HSE and security rules and regulations. (ZeTo Rules)

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– Other content as determined appropriate to the job-site and the hazards and risks to be encountered.

The OWNER and CONTRACTOR orientation program will be co-ordinated to ensure that the orientations are consistent and complementary.

Orientation records will be maintained to confirm the status of all employees at the job-site.

COMPETENCY TESTING

All HSE orientation/training courses will have competency testing as part of the course.

No personnel will be able to undertake work on the project unless they have successfully passed the relevant competency test.

For individuals who do not pass the relevant competency test, refresher training will be given together with one to one training sessions if the need arises.

Following successful completion of the initial coordinated HSE orientation course individuals will be provided with an HSE sticker to put on helmet.

CONTRACTOR/OWNER HSE personnel will organize additional training for Supervisor personnel and for all personnel involved in construction activities further additional specific training courses (e.g. PTW, scaffolding, work at height etc..) as defined in Project Specification HSE Training Program.

SUBCONTRACTOR shall assure the participation of the required personnel.

9.2 Certificates/Competency

SUBCONTRACTORs shall ensure and demonstrate evidences that prior to mobilizing any employee for the Project all employees have received the relevant statutory HSE training, according to local legislation.

As a minimum CONTRACTOR's and SUBCONTRACTOR's personnel shall have the following certification:

- CIDB Green Card (all personnel)
- DOSH Certification (when required e.g. HSE Manager, HSE Supervisor, HSE Officer)
- Confined Spaces entry

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- Crane drivers, forklift drivers, mobile platform operators
- Radiographers, scaffolders
- First aid and rescue
- Fire prevention and fire fighting
- Oil and Gas Safety Passport (OGSP) training (personnel involved in START-UP activities)

Refer to CONTRACTOR Training Matrix attached to Project Specification HSE Training Program.

9.3 Visitors

Visitors will be given appropriate short orientation and training (5-10 minutes), prior to obtaining site access credentials. This will include:

- Details of Personal Protective Equipment (PPE) required on the Project;
- Reporting of injuries, incidents and property damage;
- Location of the nearest medical facility, emergency and evacuation procedures;
- Review all barricading, signage, applicable to the visit;
- Explain No Smoking regulations and Project Procedures applying to the worker(s);
- Environmental requirements; and
- Cultural and heritage issues.

10. SELECTION OF SUBCONTRACTORS AND VENDORS

CONTRACTOR apply specific procedures in order to, first qualify and insert in a “vendor list database” and second select the possible SUBCONTRACTORS to be included in the ITB Phase.

A database has been created with all the information relevant to all aspects and capacity of the SUBCONTRACTOR including the HSE performance.

HSE concur to the semi quantity evaluation and general evaluation of the candidates during all stages of the selection process.

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In particular, during the ITB stage the candidates are informed about all HSE general and project specific requirements and are requested to submit the following information as a minimum:

- HSE organization
- HSE Policy
- HSE MS
- HSE Statistics for the last 5 year

Competency of SUBCONTRACTORS

Health, safety and environmental issues contained in the project HSE MS shall form part of the contract specification; the SUBCONTRACTOR shall provide evidence that adequate resources will be available to correctly implement the project HSE MS.

As part of the bid review, a safety profile shall be prepared for each SUBCONTRACTOR. This profile shall form a component part of the overall assessment of SUBCONTRACTOR competence.

Selected candidates may be audited, in general and specifically for HSE prior the project award.

Based on the assumptions of all these information, final decision will be determined.

11. PRE-CONSTRUCTION HSE PLANNING

HSE activities that shall be accomplished for site mobilization and prior to commencing construction activities and in general related to activities that could be considered pre-construction works will be performed in accordance with OWNER relevant instruction and documentation.

11.1 HSE for Pre-Construction Activities

Site Visits

All personnel visiting the site shall comply with the relevant requirement of OWNER.

In particular, when applicable PTW Work Authorization Form shall be issue by OWNER.

Mobilization

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Before commencing activities such as installation of temporary facilities, OWNER, CONTRACTOR and SBCONTRACTOR will ensure (each one according to his scope of work) that all relevant document and permits including Government licenses and permits have been obtained.

CONTRACTOR will submit its project HSE Management System to OWNER for review and approval.

CONTRACTOR will ensure that a copy of the HSE documentation including all relevant plans and procedures are included in the documentation issued for SUBCONTRACTOR's bid enquiry.

11.2 Temporary Facilities

SUBCONTRACTORs shall ensure that adequate office, toilet, changing and accommodation facilities are provided on the project.

SUBCONTRACTORs shall ensure that all temporary facilities installed are adequate and in accordance with all applicable relevant project's rules and regulation.

This will include:

- Installation of facilities in a manner that recognizes access and fire prevention requirements;
- Providing utilities with special regard to the protection of underground and above ground services;
- Consideration of adjacent process operations;
- Maintenance of standards of cleanliness and order;
- Ensuring that Personnel are aware and are complying with the requirements of the fire prevention plan, and that adequate fire extinguishers have been provided;
- Noting and correcting any defects.
- Ensuring that hazardous (e.g. flammable, etc) materials are stored and used in a controlled manner
- Adhering to Electrical regulations

SUBCONTRACTORs shall:

- Ensure that temporary facilities conform to local and contractual rules and regulations.

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- Before erecting any temporary building or fencing, they submit for CONTRACTOR's review and approval SUBCONTRACTOR's Temporary Facilities Plan, which at least contains:

- The proposed layout.
- The purpose of the buildings.
- Fire precautions.
- The maximum number of expected employees. *
- Furniture and equipment. *
- Emergency exits. *
- Smoking restrictions. *
- Sanitary facilities. *
- HVAC facilities. *
- The routing of proposed and existing utilities and underground services.

(Note: * Per building)

- Ensure that all temporary buildings are tied down upon placement and made secure against storm damage (If applicable by geographic area).

- Ensure that all connections for electricity, water supply and other temporary facilities made by SUBCONTRACTOR will be in accordance with legal and contractual requirements.

- To submit details of all proposed connections for prior CONTRACTOR's approval and to install such connections under CONTRACTOR's supervision.

- Post or install in temporary buildings: Emergency instructions, fire extinguishers and "no smoking" signs, if applicable, and all other applicable signs.

- Ensure that trash, oil rags, combustible materials and similar potential ignition sources do not accumulate.

- Each day prior to leaving the jobsite, check all his temporary facilities and ensure that:

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- All electrical appliances and lights are shut off/switched off.
- No flammable waste or burning cigarettes is left on floors, on tables or in rubbish bins.
- All windows are shut and all doors are locked

12. PRECOMMISSIONING

12.1 Chemical Cleaning

Minimum Requirements

SUBCONTRACTOR will supply and worn appropriate personal protective equipment.

Chemicals will be used, stored and disposed of, in accordance with instructions contained in the Safety Data Sheets.

Cleaning at the project, that requires the use of chemicals, solvents, thinners, or other petrochemical or substances classified as “hazardous,” shall be the rare exception – not the rule.

When such “cleaning” must occur, it shall be completed in a manner that protects site personnel from exposure and safely contains all of the chemicals used, so as to eliminate contamination of the work site and/or the surrounding environment.

All such chemicals shall be disposed of in accordance with industry best practices, applicable permits, OWNER policies and procedures, CONTRACTOR policies and procedures and the country’s federal, regional, state, and/or local rules and regulations. The applicable documentation shall be maintained.

SUBCONTRACTOR shall ensure:

- To contact CONTRACTOR in advance if chemical cleaning is to be performed.
- Safety precautions during chemical cleaning e.g.:
- Safety showers.
- Eye showers/wash facilities.

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- Clear barricading of entire area.
- Proper storage of hazardous materials.
- Proper disposal of/removal from site hazardous materials/chemicals.
- Applicable SDS shall be sent to CONTRACTOR in advance.

12.2 Pressure testing

Minimum Requirements

- To contact CONTRACTOR in advance if pressure testing is planned.
- That employees involved in pressure testing are properly trained and instructed.
- To clearly mark the area where pressure testing is in progress.
- To permit no one in the immediate vicinity of the testing area.
- For blanking only non-asbestos gaskets will be used.
- To establish a field procedure regarding the installation and removal of material specified for testing.
- That always a priority is given to hydrostatic (water) testing.

SUBCONTRACTOR will dispose of waste materials (hydro-test water, boiler cleaning water, chemicals, etc) in accordance with CONTRACTOR and OWNER environmental control systems.

SUBCONTRACTOR are prohibited from removing any waste materials from the Project without the approval of CONTRACTOR and OWNER.

13. HEALTH

13.1 Health Goals and Objectives

The primary goal of the CONTRACTOR Project Health Program is to provide a workplace that is reasonably free of recognized workplace health hazards.

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CONTRACTOR program includes health hazard assessments and good industrial hygiene practices. The program addresses the following:

- Ensure that all potential health hazards are identified and assessed.
- Maintain the health and well being of workplace personnel through monitoring and surveillance.
- Eliminate or control workplace health hazards to prevent occupational related illnesses or injuries.
- Characterize workplace exposure to potential health hazards.
- Ensure compliance with recognized occupational safety and health standards and regulations to include program requirements and local law, as applicable to each situation.

In order to reach the goal CONTRACTOR and SUBCONTRACTORS will implement procedure and action to control and mitigate as far as reasonably practical all recognized hazards.

In particular, the following control measure will be implemented:

- Reduce the noise to as low levels as are reasonably practicable level.
- Avoid alcohol, drug and substance use on the construction site.
- Air monitoring and surveillance
- Preventing heat and cold stress and related injuries and illnesses.
- Providing safe drinking water.
- Control of substances hazards to health Procedure (COSHH)
- Medical service

13.2 Health Hazard Evaluation (HHE)

The assessment will be performed in the form of a Job Hazard Analysis (JHA), which breaks processes down into individual tasks, identifies the hazards associated with each task and mandates specific controls. The HHE will include potential chemical, biological, physical and ergonomic hazards associated with the activities as well as an evaluation of any existing measures used to control these hazards.

Hazard Control

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When a chemical, physical or biological hazard is identified in a HHE, and cannot be eliminated from the workplace, the appropriate control(s) that are then incorporated into the work activity. Controls may include engineering, administrative or personal protective equipment. Controls shall be re-evaluated whenever a process change or other factor might affect the frequency or severity of the hazard.

13.3 Noise Exposure and Hearing Conservation

SUBCONTRACTORS shall identify and declare in advance the activities (before starting the operation on site) that can create a potential critical noise impact on their own workers and other parties; moreover they shall estimate the noise impact of said activities and identify all the necessary mitigation and monitoring measures.

The project will develop a list of high noise activities and will consider effective engineering and administrative controls to reduce employee exposure to noise hazards.

Employee exposure to occupational noise hazards shall be assessed and employees will be provided with protection from exposure.

Employees shall be trained on the effects of noise on hearing, the proper selection of hearing protection and the correct use of protection equipment.

13.4 Respiratory Protection

SUBCONTRACTORS will provide and require the use of appropriate respiratory protective equipment, manufactured to a recognized international standard and acceptable to CONTRACTOR and OWNER, whenever a respiratory system hazard exists.

The use, care and sanitation of all respiratory equipment will be done by SUBCONTRACTORS in accordance with the CONTRACTOR “Respiratory Equipment Procedure” and all the applicable local requirements.

This procedure includes:

- The name of the procedure administrator for the site,
- Cartridge change out data,
- Method to be used for sanitizing respirators,

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- Medical qualifications of those required to wear respirators,
- Methods of fit testing and employee training.

SUBCONTRACTOR supervisors will notify CONTRACTOR HSE Supervisor before starting any work that requires employees to wear respiratory protection.

Provisions shall be made for employees who wear corrective lenses and are required to wear full-face respiratory protection. These provisions shall include rotation from such respiratory protection work and eyeglass inserts or special lenses, as/if required.

Training shall be provided on the inspection, use, sanitary care, and limitations of respiratory equipment. The records of such training shall be maintained by SUBCONTRACTOR and made available to CONTRACTOR.

A competent person shall be trained and designated by SUBCONTRACTORS to store, maintain, inspect, and clean respiratory equipment.

Disposable respirators for nuisance dust shall comply with CE, BS or ANSI Standard and or local legislation.

13.5 Manual Handling

Defined as any transporting or supporting of a load (including the lifting, putting down, pushing, pulling, carrying or moving thereof) by hand or by bodily force. Mechanical assistance can reduce but not fully eliminate manual handling.

Manual handling can cause a serious risk of injuries when one or all the following characteristics area present:

- Unstable or unbalanced load
- Load difficult to hold or grasp
- Exposition to vibration
- Repetitive or sustained application of force, akward posture, movement

13.5.1 Risk Identification

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Employees shall not carry out any manual handluing activities potentially harmful, unless when they have been assessed for the risk. Ergonomic and manual handling risk assessments shall be carried out in consultation with the relevant employees. The assessment shall take into consideration the following factors:

- Analysis of work place injury records
- Consultation with employees
- Direct observation

13.5.2 Risk Assessment

Ergonomic and manual handling risk assessment shall be carried out in consultation with the relevant employees. The assessment shall be taken into consideration the following factors:

- Actions and movements
- Workplace and workstation layout
- Working posture and positions
- Duration and frequency of manual handling tasks
- Location of loads and distances moved
- Weights and forces
- Characteristics of loads and equipment
- Work organization
- Working environment
- Experience and skills
- Age
- Special needs of individuals

13.5.3 Risk Control

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When information indicates that employees are exposed to manual handling hazards, risk control measures shall be undertaken in consultation with the relevant employees. The following control options shall be considered:

- Job re-design by:
  - Modify object
  - Modify layout
  - Different actions, movements, forces
  - Modify task
- Mechanical handling equipment
- Training particular to the task and on the principles of correct manual handling techniques
- Administrative controls such as rotation of employees

The control options and the reasons for the choice shall be recorded.

13.5.4 Training

All employees undertaking manual handling activities shall receive training receiving appropriate information and instruction.

This training shall be given by a person competent to conduct training and a record of such training shall be recorded.

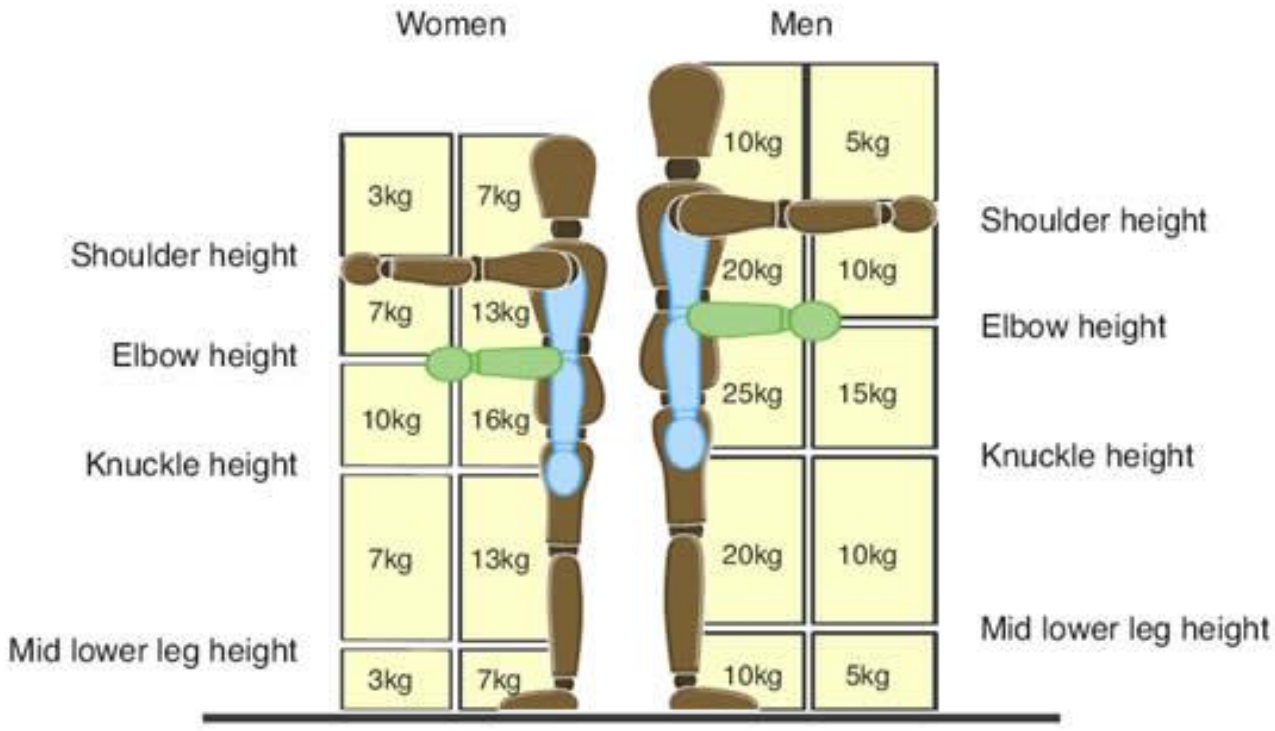
13.5.5 Basic principles of manual handling

Some basic principles that everyone should observe prior to carrying out a manual handling operation:

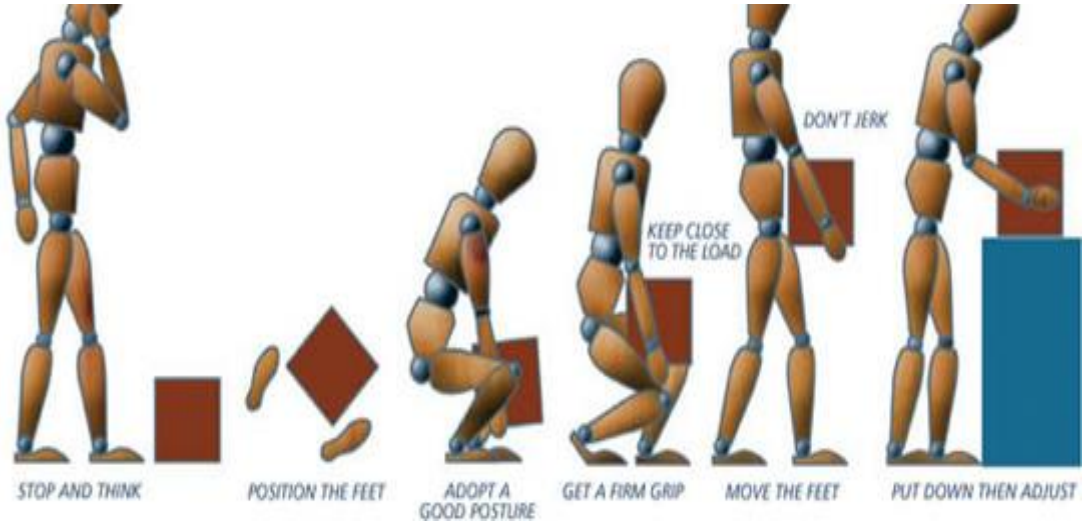
- ensure that the object is light enough to lift, is stable and unlikely to shift or move
- heavy or awkward loads should be moved using a handling aid
- make sure the route is clear of obstructions

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- make sure there is somewhere to put the load down wherever it is to be moved to
- stand as close to the load as possible, and spread your feet to shoulder width
- bend your knees and try and keep the back's natural, upright posture
- grasp the load firmly as close to the body as you can
- use the legs to lift the load in a smooth motion as this offers more leverage reducing the strain on your back
- carry the load close to the body with the elbows tucked into the body
- avoid twisting the body as much as possible by turning your feet to position yourself with the load.



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13.6 Fatigue, Cold and Heat Stress Prevention

13.6.1 Fatigue Prevention and Control

Sufficient and appropriate work breaks should be made available, based on the nature, duration and complexity of the work. Also workers performing sedentary work that requires constant vigilance such as panel operators need breaks so that they don't lose conscious attention.

Work place should be well lit, utilizing indirect lighting to avoid glare and eye strain.

Indoor temperature should be controlled at a comfortable range.

A review of manpower planning to ensure appropriate staff-workload balance may be done.

Supervisory personnel and employees shall be trained to identify and prevent fatigue signs (negative Mood, reduced communication, slips and/or lapses, poor memory, reduced attention, etc..).

Supervisory personnel shall have the authority to remove an individual who is fatigued from his work.

The limits on hours of work or rest shall be respected.

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All overtime or night works shall be approved by CONTRACTOR.

13.6.2 Cold Stress Prevention and Control

Supervisory personnel and employees shall be trained to identify and prevent cold stress disorders and to understand the use of appropriate work practices in avoiding these disorders.

Engineering controls shall be used when applicable to aid in prevention of cold stress.

Appropriate work practices such as wearing correct personal protective equipment, work/rest regimes, and other modification of work practices shall be considered when developing cold stress related health programs.

13.6.3 Heat Stress Prevention and Control

CAUSES AND SYMPTOMS

Heat stress may occur any time that work is being performed at elevated temperatures or when protective clothing is worn.

Heat stress symptoms include fatigue, irritability, anxiety, and decreased concentration, dexterity, or movement. If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur ranging from mild to fatal. Because heat stress is one of the most common and potentially serious problems that workers encounter, regular monitoring and preventive measures are vital.

CONTRACTORS and SUBCONTRACTORS will ensure that all field employees, especially front line supervisors, are trained on the warning signs/symptoms of early heat related disorders, and instructed on the clothing and work methods best suited to avoid heat and/or cold stress. Stay times shall be developed to reduce the possibility of heat related disorders, if necessary.

SUBCONTRACTOR will provide an immediately accessible, adequate, and sanitary potable water supply during all periods of the day and have available electrolyte replacement drinks or tablets during seasons of the year when heat stress may occur.

The following general preventive measures will be adopted:

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- Suggest that employees drink 16 ounces (500 ml) of water before beginning work in the morning and after lunch.
- Provide disposable 4-ounce (120 ml) cups and water.
- Urge employees to drink a reasonable quantity of water per day
- Provide a shaded area for rest breaks.
- Monitor employees for signs of heat stress. An employee with high blood pressure must be monitored often, and extra precautions should be taken
- Acclimate employees to work conditions by slowly increasing their workloads (i.e., under normal circumstances, do not begin work activities with extremely demanding tasks).
- Provide cooling devices to aid natural body ventilation.
- Ensure that adequate shelter is available to protect personnel from heat, as well as rain, which can decrease physical efficiency and increase the probability of both heat and cold stress.
- Maintain good hygienic standards by changing clothing and showering as appropriate. Clothing should be permitted to dry during rest periods. Employees should immediately report any skin problems to their supervisor.
- Utilize physiological monitoring based on ACGIH “Guidelines for Limiting Heat Strain” to determine stay-times for individuals performing work in hot weather or impermeable clothing.

13.7 Hazardous Materials

CONTRACTOR will issue and develop a procedure “HSE Control of Substance Hazardous to Health”.

The procedure will be submitted to OWNER for approval prior to beginning work.

SUBCONTRACTORS will reduce at the minimum practicable the amount of hazardous chemicals stored and utilized on site.

SUBCONTRACTORS shall obtain from CONTRACTOR for chemicals to be brought onto any work site a preventive formal approval.

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SUBCONTRACTOR shall submit Safety Data Sheets (SDS) for each hazardous material purchased and/or carried onto a worksite to CONTRACTOR.

Materials that arrive without an SDS will be quarantined and not released until the SDS is received on site and CONTRACTOR approves the material for use.

SUBCONTRACTORS shall maintain an inventory of hazardous materials on site.

SUBCONTRACTOR shall ensure that employees are trained in the recognition, proper handling and use of hazardous substances. CONTRACTOR's New Employee Orientation will include introductory training on the topic of hazardous substances.

However, specific hazardous material training shall be provided by the SUBCONTRACTOR for its Project employees whose work involves the use of any hazardous material under its control. Such training shall be properly documented, filed and made available to CONTRACTOR.

Information and training will be provided to employees as follows:

- Initial information and training, in conjunction with other site-specific training, whenever a new employee arrives on site

- Initially, when new employees are first assigned to a work area where they may be exposed to hazardous chemicals under normal working conditions or in a foreseeable emergency.

- Additionally, when a new hazard is introduced into the employees' work area. Examples of new hazards are:

- A new chemical will be used
- A previously used chemical will now be used in a different way that poses a new hazard

General Topics of Information:

The following general information will be given to all employees:

- Requirements of the Hazard Communication Standard

- Employee rights under the standard

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- Location and availability of the written hazard communication program, the Chemical Inventory List, and SDS's
- Operations in their work areas where chemicals are used
- The person(s) to contact for further information

General Training Topics:

The following general topics will be addressed during training sessions for all employees:

- Hazardous chemicals and states of matter
- Chemical, physical, and health hazards
- Routes of entry
- Exposure limits and ways to control exposure
- Personal protective equipment and engineering controls
- Container labels
- SDS's
- The person(s) to contact for further information

SUBCONTRACTOR will properly label all hazardous substances and/or chemicals that have been transferred from the manufacturer's container into another container.

Inspections will be made and documented by the CONTRACTOR to ensure that adequate labeling occurs.

The use of halon, asbestos or other banned chemical substances is forbidden on PENGERANG SITE.

13.8 Food, Water and General Sanitation

SUBCONTRACTORS shall apply OWNER requirement on Food and Water Safety Standard.

All eating and sanitary facilities will be maintained in a clean and sanitary condition at all times. SUBCONTRACTORS shall provide the necessary resources to accomplish this, including adequate washing facilities with soap and disposable towels and whatever labor is required to clean and maintain a high level of sanitation.

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SUBCONTRACTORS will provide clean, potable drinking water for its employees in a safe, hygienic manner at all worksites. Single use cups will be provided in a sanitary dispenser. These cups shall be replenished as needed during the day and trashcans provided for their disposal. "Community" or common use cups shall not be used.

SUBCONTRACTORS shall provide and maintain its own sanitary toilet facilities for its employees. The daily facilities cleaning, and maintenance, and method and location of waste disposal shall be to a high standard acceptable to CONTRACTOR and OWNER.

13.9 Pest and Vector Control

Pest Control in Construction

The work site and living areas will be designed, constructed, equipped, maintained and operated in such a manner as to prevent the entry and/or harborage of insects, rodents, and other vermin.

Effective measures such as exclusion, housekeeping and extermination shall be used to minimize the entry, presence and propagation of pests, in all areas of the jobsite.

Buildings and associated structures and facilities shall be free of vermin prior to occupancy and shall be maintained insect and rodent-free.

All sewer or drain openings shall be closed with a properly secured perforated metal cover.

There shall be no openings in exterior walls that admit insects, rodents or other vermin. Openings for pipes, conduits and other utility services in foundations or exterior walls, floors or roofs shall be closed solidly and completely by metal sheeting, concrete or other impervious material.

13.10 Housekeeping

CONTRACTOR/SUBCONTRACTOR personnel shall ensure that good housekeeping is maintained continuously throughout the duration of the work.

Access and egress of all exits, fire and safety equipment, and work areas shall be kept clear of obstructions at all times.

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No SUBCONTRACTOR, employee, operator or user shall place, leave, dump or permit to accumulate any garbage or trash in any building, or on any premises, worksite or otherwise that will afford food or harborage for insects, rodents or other vermin.

Accumulation or storage of building materials such as lumber, pipes, boxes, masonry, etc. shall be accomplished in a manner that discourages pest harborage. Materials should be elevated and provide access for visual inspection. Scheduled wastes such as oily or chemical soaked rags shall be disposed in accordance to regulatory requirements.

Standing water shall not be allowed to accumulate on the project site.

13.11 Eye Conservation

In order to reduce the risk for the eye on the project site a protection will be mandatory in all the site area (lay down and workshops included).

The proper eye protection(s) will be defined in relation to the activity performed and the relevant risk assessment.

Affected employees on site shall wear eye (with side shields) and face protection where injury to the eyes and face may be prevented by such personal protective equipment.

The protective lenses/goggles, face shield, and similar equipment shall be worn in compliance with the manufacturer requirements, governmental regulation, other regulatory/testing requirements, and OWNER policy.

Each item of protective eye and face equipment shall be properly maintained in sanitary and reliable condition. The user shall inspect it prior to each use.

13.12 Pre-Employment and Periodic Health Screening Process

CONTRACTOR shall ensure that all its employees and SUB-CONTRACTOR's employees engaged in the WORK are declared medically fit for the job and healthy by an Occupational Health Doctor approved by OWNER (FOMEMA). Any medical diseases or disabilities which may adversely influence the employee's ability to perform his role in the WORK shall be reported to OWNER prior to the commencement of the WORK.

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Any person having the following illnesses are not permitted working at WORKSITE:

- A history of fits, blackouts and fainting attacks;
- A history of heart disease or heart disorder;
- Asthma, bronchitis, or a shortness of breath on exertion;
- Nervous or mental disorder;
- Serious defects in eyesight;
- Any other disease or condition that may affect or endanger the person's safety and health.

Periodical screening will be performed as per instructions and guidelines of "PTS 60.1501.06-01 – Health Assessment for Fitness to Work".

SUBCONTRACTORS will maintain records of all such examinations and will make the results available to CONTRACTOR.

SUBCONTRACTORS shall submit the medical examinations of their employees to CONTRACTORS prior to mobilize the personnel to site as part of the process to obtaining site access credentials.

In the Table below the Frequency and the type of Medical Examination required:

Medical Examination	Frequency	Remarks
Pre-employment	Once. Within 6 months prior to employment	Mandatory for all employees
Pre-placement	Within 6 months prior to starting job identified by OPU requiring such health assessment.	Mandatory for specified job holders
Periodic	39 years and below – every 3 years 40 years and above – every 2 years	Non-mandatory
Job Specific	Initial done within 6 months of starting work. To be repeated as per schedule specified by the job type	Mandatory for job holders
For Cause	As and when required.	Mandatory for identified Employee

The Guidelines of "PTS 60.1501.06-01 – Health Assessment for Fitness to Work" defined the following items to be applied:

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- Recommended content for the various types of medical examinations
- Definition for the various categories of Fitness to Work certification
- General fitness requirements for all types of work with OWNER
- Job specific fitness requirements (food handlers, users of Respiratory Protective Equipment and Breathing Apparatus, Confined Space Workers, Drivers, Electrician, Crane operator, Firefighters and Emergency Response Personnel, Healthcare Workers)

13.13 Alcohol and Drugs

No personnel is allowed to enter to the worksite under the influence of alcohol, drugs or other intoxicating substances. The possession or consumption of drugs and/or alcoholic beverages is strictly forbidden anywhere on the Site. Offenders shall be removed immediately according to Alcohol and Drug Policy.

Regular alcohol and drugs tests can be conducted by CONTRACTOR/OWNER.

Any person who is suspected of being under the influence of intoxicating substances shall immediately be removed from the construction site, plant or building where he was working and CONTRACTOR will apply CONTRACTOR Disciplinary Action Procedure in accordance with Local Law and Regulations.

13.14 Smoking

Smoking is not allowed on Site. CONTRACTOR/SUBCONTRACTOR shall incorporate dedicated smoking locations. The smoking locations are subject of approval by OWNER and these areas will be regularly inspected by CONTRACTOR's HSE team. Any person found smoking outside dedicated location will be removed from Site.

During and after START-UP, smoking shall be prohibited on Site, inside the warehouse and in or on any other specified areas.

14. MEDICAL AND EMERGENCY SERVICES & EVACUATION

14.1 Medical Services and Medical Support/Transport

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CONTRACTOR is responsible to provide first aid / medical room located at an appropriate location at the PENGERANG SITE within its own camp area. The facility should be manned throughout the working hours and comply with requirement of section 3.4.4 -First Aid / Medical Room of "PTS 60.1501.01 - Medical Emergency Management".

CONTRACTOR will build and operate a first aid station ("FAS") within its own construction area manned with medical personnel on a 24 hours a day / 7 days a week basis.

SUBCONTRACTOR as a minimum shall provide inside their assigned construction areas and camp area facilities first aid boxes in adequate number and content according to the requirement of section 3.4.5 - First Aid Boxes of "PTS 60.1501.01 – Medical Emergency Management" and any other requirement of OWNER‟s medical management and health inspections system.

CONTRACTOR will regularly inspect the SUBCONTRACTOR's first aid kits to ensure that they adhere to the local legislation and contractual requirements.

14.2 Emergency Response/ Emergency Evacuation Procedure

CONTRACTOR will issue an "Emergency Response Plan" according to and consistent with OWNER Emergency Response/Emergency Evacuation Plan for the existing Plant.

The plan will address emergency evacuation, medical emergencies, others. The plan will be submitted to OWNER for approval.

The plan will include emergency alarm systems, assembly and evacuation points, an employee head count process, and provisions for employee training before entering the Jobsite and any specific worksite as a part of CONTRACTOR's New Employee Orientation.

CONTRACTOR shall conduct emergency evacuation exercises and/or fire drills on a quarterly basis using a probable incident scenario agreed by OWNER in advance. OWNER shall be invited to observe the drill and provide input for improvement

SUBCONTRACTORS will provide sufficient trained personnel as Emergency Response Team (ERT)

SUBCONTRACTORS shall provide all emergency equipment and supplies needed to support the work and each work location.

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CONTRACTOR plan will include procedures for severe weather conditions and specific no work criteria.

14.3 Blood Borne Pathogens

SUBCONTRACTOR's employees who are exposed to blood borne pathogens shall be properly trained regarding their responsibilities, required control measures, and personal safety. Proper personal protective equipment shall be used when exposure hazards exist.

Please note that a GOOD SAMARITAN ACT (see definition section) are not considered an occupational exposure and therefore exempt from the requirements herewith exposed.

SUBCONTRACTOR's employee whose job duties put them at risk of exposure (i.e. medic, nurse, first aid person, etc.) shall be offered vaccinations according to the local laws. Documentation of the vaccination or declination shall be maintained and made available to CONTRACTOR before the employment on site as integral of the application to obtaining site access credentials.

SUBCONTRACTOR shall provide all its employees with a general overview on the hazards associated with blood borne pathogens, possible means of exposure, and proper control methods.

Provisions shall be made for proper disposal of hazardous medical wastes and a sign posted in the treatment area warning of biohazards. A "needles" container according to local laws and requirements shall be maintained in the first aid area for the secure disposal of used needles and similar medical waste. Proper sterilization methods and materials shall be used.

14.4 Spill Prevention and Response

CONTRACTOR will prepare and maintain a "Spill Prevention and Response Plan" that will be compatible with the local requirements.

SUBCONTRACTORS will provide any necessary equipment required to implement the Spill Prevention and Response Plan.

15. SAFETY

15.1 Personal protective equipment (PPE) and clothing

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Minimum Requirements:

- Approved personal protective equipment, specific to the hazards of each job task, shall be required as applicable to the project.

- All personal protective equipment utilized at the work site shall be properly maintained in sanitary and reliable condition and shall be inspected by the user prior to each use, as well as on a regular schedule by a competent person. This is a mandatory requirement.

- Where employee-owned equipment is allowed, it shall be adequate to protect against the hazard that requires its application.

- The SUBCONTRACTOR with the assistance of CONTRACTOR shall conduct a site-specific hazard assessment, prior to the beginning of any work, identifying the potential hazards present that may require personal protective equipment to ensure worker's safety and well being. This assessment shall be documented.

- The personnel on site shall be trained in the correct application and use of personal protective equipment that may be utilized on site. Each individual must demonstrate the ability to use the personal protective equipment correctly prior to being allowed to use it in work operations. This shall be certified, in writing, by individual identity.

Record Retention

Training records shall be kept on file in the CONTRACTOR and SUBCONTRACTOR Safety Office for the duration of the project.

CONTRACTOR and SUBCONTRACTORs shall ensure that their employees wear as minimum:

- Safety Helmet.
- Safety Footwear.
- Eye Protection (safety spectacles with side shields as a minimum).
- Gloves.
- Hearing Protection.

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- One piece coverall for construction activities (made of non-fire retardant material).

CONTRACTOR and SUBCONTRACTORS shall also make provision for the supply of additional PPE, as circumstances may demand having regard to the activity being performed or the circumstances, such as:

- Goggles.
- Face shields for grinding.
- Rubber boots with toe protectors and reinforced soles.
- Wet weather clothing.
- Respiratory equipment.
- One piece coverall (in a colour which differs from the overalls used by OWNER).
- One piece coverall made of fire retardant material (for personnel who work in high fire-risk areas and/or activities during COMMISSIONING and START-UP phases).

CONTRACTOR/SUBCONTRACTOR shall use ultrasonic, gas leak detectors, wherever required during the introduction of hydrocarbons or inspections of confined spaces inside PENGERANG AREA.

Although the following listing of regulations is not complete, JSA's determine the specific requirements and can be used as a compliance check. (note: the following examples do not necessarily cover the minimum requirements for the items shown).

Hearing Protection

Employees shall use hearing protection when they are exposed to a noise level that exceed 85 dBA, 8-hour time weighted average.

SUBCONTRACTORs shall clearly indicate during which activities and in which areas the noise level exceeds 85 dBA.

Respiratory Protection

All employees must wear appropriate respiratory protection for activities involving contaminants.

All employees using respiratory protection must be instructed and trained in the use and limitations of respirators.

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SUBCONTRACTORs shall always contact the CONTRACTOR Safety Representative before starting any activity requiring respiratory protection.

(Refer also to Respiratory Equipment Procedure which will be issued)

Goggles, Face Shields, Welding Shields

SUBCONTRACTORs shall ensure that their employees wear the appropriate goggles or face shield when machines or operations present potential eye and face injury from physical, chemical or radiation agents.

Employees are required to wear safety glasses with face shields and welding hoods.

Fall Protection

All employees working more than 2 m above grade shall wear and use a full body safety harness with double lainyards, if not working from a completed permanent platform. (It is recommended employees be tied off at all times, including while on properly erected scaffolding or temporary platforms).

Hand and Arm Protection

SUBCONTRACTOR shall ensure that gloves are worn on site as required, except for instrument calibration or similar work.

SUBCONTRACTOR shall identity for each activity which type of glove is required.

We report hereafter for an easy reference the CONTRACTOR PPE Matrix General Site Regulation:

Table 15.1: Personal Protective Equipment Matrix - General Site Requirements

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	ACTIVITY	HAZARD	THREAT	FP	HH	SG	G	FS	HP	SB	OTHER	COMMENTS
1	Site Access	Slips, trips, falling and fling object, struck against or on	Construction Environment		M	M			R	M		Vehicles, offices exempt. Also, rating areas void of hazards
2	Handling Material	Lifting injuries, lacerations, punctures	Sharp edges, splinters, rough surfaces		M	M	M		R	M		
3	Chemical handling	Dermatitis, blisters, burns	Contact with corrosive, toxic or defatting agents		M	M	M	R	R	M	Apron, suit, chemical goggles, protective clothing and respirators where required	PPE material of construction compatibility. Face shield and or goggles depending on threat.
4	Welding, burning cutting	Burn, retina injury, inhalation hazards	Airborne contaminates, I.R. radiation, contact with heat	R	M	M	M	R	M	M	Leathers; shaded welding lenses; cutting goggles, fire watch, fire extinguisher, cleared area, hot work permit? Respiratory protection where required	Hard hats required unless other head protection provided
5	Grinding, chipping	Inhalation hazard, impalement eyes, face, body	Flying projectiles	R	M	M		M	M		Respiratory protection	Safety glasses required under face shield
6	Hydro blasting	Impalement eye, face, body; contusions	Flying projectiles	R	M	M	M	M	M	M	Goggles required in place of SG. Protective suit. Water proof safety boots	Hydro blasting
7	Jack hammering	Impalement, fractures contusions	Stuck by objects/flying particles		M	M	M	M	M	M	Metatarsal foot protectors	Jack hammering
8	Painting, coating, welding, chemical	Generating airborne vapour, particles, gases	Inhalation exposure	R	M	M	R	R	R	M	Respiratory protection as specified by PM's HSE representative	
9	Working at Height	Fall on or onto	Working at height greater than 2m or above on rotating systems with energy potential	M	M	M	M	R	R	M		

KEY HH: Hard Hat. **SG:** Safety Glasses* All eye glasses shall have side shields. **G:** Gloves* Hand protection shall be carried and available for use. **FS:** Face Shield* **HP:** Hearing Protection* **SB:** Safety Boots* boots shall have puncture resistant soles. **FP:** Fall Protection; full body hardness including shock absorbent lanyards. **M:** Mandatory. **R:** May or may not be mandatory dependent on activity. **All PPE equipment shall be approved by the TCM HSE representative prior to use on the project and shall be supported with manufacturing design specifications suitable for application.**

General Apparel

Every employee will at all times wear clothing that protects the body and extremities. The typical personnel hazards listed below can be prevented as follows:

Thermal burns resulting from contact with hot pipes, can be prevented by using long sleeve shirts and cloth gloves.

Chemical burns and/or skin absorption of allergens and toxins can be prevented or minimized by use of appropriate chemical protective clothing (CPC).

Loose clothing will not be worn where it can contact or catch on energized conductors, moving parts, equipment, or other hazards of this type.

Preference should be given to natural fibers in the clothing worn by personnel.

Short pants are prohibited as outerwear.

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Finger rings or necklaces are prohibited when there is a danger of catching them on moving parts or contacting an energized conductor.

PPE Technical Specification

Safety spectacles: International Standard (No Shaded lens to be used in areas of shade or limited light) or equivalent

Safety Helmet (With Chinstrap): International Standard

Helmet Colors (recommended):

- White for Team Leaders
- Yellow for all general construction workers
- Red for all HSE, Security, Medical and emergency response personnel

Helmet company identification:

All personnel must be readily identified by bearing on the helmet company name or logo.

Safety footwear: International Standard

Steel toe-cap and steel shield

Hearing Protection: Disposable ear-plugs, ear inserts or ear muff that meet BS or ANSI or equivalent, rated as necessary to reduce noise exposure below 85 dB A.

15.2 Fall prevention and protection

CONTRACTOR will issue a dedicated “Fall Prevention and Protection Procedure” according and in agreement to local legislation.

Introduction

Working at heights has proven to be amongst the most hazardous activities during construction. Therefore SUBCONTRACTORS shall ensure strict adherence to site rules and regulations stipulated in this subsection. Nonconformance may lead to dismissal of involved SUBCONTRACTOR’s supervisor.

Goal

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To provide 100% fall prevention for all personnel working above ground level.

Minimum Requirements

Maximum use will be made of primary fall protection systems, such as scaffolds, aerial lifts, personnel hoists, etc.

Fall protection equipment shall be inspected prior to each use.

SUBCONTRACTORs shall adopt a 100% fall protection policy that makes provision for secondary fall protection (full-body harness with double lanyard complying with International and local standard) for all employees who are working or traveling more than 2 meters above ground (or less, if assessed that it is needed. All fall protection devices shall be manufactured and used in accordance with a recognized international standard acceptable to CONTRACTOR.

All SUBCONTRACTOR employees shall be provided with an approved full body harness and a double lanyard as a minimum. Lanyards shall be secured when working in excess of two (2) meters off the ground where a fall exposure exists. Employees may detach the lanyard if a walking surface is provided and constructed with scaffold grade planking with handrails, mid-rails and toe-boards. If walking surfaces are not available, lifelines capable of supporting at least 2.500 kg are to be provided for mobility or the employee may be issued a second lanyard to ensure 100% fall protection. Employees are to secure their body harness when working from scaffolding.

Equipment shall be selected, used and maintained in such a manner to maximize personal safety and minimize risk to the user.

All personnel will be trained on the safe and proper use of fall protection equipment.

Fall protection equipment will be inspected and approved by a Competent Person on a monthly basis.

Safety Belts will not be used on site.

15.3 Scaffolding

CONTRACTOR will issue a Safety Scaffolding Procedure.

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A safe means of access shall be provided for any work to be carried out at a height greater than 2 meters above ground (or less than 2 meters, if assessed that it is needed).

If a suitable permanent access is not available, a well-designed, erected, inspected and maintained scaffold will provide a safe means of access and safe working areas. Additionally, safe access to scaffold work platforms by ladder shall be provided. All scaffoldings shall be constructed in accordance with BS 5973 Code of Practice for Access and Working Scaffolds and Special Scaffold Structures in Steel or its equivalent.

All scaffolding materials and components shall be as follows:

a. Scaffold tubes

All tubes shall be galvanised steel 48.3mm OD and wall thickness 4mm comply to BS 1139 Part 1, 1982 and free from cracks, splits or excessive corrosion and straight. Black steel or aluminum scaffold shall not be allowed to be used at SITE.

b. Coupling and fittings

They shall be of sound construction, comply with BS 1139, Part 2. Tubular and fittings of different standards shall not be mixed.

c. Board or decking meet the recommended BS 2842:1981 or regulation 87 of Factory and Machinery Act 1967.

All timber scaffold boards shall follow the Factories and Machineries (Building Operations and works of Engineering Construction), Safety regulations, 1986.

d. Ladders

Ladders shall meet the requirements of BS 1129:1982.

e. Frame or tubular scaffold

Proprietary steel frame or tubular scaffold of sound design and construction shall be approved by OWNER before use.

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SUBCONTRACTORS shall submit for CONTRACTOR approval, scaffolding systems to be utilized on the Project. This shall include the manufacturer of the scaffold. No scaffold systems shall be used prior to this approval being given.

SUBCONTRACTORS shall provide all equipment, supervision and manpower for the transport, erection, alteration, dismantling, storage and security of their scaffolding requirements, together with inspection of scaffolding systems.

The mixing of differing scaffolding system components is prohibited. Exemptions to this may be authorized exceptionally in writing by CONTRACTOR on a case-by-case basis.

SUBCONTRACTORS shall develop a scaffold tagging system (SCAFTAG) compatible with the OWNER system.

A red tag shall be utilized to indicate scaffolds under construction or demolition, yellow to indicate scaffolds that are complete but have hazards associated with them, and green to indicate scaffolds erected to a complete, safe standard.

SUBCONTRACTORs shall erect or modify scaffolds under the direction of a trained, competent scaffold inspector whose resume and qualifications have been submitted to and accepted by CONTRACTOR. The competent person shall sign all scaffold tags and perform and document inspections before initial use, including initial use following alteration, and daily thereafter.

SUBCONTRACTOR will provide safe access/egress to all levels of scaffolds. Scaffold platform accesses shall be protected to prevent the possibility of accidental fall through utilizing secured access gates.

SUBCONTRACTORS shall have a qualified, professional engineer design all scaffolds over 15 meters in height.

All scaffolds erected by SUBCONTRACTOR shall have casters, jackscrews, or base plates installed. Mudsills shall be used where required. Scaffolds shall be level and plumb, capable of supporting at least four times the anticipated load, and secured to a solid structure whenever possible load bearing capacity of ground, paving etc. shall be verified.

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SUBCONTRACTORS will provide scaffold user training to all employees, will verify employee comprehension by testing and will maintain training and testing records which shall be made available to CONTRACTOR.

All scaffolding material shall be of sound construction and adequate strength and shall be manufactured, constructed and maintained to local standard. Scaffold planks shall comply local standards and contractual specifications.

SUBCONTRACTOR scaffolding supervision and scaffolding personnel shall ensure that all scaffold structures meet the project approved scaffold standards.

15.4 Barricading

SUBCONTRACTORS are responsible for properly erecting and maintaining barricades and barriers in such a manner that they provide adequate protection and do not impede the work of other.

Barricades and barriers shall have appropriate signs and tags indicating the nature of the hazard and the responsible supervisor.

Barricades left after dark on or in close proximity to roadways shall be properly equipped with flashing amber lights.

SUBCONTRACTORS will provide and use appropriate barrier devices to identify the nature of the job hazard involved (i.e., yellow and black for "CAUTION" or red and black for "DANGER"). Barrier devices, including barrier tape, shall not be used as a substitute for a barricade as they do not offer adequate protection from falls. Barrier devices shall be used only in those applications where temporary identification of a hazard is needed; but not as a primary means of protecting employees from exposure.

CONTRACTOR and SUBCONTRACTORS will ensure that employees understand and comply with barricade and barrier procedures (i.e. prohibited entry into red barrier taped areas).

15.5 Floor & Wall Openings

SUBCONTRACTORS shall review the fall hazards involved in their scope of work and construct standard handrail systems where required. Handrails shall be constructed with the top rail 120 cm (42 inches)

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from the floor or platform level and shall have a mid-rail and toe-board. Toe-boards shall extend 10 cm (4 inches) or above the floor or platform level.

CONTRACTOR and SUBCONTRACTORs shall install vertical support posts for handrails at intervals of not more than 2.5 meters (8 feet).

CONTRACTOR and SUBCONTRACTORS shall barricade all floor openings, or install secured, properly labeled and substantial covers (able to withstand at least twice the anticipated load). All floor opening covers shall be stencilled or painted with this statement: "OPEN HOLE - DANGER, DO NOT REMOVE."

Up lifting of floor gratings and for their proper reinstatement.

Standard rail systems shall be erected as a primary means for preventing fall or other injuries associated with floor and roof openings.

Standard railing systems shall be capable of restraining 100 kg of imposed weight.

All floor/roof openings not afforded standard rail system protection shall be covered with substantial covers capable of supporting 500% of anticipated floor loading and be properly labeled.

15.6 Roofing work

General Guidelines

Prior to performing any work, including preliminary inspection, the structural integrity of the roof will be verified (i.e., is the roof capable of supporting the intending loads?).

Roof access will be closely monitored by a supervisor during inclement weather.

Roof access and work shall be prohibited at night unless appropriate and adequate illumination is provided and authorization is obtained from the CONTRACTOR HSE Manager.

Employees engaged in roofing work will be protected from falling from all unprotected sides and edges of a roof by one of the following methods:

- Low-slope roofs (having a slope less than or equal to 4 inches [10.2 cm] vertical, 12 inches [30.5 cm] horizontal) with unprotected sides and edges 6 feet (1.8m) or more above lower levels will be protected by guardrail systems, safety net systems, personal fall arrest systems, or a combination of warning line

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system and guardrail system, warning line system and personal fall arrest system, or warning line system and safety monitoring system. Or, on roofs 50 feet (15.2 m) wide or less, the use of a safety monitoring system alone (i.e., without the warning line system) is permitted.

- A steep roof (having a slope greater than 4 inches [10.2 cm] vertical, 12 inches [30.5 cm] horizontal) with unprotected sides and edges 6 feet (1.8 m) or more above lower levels will be protected by guardrail systems with toe boards, safety net systems, or personal fall arrest systems.

- A guardrail system will be installed and maintained at the perimeter of all open sides that present a fall exposure of more than 6 feet (1.8 m).

15.7 Excavations & Trenching

General Requirement:

- Excavation or trenching work is prohibited until all conditions are in compliance with the OWNER/CONTRACTOR permit requirements.

- Only competent person's will classify all soils and perform daily inspections of all excavations/trenches

- All underground services and/or utilities shall be identified on an engineered drawing. Notifications shall be performed in accordance with the procedure prior to commencing any excavation.

- Spoil material shall be placed at least 1 meter away from the excavation edge.

- Where trenches or excavations exceed 1.5 meters in depth, protective systems must be used and a PTW complete with confined space certificate shall be secured.

- Warning signs and barricades shall be installed in a manner that prevents accidental entry into the trenched or excavated area.

- No mechanical excavation within 1 meter of the existing service shall be allowed. All underground services shall be hand exposed and identified.

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- Prior to opening an excavation or trench an Excavation Permit shall be completed to identify existing underground utilities and provides a soil classification

- A designated competent person shall be on site at all times during which excavation activities are conducted.

- All excavations shall be inspected by a competent person before entry and the results recorded:

- At the start of each shift.
- After rain
- After any condition that can change the integrity of the soil.

CONTRACTOR will issue Project Specification Excavation Procedure.

15.8 Vessels and Confined Spaces

CONTRACTOR will issue a Project Specification Confined Spaces Procedure.

Confined space entry shall be authorized through a Permit to Work approval process. The procedure designates what types of training will be required, who will be trained, rescue procedures, personnel and training requirements and specific precautions for the different types of confined spaces at the site.

CONTRACTOR will examine each confined space before initial entry to evaluate the specific hazards and SUBCONTRACTOR's safety precautions.

CONTRACTOR/SUBCONTRACTOR personnel entrants shall be certified medically fit by the Approved Medical Examiner (AME) before they are allowed to work in a confined space.

During commissioning confined space entry shall be subject to the OWNER's permit to work control.

<u>General Measures</u>

- All confined spaces shall be identified and marked as they develop or arrive at a location.

- All affected employees will be trained in the aspects of the written plan.

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- Atmospheric testing (oxygen content, flammable gases and vapors and potential toxic air contaminants) will be conducted on all confined space prior to entry and written documentation maintained.

- All energized piping systems shall be locked or blocked and tagged to isolate contaminants and energy and all electrical sources shall be isolated.

- Means for constant two-way communication shall be provided.

- Only low voltage or Ground Fault Circuit Interrupter (GFCI) controlled electrical power shall be used,

- A hazard assessment shall be performed and documented on a Safe Work Permit prior to entry.

SUBCONTRACTORS shall ensure:

- That a Work Permit is used at all times, and those permit regulations are strictly followed.

- All personnel responsible for safety watches (confined space attendants) are easily identified, competent and aware of the duties associated with each emergency situation that may occur within the confined space

- An emergency rescue team shall be available for all confined space entries and that all employees know how to summon assistance.

- That employees who are to enter a confined space are properly instructed, and trained in the use of protective equipment, if applicable.

- To have stand by or available on site the appropriate extraction equipment and personnel trained in rescuing people from confined spaces

- That oxygen - % and % LEL are monitored, and that warning systems are in place if safety margins are exceeded; in case safety margins cannot be maintained independent air/breathing equipment is mandatory.

- That a safety watch is present at all times

- That if electricity is to be used, maximum 110 Volt DC or 42 Volt AC, with GFCI protection, is utilized.

- That gas and oxygen cylinders will be kept outside the confined space at all times.

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- That welding leads and cutting hoses are removed from confined spaces when not in use.
- An emergency response plan is available for all confined space entries the all employees known to summon assistance
- To submit a safety procedure (JSA) for CONTRACTOR comment and approval.

Definition

A vessel or confined space is a location that:

Is large enough and so configured that an employee can enter and perform work and (2) is not designed for continuous employee occupancy and (3) has limited or restricted means of entry or exit.

15.9 Lock out / Tag out Procedure (LOTO)

SUBCONTRACTOR will ensure that all employees have instruction on the specific lockout/ tag out procedure and comprehension testing shall be conducted to verify knowledge and understanding of the procedure. Records of training and testing shall be kept, filed, and made available to CONTRACTOR and OWNER.

15.10 Portable Ladders - Control and Inspection

CONTRACTOR will issue Project Specification Portable Ladder Inspection Procedure

SUBCONTRACTOR shall monitor ladders to ensure all ladders used on the Project are commercially constructed of wood, fiberglass or metal have non-slip feet, and that wooden ladders have been treated with preservative.

Generally, job made ladders will be prohibited. Ladders properly designed, constructed and approved by the CONTRACTOR prior to use maybe acceptable in limited applications.

SUBCONTRACTOR shall document quarterly inspection of ladders.

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SUBCONTRACTORs shall use ladders for egress and/or to conduct low level work of short duration and shall not use ladders in lieu of scaffolds as a primary means of conducting work of longer duration.

Ladders shall meet the requirements of BS 1129:1982.

15.11 Cranes and Material Handling

CONTRACTOR will issue Project Specification Crane and Lifting Procedure

All cranes supplied by SUBCONTRACTORS shall have valid certificate of fitness issued by authority e.g. PMA certificate issued by DOSH Malaysia. All cranes shall be inspected, tested and witnessed by OWNER competent person before putting them into service. All associated lifting equipment shall be inspected.

SUBCONTRACTORS shall inspect and maintain all cranes to ensure they are in safe working conditions. All defective cranes shall be taken out of service, repair or replace if necessary. Whenever there is any doubt on the integrity of the crane, load test shall be performed at SUBCONTRACTOR‟s cost.

A colour coding shall be used to identify inspected lifting appliance. CONTRACTOR shall seek approval from OWNER on any heavy lifting of **15 tons and ab**ove. CONTRACTOR is responsible for ensuring that a competent and authorised operator operates any lifting device and that a signal man is designated to signal the operator as necessary to properly place and control the loads.

Prior to performing any lift, the operator shall determine the weight of the object being lifted and ensure that cables, lifting device, slings, wire ropes, chains etc. used are of a sufficient strength to support the weight of the load.

No worker shall be allowed under the load. Tag lines shall be used to guide and control the load where excessive movement is possible.

A competent worker shall inspect all wire rope, chains, and slings prior to performing any lift. Record of inspection shall be kept for CONTRACTOR/OWNER’s review. During winch or tow, all personnel shall be clear of the “whip area‟ of cable/rope under tension.

All cranes supplied by SUBCONTRACTOR will have current, annual, documented inspections of sufficient detail to be acceptable to CONTRACTOR and OWNER. Documentation of such inspections shall be made available to CONTRACTOR prior to access of the equipment to the Project.

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SUBCONTRACTOR will provide and ensure that operators inspect daily all equipment. No equipment shall be operated if hazardous conditions are identified.

15.12 Suspended Personnel Platforms

CONTRACTOR will issue a Project Specification Man-lift Baskets Safe Utilization Procedure

SUBCONTRACTOR will notify CONTRACTOR prior to using any suspended personnel platform and develop a Lift Procedure to be reviewed and accepted by CONTRACTOR prior to their use. The procedure shall include, but not be limited to, employee training, pre-lift meetings, trial lifts, and platform inspection.

Personnel platforms (baskets) shall be designed by a qualified engineer and manufactured and tested by competent personnel. They shall have permanent markings indicating maximum weight.

Minimum Requirement

- Use of the personnel platform is prohibited until all conditions are in compliance with the CONTRACTOR permit requirements;
- Personnel platforms (baskets) shall be designed by a qualified engineer and manufactured by competent personnel;
- The crane/derrick used shall have an operational anti two block device and locking devices on the hook;
- A positive means of communication shall be provided between the crane operator and employees in a crane suspended personnel platform;
- Employees in the platform shall wear full body harnesses attached to a designated anchor point;

15.13 Articulating Boom Platforms

Machines manufactured and used for elevated personnel platform work (JLG, Hi-lift, etc.) shall be operated and maintained in accordance with manufacturer recommendations and only by trained and qualified individuals. Training and comprehension test records shall be maintained on file at the Jobsite and made available to CONTRACTOR upon request.

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All persons inside work platforms shall wear a full body harness attached to a designated anchor point. A fire extinguisher shall be provided on all such equipment.

Equipment used to hoist personnel shall not be used for material, if this constitutes a hazard.

During operation an individual shall remain at the main ground control.

Minimum Requirements:

- Machines manufactured and used for elevated personnel platform work (JLG, Hi-lift, etc.) shall be correctly operated and maintained;
- All persons inside work platforms shall wear a full body harness attached to a designated anchor point;
- A fire extinguisher shall be provided on all such equipment;
- Equipment and tools shall be limited and the lift shall not be used in lieu of rigging devices or cranes;
- Workers leaving the platform to access and elevated work area shall tie-off to an approved anchor point on the structure and the lift shall remain immediately accessible should descent be necessary;
- A pre-start inspection of the equipment shall be performed by a competent person. The user will be responsible for ensuring that this has occurred;
- The equipment will be used only on level ground;
- Platforms/baskets will not be loaded in excess of the design working load;
- The weight of personnel in baskets is counted as part of the load;
- Articulating boom platforms are to be used for lifting personnel and small hand tools. The use of an articulating lift as, or in lieu of, a crane is prohibited;
- Personnel will consider the overall dimensions of the unit and always be sure that there is sufficient clearance before moving under any overhead obstruction and working near electrical lines;
- Personnel will not walk under a boom to gain access to the platform;
- Personnel will not tie the platform off to any structure for any reason;

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- Personnel are required to stand on the platform floor; standing on the railing is prohibited;
- Personnel will always watch for obstructions and pathway conditions in the direction the machine is moving;
- Personnel will not rest the boom or basket on a steel structure of any kind;
- Platforms will not be used as access to any structure. Personnel must stay in the basket at all times when it is elevated;
- All equipment must be equipped with a 6.0 kg fire extinguisher mounted on the basket;
- Proper barricading pylons and/or a “flag person” will be used when operating in high-traffic areas. This includes all plant roadways.

15.14 Compressed Gas Cylinders

CONTRACTOR will issue a Project Specification Gas Cylinder Use and Storage Procedure

Minimum Requirements

- Cradles and/or cages shall be provided for lifting compressed gas cylinders;
- All cylinders shall be used on wheeled carts;
- Compressed gas cylinders storage shall:
  - be segregated by type;
  - be labelled and signed in accordance with Malaysian standards;
- protective isolation of fuel gasses from oxygen;
- provisions to keep cylinder caps in place when provided by the supplier;
- positive upright securing of bottles, and
- maintenance of safe distances from ignition sources;
- Is prohibited the use or storage of compressed gas in confined spaces;

15.15 Electrical Equipment Inspection (ELCB or GFCI)

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As far as, all electrical cord sets and receptacles not part of the permanent electrical wiring system of a building or structure, and all electrical equipment and tools used in connection with construction activities, are concerned, SUBCONTRACTOR shall operate in compliance with all local standard and requirements.

No part of any lifting device or any equipment operated near power lines shall be closer than the following minimum 'voltage safe distances':

- Up to 50 kV the safe distance shall be 3.0 m;
- For 750- 50k V, the safe distance shall be 3.0m;
- For 50k-250k V, the safe distance shall be 4.5m;
- For 250k V, the safe distance shall be 6.0 m.

The above clearance applies in all directions. All overhead lines shall be identified with a highly visible sign placed 7m from both sides of the lines, 1.8m above ground. A restriction guard pole connected with ropes shall be installed to restrict clearance close to power lines.

SUBCONTRACTOR shall fully comply with the project requirements, which includes quarterly color code changes, the use of Earth Leakage Protection Devices (ELPD) or Ground Fault Circuit Interrupters (GFCI) on all temporary electrical applications.

SUBCONTRACTORS shall train employees regarding electrical inspection and electrical safety.

SUBCONTRACTORS will maintain records of all tool inspections and make these records available to CONTRACTOR.

SUBCONTRACTORS will ensure all tools are checked for electrical continuity after repairs are made.

SUBCONTRACTORS will ensure that personnel are isolated from electrical distribution centers. This includes Fencing and locking transformers.

15.16 Underground and Overhead Electrical Installations

SUBCONTRACTOR shall operate in compliance with all applicable regulations relevant to the exposing and supporting of underground electrical installations.

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SUBCONTRACTOR will provide details in method statements prior to commencing work

All employees engaged in the applicable work operations will receive instruction on exposing and supporting underground electrical installations procedures.

15.17 Lightning Arrestors for EPCC Activities

In recognition of the fact that Johor has recorded the most occurrences of lightning in Malaysia, CONTRACTOR shall install lightning arrestors at suitable locations on the WORKSITE in order to provide a safe zone for CONTRACTOR'S activities.

CONTRACTOR shall ensure that the specifications for the lightning arrestors fulfill the requirements of OWNER and national / state authorities.

15.18 Vehicle Operations

CONTRACTOR will issue a Project Specification Vehicles Operation and Maintenance Plan.

This will include how it shall manage the safe transport of materials and equipment to the Project. This plan will include at a minimum the following:

- Inspection and maintenance
- Selection and assurance of driver competence
- CONTRACTOR’s responsibility to manage all transport associated with the execution of his scope of work.

SUBCONTRACTORS shall ensure all vehicles are registered/licensed, maintained in a roadworthy condition, and operated in a safe manner in accordance with manufacturer recommendations.

SUBCONTRACTORS shall ensure all persons operating vehicles are healthy and unimpaired, have appropriate and required operator’s licenses, and observe established road regulations and/or Jobsite regulations.

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SUBCONTRACTORS shall provide a seat belt for each vehicle passenger and enforce the wearing of seat belts any time a vehicle is in motion. Busses provided for Project transportation may be exempt from this requirement.

Vehicle's operators/drivers will be evaluated for competency by the SUBCONTRACTOR and CONTRACTOR prior to being permitted to operate/drive on the Project.

15.19 Non-destructive testing

CONTRACTOR will issue a Project Specification Radiography and NDT Safety Procedure.

This procedure shall address at a minimum the following:

- Storage and transport of radioactive sources
- Emergency procedures

Radiography work shall be performed under a CONTRACTOR and/or OWNER issued Permit for Radiography and only by SUBCONTRACTOR possessing the proper licenses and certificates as per Malaysian Atomic Energy Licensing Board (AELB).

Where laboratories are used to analyze samples, the laboratories shall be acceptable to CONTRACTOR.

SUBCONTRACTOR will instruct employees on the potential for radioactive hazards during radiography and the precautions to be followed in the event of an emergency.

SUBCONTRACTORS will ensure that radiographic exposure devices, storage containers and source changers are kept locked and physically secure when not in use.

Perimeter areas around radiographic work will be properly barricaded and posted with appropriate warning signs.

15.20 HSE (Safety, Fire and Confined space) Watches HSE

Safety Watcher

All Safety Watchers shall be trained before performing watch duties. Stickers on their hard hats will be used to indicate that they have received safety watch training together with the information being contained in their individual HSE Training Passport.

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More than one Safety Watch may assist with a particular job.

Safety Watcher's must be fully capable of informing others of emergency conditions and of understanding their requirements.

There are five types of Safety Watcher, as follows:

- Fire watch (standby watch for particular hot work in classified areas)
- Man way (or entry) watch
- Man way (or entry) watch when using respiratory protection
- Traffic watch (flagman)
- Equipment watch (flagman)

15.21 Work Beyond Normal Working Hours and Night work

15.21.1 Work Beyond Normal Working Hours

The scope of the present instruction is to guarantee a suitable safety and work supervision when working activities shall be carried out by any SUBCONTRACTOR, outside the normal site working hours.

Definitions:

Normal Site Working Hours:

All the activities performed at the Plant from 07.00 a.m. to 06.00 p.m. from (to be specify according to the geographic area), excluding holidays.

Outside the normal Site Working Hours:

All the activities carried out before and after the normal Site Working Hours or during holidays.

Instruction for the activities to be performed beyond Normal Working Hours:

SUBCONTRACTORS shall formally request to CONTRACTOR the permission to perform activities in the Plant outside the normal Site Working Hours. This request shall be handover to CONTRACTOR through a signed cover letter within the 04.00 p.m. of the previous day. The cover letter shall enclosure one or

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more of the attached request form; each filled and duly signed one for any different activities, discipline or lower tier SUBCONTRACTOR.

The attached form (Appendix 5) that shall be utilized is divided in three sections:

First section:

- Contains information about the exact duration of the activities to be performed outside the normal Site Working Hours (date and time);
- Defines who is making the request (SUBCONTRACTOR);
- Contains the name of the Discipline Supervisor and the HSE Supervisor that will be present at site and responsible for the activities carried out outside the normal Site Working Hours.

Second section:

- Contains information about the possible lower tier SUBCONTRACTOR that will be entitled to carry out activities outside the normal Site Working Hours;
- Describes the number of workers involved in these activities;
- Contains the name of the Discipline and HSE Supervisors that that will be present at site and responsible for the activities carried out outside the normal Site Working Hours;
- Describes the area and the exact location of the works;
- Describe all phases of the activities to be performed outside the normal Site Working Hours;
- Contains the stamp and signature of the SUBCONTRACTOR Site Manager.

Third section:

- Contains the name of CONTRACTOR Discipline Supervisors that may be present at Site;
- Contains the name of CONTRACTOR Safety Officer that will be present at Site;
- Contains the CONTRACTOR CSM signature for authorization;
- Contains the CONTRACTOR HSE Department signature for information.

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The form relevant to activities to be performed outside the normal Site Working Hours when authorized will be returned to SUBCONTRACTOR duly signed. Only the activities authorized by CONTRACTOR as per the present instruction are permitted.

Due to the particularity and the implications related to the carrying out of activities outside the normal Site Working Hours, the SUBCONTRACTOR must provide, verify and guarantee that all the Project HSE procedures, standards and regulations are integrally applied and all the prevention and protection measures necessary to perform the work in a safe manner are in place before to start the activities.

The execution of activities outside the normal Site Working Hours must be performed in compliance with all the provisions imposed by the law and the national and local Labor Authorities.

15.21.2 Night Work

In addition to what is prescribed in the previous paragraph, SUBCONTRACTORS that intend to perform a night work will submit in advance a relevant method statement and JSA to CONTRACTOR for approval.

Minimum Requirement

Prior to work commencing the SUBCONTRACTOR shall ensure the following:

- Work is planned as far as practicable to limit the need for night work;
- The CONTRACTOR's and OWNER's representative are properly notified of the work and they agree that all necessary precautions have been properly planned;
- All required precautions specified in this procedure or those agreed with the respective HSE Manager are implemented;
- Coordination of radiography activities; ensure that signs, barriers, adequate lighting, and flashing lights are provided; verify that the relevant persons have been informed;
- Provision of instructions in regard to the movement of vehicles (concrete trucks) within the areas of work;
- Adequate barriers are provided around areas where hazards may exist, and that such hazards are clearly lit (Flashing lights);

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- Lighting provided is adequate (per the table) and that personnel are not working in the shadows;
- JHA's and JSA's have been completed as required by the nature of the work;
- Adequate medical coverage is in place during work activities;
- All necessary tools and equipment are provided and that personnel access routes to the tools are illuminated in accordance with this procedure;
- Regular inspection and maintenance of lighting equipment takes place;
- All lighting equipment installed has been checked and certified in accordance with project requirements;
- Cables and other material are located in a way that prevents trip hazards;
- Public access to work areas is restricted to the extent possible;
- Authorization from the Site Manager or his designee to work beyond normal working hours is obtained;
- Employees are provided with suitable and sufficient personal protective equipment;
- There is a First Aid Attendant(s) present when working at night.

15.22 Ordnance and explosives

Should be necessary to use explosive on site, CONTRACTOR and SUBCONTRACTOR will submit detail of his program for OWNER and the relevant local authority approval and shall obtain all relevant permits and comply with the regulatory requirements for the use of explosives.

CONTRACTO/SUBCONTRACTOR shall ensure that every reasonable precaution and mitigation measures will be taken to ensure that CONTRACTOR personnel handling the explosives comply with established

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industry standards and best practices in the safe transportation, storage, handling and usage of explosives.

15.23 POTENTIAL FINDINGS OF UNEXPLODED ORDNANCES (UxO)

OWNER has engaged a third party expert to provide recommendations with respect to the disposition of any potential findings of Unexploded Ordinances ("UxO") on the PENGERANG SITE.

Upon a discovery of an Unexploded Ordinance at the Site during the course of work it is imperative all personnel is already trained on the action to be taken and follow all safety and security instructions given to them by OWNER.

The following instructions must be included as part of the daily HSE toolbox talk.

The following instructions are related to the discovery of a finding of an UxO during the performance of the work:

- Immediately stop all work in the vicinity of the find. It is the duty of the Security / HSE Officer for the WORKSITE to stop all work in a 100m minimum radius before arrival of the Police.
- Mark the location of the UxO by using a ground marker, e.g. using a red flag.
- Restrict / barricade the area of the find up to 100 meters from the location of the UxO and request personnel to stop working around a periphery of 500 meters until further a assessment is carried out by the OWNER’s UxO experts. Safety tape / a line should be used as a barricade. All access routes to the location must be marked with dual language special signage e.g. DANGER / BAHAYA and NO ENTRY / DILARANG MASUK.
- No workers, including management, are allowed into the restricted / barricaded area.
- Report a finding of an UxO to the CONTRACTOR's manager for the WORKSITE and OWNER’s manager immediately.
- CONTRACTOR's manager for the WORKSITE in liaison with OWNER’s manager shall immediately report the find to the Police.
- The area shall remain cordoned and off limits to all workers until the UxO has been cleared by the Police and certified as safe & secure.

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CONTRACTOR/SUBCONTRACTOR personnel shall be instructed NOT to do the following:

- Do not move the UxO, or if already moved during the WORK, do not move further following discovery.
- Do not touch, drop, heat treat or tamper the UxO in any way.
- Do not attempt to remove the detonator or attempt to make it detonate, e.g. by hammering it, dropping it from height on to hard surface or squeezing it with any means. In summary personnel should 'LEAVE IT ALONE'.
- Do not apply any heat source or pressure to the UxO or surrounding environment.
- Do not enter the restricted / barricaded area.
- Be aware the UxO could also detonate by effects of lightning.

CONTRACTOR/SUBCONTRACTOR shall strictly follow all instructions given by OWNER, OWNER's third party UxO experts and Police until successful disposition or removal of the UxO.

15.24 Permit To Work

CONTRACTOR will issue a Project Specification Permit to Work Procedure, according and in agreement with OWNER's Work Permit Procedure.

All personnel participating in Permit To Work activities will receive appropriate training.

The typical activities, where the PTW System will apply, as a minimum, are:

- Work at height;
- Confined space entry;
- Rock blasting;
- Electrical isolation & re-activation;
- Welding / cutting / machining;
- Painting and surface blasting;
- Excavation;

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- Piling;
- Heavy lifting;
- Scaffolding erection;
- Radiography work;
- Critical lifting as follows:
- Lifting over live process facilities or equipment;
- Personnel transfer using lifting equipment;
- Coordinated lift whereby the weight of load exceeds the maximum lifting capacity of one of the lifting appliances e.g. using of multiple cranes;
- Lifting of special load structure e.g. boiler, compressor, pressure vessels or reactor;
- Lifting load of weight of more than 80% of rated capacity of the lifting equipment at the specified working radius and boom angle in accordance with the crane load chart;
- Lifting more than 10 tons in close proximity of live process equipment.
- Hot work (during COMMISSIONING and at locations near flammable materials).

CONTRACTOR/SUBCONTRACTORS will need to comply with the OWNER's PTW System, as given to them by OWNER. The PTW System will be developed appropriately to be in line with the PTS and fully applicable for each phase (e.g. CONSTRUCTION, COMMISSIONING etc).

15.25 Tools and equipment

CONTRACTOR will issue a Project Specification Construction Tools & Equipment Inspection Procedure.

SUBCONTRACTOR shall provide and ensure that all tools are used in accordance with the manufacturers' recommendations, have required guards in place, and are maintained in good working order.

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All job made tools shall be subject to inspection and approval by the CONTRACTOR's HSE manager prior to use. Generally handmade tools shall be prohibited on the Project. All tools and equipment shall be used and maintained in accordance with manufacturer recommendations. If exceptions to this rule are needed (i.e. spreader beams), they shall be brought to CONTRACTOR's attention for review and acceptance prior to use.

15.26 Office HSE

CONTRACTOR will issue a Site Office Safety Procedure, according and in agreement with OWNER's requirement.

CONTRACTOR and SUBCONTRACTOR will ensure the temporary facilities strictly conform to local legislation, fire prevention standard and other applicable standards.

15.27 Grit blasting

CONTRACTOR will issue a Project Procedure HSE Grit Blasting Procedure.

SUBCONTRACTOR shall provide the blaster with an approved air face mask and oil free air supply. Associated workers and any other personnel within the blasting area shall wear approved respiratory protection. The blasting gun shall have a 'dead man' safety device operated by the blaster. Under no circumstances the device shall be tied back or defeated.

SUBCONTRACTOR shall made efforts to minimize the exposure of the blasting grit to the surrounding environment. Protective shield shall be erected and notice board shall be posted in order to prevent exposure of the blasting grit to other workers in the vicinity.

This plan will include details on specialized personnel protective equipment and disposal plans for spent grit.

16. FIRE PREVENTION AND PROTECTION

16.1 Fire prevention and Protection Plan

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CONTRACTOR will issue a Project Procedure Fire Prevention and Protection Plan and a Project Procedure Fuel Storage Procedure, according and in agreement with OWNER and statutory rules and regulation.

This will include all site construction area as well other temporary facilities.

CONTRACTOR will include in its Fire Protection and Prevention Plan a plan to ensure that fire protection equipment is placed and maintained in proper locations as work progresses.

The fire prevention/protection will be characterized by the following general principles:

- Minimal bulk storage on site of flammable substances;
- Isolation of flammables from sources of ignition;
- Ongoing housekeeping program;
- Training in fire prevention and suppression techniques;
- Permit to work control of hot-work and electrical activity in classified areas;
- Containment of sparks and flames from hot work;
- Escape route planning; and
- Restricted smoking areas.

This approach will be supported by the employment and maintenance of fire extinguishers at strategic locations throughout the work-site and also the deployment of a fire and emergency response truck, which shall remain permanently charged at a strategic location.

This truck shall be mobilized in response to all fires on site and shall be used during emergency response training exercises.

Prior to the start of Commissioning activities, all operational fire protection equipment must be in place.

SUBCONTRACTOR shall monitor its work and office areas to ensure that all doors, stairwells, aisles and means of egress are kept clear and unobstructed at all times.

All hazardous areas shall be posted with appropriate signs and access shall be controlled.

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Where temporary welding enclosures are required, SUBCONTRACTOR will ensure that these enclosures are constructed with flame resistant materials (such as fire blanket).

SUBCONTRACTOR will instruct its employees in regards to the facility/Project smoking policy and monitor to ensure that posted "no-smoking" zones are observed.

SUBCONTRACTOR shall ensure that employees are trained in and comply with the requirements for proper fire prevention and equipment use when welding or cutting.

SUBCONTRACTORS shall protect its employees against the welding and cutting hazards.

CONTRACTOR will issue a Project Specification HSE Cutting, Welding and Grinding Procedure for the maintenance and inspection of welding, grinding, or cutting equipment, SUBCONTRACTOR shall ensure that the procedure is implemented and maintained.

16.2 Equipment

SUBCONTRACTORS shall provide all fire protection and prevention equipment necessary for its operations, including, but not limited to fire hose, nozzles, extinguishers, etc.

SUBCONTRACTORS shall provide an adequate number of fire extinguishers of the correct size and type for its work activities. Extinguishers shall be maintained per manufacturers recommendations, inspected monthly, and tested annually.

SUBCONTRACTORS shall train employees in the proper use of fire extinguishers.

SUBCONTRACTOR shall effectively ground the frame of Arc-welding and cutting machines that incorporate a power outlet.

17. ENVIRONMENTAL PROTECTION

17.1 General Environmental Requirements

The Project shall be constructed and commissioned in accordance with the following principles:

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- All applicable legal requirements, regulatory constraints and recommendations for environmental protection specified by Local laws (i.e. National Regulations, Provincial Regulations and local standards) shall be complied with;

- The PENGERANG PROJECT Detailed Environmental Impact Assessment ("DEIA") and its approval conditions.

- The Environmental Management Plan ("EMP") prepared by OWNER and its approval conditions issued by DOE.

- The Erosion and Soil Control Plan ("ESCP") prepared by OWNER as part of the OWNER's Environmental Management Plan submission and the ESCP approval conditions from the Department of Irrigation and Drainage.

- The Air Dispersion Study ("ADS") to be prepared by OWNER.

- The reduction of hazards and adverse environmental impacts to a level "As Low As Reasonably Practicable" (ALARP).

- The use of the "precautionary principal" in applying strict standards wherever feasible, where existing conditions are likely to be close to natural levels, and where impacts on sensitive environmental are not fully understood;

- No halons, CFCs, PCBs or asbestos shall be used on the Project for any purpose unless its absence would "cause immediate and catastrophic loss of life, which would have a probability of occurrence greater than that, which is normally acceptable".

- The use of chlorine-containing materials (including materials of construction) shall be minimized.

17.2 Environmental Control

17.2.1 Environmental Management

SUBCONTRACTOR shall fully comply with all the applicable environmental specifications, plans, procedures and work practices.

CONTRACTOR will develop plans and procedure based on the above for day-to-day construction activities.

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17.2.2 Construction Environmental Control Plan

CONTRACTOR will issue Construction Environmental Control Plan.

SUBCONTRACTORS shall follow CONTRACTOR's plan for the management of any unexpected discovery on the Jobsite. In the event of SUBCONTRACTORS uncovers or discovers archaeological resources, cultural artifacts, gravesites, bones, buried tanks or containers, unknown structures, or discolored/ odiferous soil, the SUBCONTRACTORS shall immediately stop work in the area, the area shall be barricaded or flagged, and CONTRACTOR contacted immediately.

SUBCONTRACTOR shall adopt all the necessary measure in order to minimize the discharge of visible fugitive dust beyond the property line that shall interfere with land use or violate Jobsite air quality standards.

SUBCONTRACTORS ensure vehicles operating on the Jobsite shall meet Local air emission regulations.

During the site preparation, construction, and start-up activities of the Project, SUBCONTRACTORS shall perform work in a manner that shall minimize the effects of noise generated by their activities.

17.2.3 Construction Waste Management Plan

CONTRACTOR will issue before starting work, a Project Construction Waste Management Plan according and in agreement with the DOE requirements, DEIA report and approval conditions and OWNER's waste management instructions for PENGERANG PROJECT.

This document will describe the CONTRACTOR procedures for correct characterization, handling and storage of wastes.

The plan will address hazardous waste (waste oil, chemicals, asbestos etc.) and specify the requirements for separation, storage and transport including disposal routes.

Combustion of waste, including vegetation is prohibited on the Jobsite.

SUBCONTRACTORS are responsible for characterization and segregation of their own wastes prior to storage, recycling, or disposal in accordance with the applicable regulation.

SUBCONTRACTORS are responsible for regularly transporting their Jobsite generated waste to the temporary storage area.

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SUBCONTRACTOR shall manage all hazardous materials in such a manner as to minimize the potential for threats to human health and the environment.

All liquid effluent (e.g., sanitary sewage, wastewater from shower facilities, wastewater from canteen facilities) will be collected in closed-drain systems and passed to the wastewater discharge from the Jobsite that will comply with Local regulations.

17.2.4 Spill Prevention and Response Plan

CONTRACTOR will issue, before starting work, a Spill Prevention and Response Plan according and in agreement with local legislation.

SUBCONTRACTORS shall provide any necessary equipment required to implement the Construction Spill Prevention and Response Plan. CONTRACTOR and SUBCONTRACTORs will take all necessary measures to prevent hydrocarbon (e.g. oil, diesel, etc.) and chemical (caustic, acid, detergent, etc.) contamination of soil, groundwater, surface water.

General guidelines for prevent spills include:

- Identification of all potential areas and materials for spills;
- Ensuring all equipment is in good mechanical condition, effective, fit for purpose, with accurate maintenance records and schedule;
- Ensuring non-mobile plant is equipped with appropriately sized drip trays to collect any potential leaks/spills;
- Inspection and monitoring procedures to be carried out;

18. MONITORING PERFORMANCE

18.1 Construction HSE Inspection and Monitoring Plan

CONTRACTOR and SUBCONTRACTORS shall perform Monitoring, Inspection and Auditing activities during all the phases of the project realization, site preparation, construction and precommissioning.

Inspection and Monitoring activities will be detailed in the following procedure that will be issued before starting work on site:

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CONTRACTOR Project Specification Site HSE Inspection, Audits and Assessment.

CONTRACTOR will develop an internal audit program with details of areas and activities to be audited and the proposed schedule, The HSE audit program shall be agreed in advance by OWNER.

SUBCONTRACTORS shall provide all necessary assistance to CONTRACTOR for the inspection and monitoring of their activities.

18.2 Governmental Inspections

CONTRACTOR and SUBCONTRACTORS shall ensure its personnel are aware of and comply with the procedures to be taken in the event of a government inspection of any type (e.i DOE, Bomba, DOSH, CIDB, PDRM - Ministry of Health, Polis Diraja Malaysia).

CONTRACTOR will immediately notify the OWNER when a government inspector of any type requests entry onto the Project.

Following any government inspection, SUBCONTRACTORS will submit a written report to the CONTRACTOR, which details all aspects of the inspection.

18.3 Shortfall and Remedial Action Plan

This plan is developed by the HSE Manager or the HSE team in response to shortfalls, gaps, or deficiencies identified by audits or through other means, including implementation feedback loops.

Corrective actions may include issuance of an addenda or revisions to the HSE management plan or specific project procedures. The log of shortfall and remedial action plan items is to be maintained by the HSE department for possible future audits.

18.3.1 Procedure

All recommendations/action items arising from HSE related activities shall be formally recorded together with the current status of closeout of such items.

This will include recommendations/action items assigned to SUBCONTRACTOR organizations. Both electronic and non-electronic records will be made available for inspection by CONTRACTOR and OWNER at all times.

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Such recommendations/action items may arise from:

- HSE Assessments
- Planned Emergency Evacuation Exercises
- H&S Surveys/Inspections/Tours
- Incident/Injury Investigations

Designated Focal Points

Designated focal points will be nominated for the follow-up and closeout of recommendations/action items raised.

These focal points will have the authority and resources available to ensure items are closed out to the satisfaction of CONTRACTOR.

A completion date will be defined whenever possible taking in consideration the severity of the non-conformance. In general, a corrective action should be closeout within 24 hours.

In case of corrective action items related to accident or incident investigations, those should be closed out whenever possible immediately in order to reduce the possibility of reoccurrences.

Project Data Base

A Project Data Base will be developed for the storing of all recommendations/action items raised, together with current details of follow-up action taken and closeout dates.

The format of the Project Data Base will be approved by CONTRACTOR.

CONTRACTOR will have access to the Project Data Base at all times.

Record Keeping

A full non-electronic record of all HSE related activities where recommendations/action items have arisen shall be kept in addition to the storing of such information on the Project Data Base.

CONTRACTOR will have access to the Project HSE Records at all times.

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On a Monthly basis SUBCONTRACTOR will provide CONTRACTOR with the status of all recommendations/action items as part of his Monthly HSE Report.

Major learning points from information received will be cascaded to the workforce via bulletins, safety meetings, tailgate meetings, etc.

18.4 Performance Review

CONTRACTOR will undertake HSE reviews to gather information from monitoring, inspection and auditing activities and to assess the effectiveness of HSE Policy, objectives and procedures on site.

Management will make adjustment to the HSE-MS if and when necessary.

19. AUDITS AND ASSESSMENTS

19.1 Audit/Assessments

CONTRACTOR will establish an assessment process for measuring the compliance with the Project HSE-MS and will also include scheduled audits of all SUBCONTRACTORS and their HSE-MS.

CONTRACTOR will use information derived from its assessment process in Supervisor Safety meetings to enhance supervisor safety awareness and improve overall CONTRACTOR safety performance.

CONTRACTOR will perform periodic HSE assessments of the Project (i.e. 20% construction progress, 50% construction progress and before the pre-commissioning/commissioning activities). SUBCONTRACTORS shall provide CONTRACTOR with timely, complete and open access to its safety process, files, records, etc., and shall participate in this assessment as/if requested.

19.2 Reporting/Investigating Incidents and Accidents

CONTRACTOR will issue as part of the Project Construction HSE MS a Project Specification Reporting and Investigation of Accident and Incidents Procedure.

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CONTRACTOR will develop the Practices necessary to ensure that all incidents are fully investigated to include, as a minimum, the following:

- A formal Incident/Near-Miss investigation form shall be used to investigate the following types of incidents:
- Fatalities
- Hospitalization of one or more employees injured in the same incident
- Debilitating injuries
- Cases involving a Doctor's care
- Recordable injuries/illnesses
- Restricted workday cases
- Lost workday cases
- Utility damage
- Fires
- Vehicle/equipment accidents
- Incidents involving a fatality, hospitalization of one or more employees injured and debilitating injuries will require the assistance of the Home Office Construction HSE Manager (COHSE).

CONTRACTOR's New Employee Orientation will include information about employee responsibility for reporting all injuries, illnesses, property damage and near miss incidents.

SUBCONTRACTOR shall promptly report all such occurrences to CONTRACTOR. CONTRACTOR unless directed otherwise, shall take the lead in the investigation, documentation and initiation of corrective action.

19.3 Incident Notification and investigation

CONTRACTOR shall notify any occurrence of incident(s) at WORKSITE to OWNER without any delay and definitely within the first 24 hours.

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All incidents involving death shall be reported to the Police immediately. All accidents, dangerous occurrences, poisoning and occupational diseases prescribed under the Occupational Safety and Health (Notification of Accident, Dangerous Occurrence, Poisoning and Occupational Diseases (NADOPOD)) Regulations 2004 shall be reported to the Department of Occupational Safety and Health (DOSH) within the specified time frame.

All incidents involving a death shall be immediately reported to OWNER and to the Police Administration, as per process requested by OWNER, in order to comply with National and State regulations.

CONTRACTOR shall not interfere with incident area and shall keep or preserve evidence(s), except it needed to interfere for ensuring safety of personnel.

CONTRACTOR shall, promptly following such incident(s), investigate all incidents resulting in injury or death to personnel, or damage to equipment, or having the potential to have resulted in injury or death to personnel or damage to equipment and shall take immediate measures to avoid any recurrences.

19.3.1 Incidents Notification inside the Site organization

All employees operating on site shall report immediately any accident and incident they are witnesses or involved in to the direct supervisor/foreman and activate the emergency response according to the emergency procedure in place.

SUBCONTRACTOR Supervisors in order to allow a prompt investigation of the event, the segregation of the accident area if necessary and the collection of the witnesses shall immediately notify any Incident to all the following CONTRACTOR representatives:

- Discipline Supervisor,
- Site Manager and
- Site HSE Manager (Site HSE Office)

Please note that not only the events clearly "work related" according to OSHA record keeping guideline shall be immediately reported but also other events occurred for instance during transportation from and to the site, at the camp, during recreation activities outside the working hours, etc.

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The Doctor/Nurse responsible for the emergency and first aid unit shall also inform immediately the CONTRACTOR Site HSE Department in case of any emergency call received. To do so an adequate fast and continuous communication channel shall be established (Phone, Mobile Phone, two-way radio apparatus) in between the infirmary-first aid unit and the CONTRACTOR Site Organization.

19.3.2 Notification and emergency "Call Tree"

In order to facilitate the site internal notification and a correct information process an emergency Call Tree shall be established on site since the beginning of the activities an Emergency Call Tree Card will be prepared by CONTRACTOR, the card shall summaries the essential data of the call tree and in particular the name and numbers of the key persons of the project that must be immediately informed in case of serious accident and/or incidents with significant property damages.

The Call Tree Card will be distributed to all the CONTRACTOR's and SUBCONTRACTOR's Foreman and Supervisors with the instruction to be carried with them all time.

19.3.3 CONTRACTOR Incidents Notification to the Head Quarter Organization

CONTRACTOR will develop the Practices necessary to provide Incident Notification to the appropriate personnel at the CONTRACTOR Head Quarter to include, as a minimum, the following:

In case of incident that is included in the following categories of events:

- For accidents resulting in a fatality or the hospitalization of one or more employees injured in the same incident, for major Injuries or health effects to personnel (CONTRACTOR, COMPANY, SUBCONTRACTORS, others) participating to the project including third parties if affected by activities managed by CONTRACTOR (Major Injuries/health effects means that the injury can potentially lead to an LTI or to a fatality or to a permanent disability, practically only First aid cases and Medical Treatment cases are not included)
- Extensive or Major assets damage (even if the event do not produce injuries).
- Environmental Incidents that generate severe environmental damage and that could lead to a serious impact on COMPANY and/or CONTRACTOR reputation.

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(Please note that not only the events clearly "work related" according to OSHA record keeping guideline shall be reported but also other events occurred for instance during transportation from and to the site, at the camp, during recreation activities outside the working hours, etc.).

CONTRACTOR Site Manager (or his deputy or other person designated in the CONTRACTOR site management) is required to notify as soon as possible (by phone, mobile phone or SMS) and in any case within two hours at least ALL the following CONTRACTOR head office functions:

- PROMA Projects Management
- DICON Construction & Subcontracts Construction
- CONST Construction
- COHSE Construction HSE Head of Department
- QHSE
- HR Human Resources (only in case of CONTRACTOR’s personnel involved)

The following information must be provided at a minimum:

- Employee's name and organization (SUBCONTRACTOR)
- Employee's date of birth
- A brief description of what happened
- A report of the employee's current status

In addition, in case of accidents resulting in a fatality or the hospitalization of one or more employees injured in the same incident with a suspended prognosis, EPC Projects shall notify the CONTRACTOR Managing Director immediately.

Other injuries requiring a Doctor's care, recordable injury (other than LTI and Fatalities) and restricted work-day cases shall be reported to the Construction Head of Department (COHSE) and CONST (by phone or mobile phone, SMS) within four (4) hours of occurrence and using a Preliminary Incident/Near-Miss Notification Form within 24 hours.

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Other incidents involving major property damage, incidents involving the public, fires and/or near-misses will be reported to Construction Head of Department (COHSE) and CONST within 24 hours of occurrence using a Preliminary Incident/Near-Miss Notification Form.

In addition, in case of accidents resulting in a fatality or the hospitalization of one or more employees injured in the same incident with a suspended prognosis, DIPMC or CONST shall notify the CONTRACTOR Managing Director immediately.

If the person(s) injured is directly hired by CONTRACTOR, DIPMC and/or CONST shall notify immediately HR.

Other incidents involving property damage in excess of 5.000 Euro, incidents involving the public, fires and/or near-misses will be reported to Home Office Construction HSE Manager (COHSE) and CONST within 24 hours of occurrence using a Preliminary Incident/Near-Miss Notification Form.

19.4 Records and reports

Weekly Reports

SUBCONTRACTORS shall issue weekly safety reports to keep to CONTRACTOR and OWNER management. The standard format for the weekly report is as follows:

- Introduction. The first paragraph of the report is an introduction and should be limited to short statements concerning safety related issues. It includes the reporting period, orientations, incidents, near misses, unsafe working conditions, audits performed and practices and the steps taken to correct deficiencies.

- Injuries. This part of the report is the injury summary. It is divided into two sections: first-aid only and doctor cases. These are further broken down by CONTRACTOR, craft, type of injury, its cause, area on site, and classification of the injury.

- Manhours. Include the number of man-hours worked for the week, broken down by direct and indirect hours for the SUBCONTRACTOR. Give the total man-hours worked Year-To-Date and Project-To-Date.

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- Safety Hazards. Serious safety problems observed since the previous report should be noted in this paragraph. Briefly describe the steps taken to correct the hazard. Note any Incident Reports or Stop Work Orders issued.

Monthly Reporting

The standard Monthly Reporting format as is follows:

- Monthly Safety Report. The Monthly Safety Report is a detailed account of all CONTRACTOR and SUBCONTRACTORS performance.

- Safety Summary. Page One of the Safety Summary includes performance charts and graphs, detailed information on accidents, incidents, near misses, and injuries. Page Two provides information on achievement of benchmarks and recognition of individuals and/or SUBCONTRACTORS number of Orientations, improvement initiatives and audits/inspections.

CONTRACTOR will record and report as minimum the following HSE performance indicators data:

- Near Misses
- First Aid Cases
- Medical Treatment Cases
- Reportable Cases
- Lost Time Injury Cases
- Permanent Disability Cases
- Fatalities
- TRIR
- LTIR
- Nr. Observations (UA/UC and positive)
- Environmental Incident

Registers

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The Following register will be utilized on site:

- Inspection of excavation
- Inspection of Lifting Gear
- Inspection of Electrical Powered hand tools
- Inspection of pressure vessels
- Scaffolding
- Inspection of Cranes and Lifting machines
- Legal register (to be revised and updated every semester or whenever legislation has changed in order to be in compliance with Malaysian regulation)

20. HSE INCENTIVE SCHEME

CONTRACTOR is responsible to develop and promote an HSE incentive scheme philosophy throughout the whole PROJECT, as per OWNER's instructions and OTHER CONTRACTORS HSE incentive schemes.

CONTRACTOR shall be fully responsible to sponsor and drive the HSE incentive scheme on WORKSITE throughout the duration of the PROJECT for CONTRACTOR'S activities and workforce and ensure appropriate follow up.

The HSE incentive scheme shall be based on an objective assessment of workforce HSE performance, as per HSE key performance indicators ("KPIs"), reported on monthly basis and may have the form of an HSE competition or awards' program.

CONTRACTOR shall evaluate HSE performance by comparing the leading KPIs (e.g. HSE training hours, HSE inspections, UA/UC, Hazard Observations), the lagging KPIs (e.g. LTIF, TRCF etc) and the manhours of its team within CONTRACTOR's workforce. A budget shall be allocated on a monthly basis and shall be for HSE awards to be given to the best performing team(s) and individual(s).

CONTRACTOR Project Specification HSE Incentive Scheme shall describe the incentive scheme program and calculation scheme of awards.

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The disciplinary action which shall be taken against any individual who is identified as being in contravention of HSE and Security procedures shall be defined in the Disciplinary Action Procedure.

21. REFERENCE DOCUMENTS

The following OWNER and CONTRACTOR's HSE documents are applicable to the Project and are referred in this document.

Atomic Energy Licensing Act, 1984
Atomic Energy Licensing Act 1984 - Radiation Protection (Basic Safety Standards) Regulations 1986
Atomic Energy Licensing Act 1984 - Radiation Protection (Licensing) Regulations 1986
Civil Aviation Act 1969
Civil Aviation Regulations 1996
Control of Tobacco Product Regulations 1993
Construction Industry Development Board, 1994 : (CIDB)
Commercial Vehicles Licensing Board Act 1987
Customs (Prohibition Of Export) (Amendment No.2) Order, 1993
Dangerous Drugs Act 1952
Destruction of Disease Bearing Insects Act 1975
Drainage Works Act, 1954
Electricity Regulations 1994
Electricity Supply Act 1990
Employees Social Security Act 1969
Environmental Quality (Clean Air) Regulations 2014

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Environmental Quality (Halon Management) Regulations 1999
Environmental Quality (Prescribed Activities) (Open Burning) Order, 2000
Environmental Quality (Prescribed Activities)(Environmental Impact Assessment) Order 2015
Environmental Quality (Prohibition on the Use of Chlorofluorocarbons and Other Gases as Propellants and Blowing Agents) Order, 1993
Environmental Quality (Refrigerant Management) Regulations 1999
Environmental Quality (Scheduled Wastes) Regulations 2005
Environmental Quality Act 1974
Environmental Quality (Industrial Effluence) Regulations 2009
Environmental Quality (Sewage Effluent) Regulations 2009
Environmental Quality (Control of Emission from Petrol Engines) Regulations 1996
Environmental Quality (Prohibition on the Use of Controlled Substance in Soap, Synthetic Detergent and other Cleaning Agents) Order 1995
ACT / REQUIREMENT
Factories And Machinery (Building Operations And Works Of Engineering Construction)(Safety) Regulations, 1986
Factories And Machinery (Fencing Of Machinery And Safety) Regulations, 1970
Factories And Machinery (Noise Exposure) Regulation, 1989
Factories And Machinery (Notification, Certificate Of Fitness And Inspection) Regulations, 1970
Factories And Machinery (Persons-In-Charge) Regulations 1970
Factories and Machinery (Safety, Health and Welfare) Regulations 1970

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Factories and Machinery (Steam Boiler and Unfired Pressure Vessel) Regulations 1970
Factories And Machinery Act 1967
Fire Services Act 1988
Food Act, 1983
Food Hygiene Regulations 2009
Heliport Fire Safety Requirements - Guidelines
LEM/TEK/30 Sem.2: Guidelines on Radiological Monitoring for Oil & Gas Facilities Operators Associated with Technologically Enhanced Naturally Occurring Radioactive Material (TENORM)
Malaysia Employment Act 1955
Medical Act 1971
Medical Assistant (Registration) Act 1977
Nurses Registration Regulations 1985 (Nurses Act 1950)
Occupational Safety & Health (Safety And Health Officer) Regulations 1997
Occupational Safety and Health (Prohibition of Use of Substance) Order 1999
Occupational Safety and Health (Use and Standards of Exposure of Chemicals Hazardous to Health) Regulations 2000
Occupational Safety And Health Act 1994
Occupational Safety And Health (Safety And Health Committee) Regulations 1996
Occupational Safety and Health (Notification of Accident, Dangerous Occurrence, Occupational Poisoning and Occupational Disease) Regulations 2004
Occupational Safety and Health (Classification, Labelling and Safety Data Sheet of Hazardous Chemicals) Regulations 2013 (CLASS Regulations)

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Occupational Safety And Health (Control of Industrial Major Accident Hazards) Regulations 1996
ACT / REQUIREMENT
Pesticides Act 1974
Petroleum (Safety Measures) (Transportation Of Petroleum By Pipelines) Regulations 1985
Petroleum (Safety Measures) Act 1984
Poisons Act 1952
Poisons Regulations, 1952
Prevention and Control of Infectious Disease Act 1988
Private Healthcare Facilities and Services Act 1998
Protected Areas & Protected Places Act 1959
Public Health Ordinance, 1962
Registration of Contractors (Construction Industry) 1995
Sewerage Services Act 1993
Solid Waste And Public Cleansing Management Act 2007
Street, Drainage And Building Act 1974
Uniform Building By Laws (UBBL) 1984
Water Services Industry Act 2006

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22. APPENDICES

APPENDIX 1: PROJECT POLICIES

They shall be issued in a next stage

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APPENDIX 2: CONTRACTOR SITE HSE ORGANIZATION CHART

It shall be issued in a next stage

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APPENDIX 3: DEFINITION AND ACRONYMS

ACCIDENT An Incident which has resulted in actual Injury and/or Damage (Loss) to Assets, the Environment, Social programs, Reputation or to 3rd Parties

ACGIH American Conference of Governmental Industrial Hygienist

ACTIVITY Work to be carried out as part of a process, characterized by a set of specific inputs and tasks that produce a specific set of outputs to meet Project requirements.

ALARP As Low As Reasonably Practicable

To reduce a risk to a level which is as low as reasonably practicable involves balancing reduction in risk against the time, trouble, difficulty and cost of achieving it. This level represents the point, objectively assessed, at which the time, trouble, difficulty and cost of further reduction measures become unreasonably disproportionate to the additional risk reduction obtained.

ASSESSMENT The process of analyzing and evaluating hazards, and involves causal and consequence analysis, and requires determination of likelihood and risk.

CAS Chemical Abstract Service

CAUSE Cause is an event that could result in the release of the hazard.

CECP Construction Environmental Control Plan

PMF Plant Medical Facility

COMPETENCE a) The necessary awareness, knowledge and skills to fulfill the requirements of the job/position. Competence is therefore the level of performance which a person must achieve to carry out specified tasks or work without close supervision. b) The ability to perform a particular job in compliance with performance standards.

CONSEQUENCE Consequence is the result of the release on the workforce, local population, or the environment.

COSHH Control of Substances Hazardous to Health

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COST BENEFIT ANALYSIS

Cost benefit analysis is the means by which the relative cost and benefits of a number of risk reduction measures are evaluated.

CRITICAL FACILITIES AND OPERATIONS:

Those in which there is a serious risk from incidents related to Health, Safety and Environmental

dB(A) Decibels weighted on the A scale

ERP Emergency Response Plan

EL Project Exposure Limit

ELCB Earth leakage contact breaker

EMPLOYEE Any person engaged in activities for the benefit of the Project or CONTRACTOR (SUBCONTRACTOR) and who receives payment, even on a temporary basis. This includes so called Day Laborers employed by the Project or CONTRACTOR, SUBCONTRACTORS and LOWER TIER SUBCONTRACTORS.

EMPLOYMENT All work or activity performed in carrying out an assignment or request of the Project or CONTRACTOR, SUBCONTRACTOR, including related activities not specifically covered by the assignment or request. This includes driving to and from a workplace.

EMS Environmental Management System

EPC Engineering, Procurement and Construction

ERT Emergency Response Team

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ESD Emergency Shut Down

Excavation Any operation in which the earth is penetrated or removed, including (but not limited to): trenching, opening of pits, drilling bore holes, pile driving, digging of foundations, driving of earth stakes and pickets. An excavation is any man-made cavity or depression in the earth's surface.

Excavation Permit A form that documents the work to be done, the checks that have been carried out and the safety precautions to be taken, duly authorized by the CONTRACTOR/OWNER or delegate.

EXPOSURE HOUR Exposure hours are the total number of hours worked including overtime and training but excluding leaves, sickness and other absences.

EXPOSURE INCIDENT (BLOOD BORNE PATHOGENS) is defined as a specific eye, mouth, or other mucous membrane, non-intact skin, or parental contact with blood, or other potentially infectious materials, that results from an employee's duties.

FATALITY (FAT) This is a death resulting from a Work Injury, Occupational or Illness, regardless of the time intervening between injury and death.

FATAL ACCIDENT RATE [FAR]

The Rate is the number of work-related Fatalities per 100 million exposure hours.

FIRST AID CASE (FAC)

A one-time treatment and subsequent observation of minor scratches, cuts, burns, splinters, and so forth, which do not ordinarily require medical care. Such treatment and observation is considered first aid even though provided by a physician, or registered professional personnel.

GFCI Ground fault circuit interrupter

GOOD SAMARITAN ACT

Is first aid, given in an emergency, by either a trained or untrained person not designated as a first aid provider by his OWNER and whose duties do not normally require providing first aid.

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HAZID Hazard Identification

HEAT STRESS A potentially serious condition resulting from strain on the temperature regulating capacity of the body, caused by prolonged exposure to high temperatures or other confounding environmental factors.

HSE Health, Safety and Environment

HSE-MS HSE Management System

HAZARD Hazard is the potential to cause harm, including ill health and injury, damage to property, products or the environment, production losses or increased liabilities.

HAZID Hazard Identification is the technique for early identification of the hazards and threats of of the hazards and threats of a new facility.

HEMP Hazards and Effects Management Process

IH Industrial Hygiene

INCIDENT An event or chain of events which has caused or could have caused injury, illness and/or damage [loss] to people, assets, the environment or reputation. An incident involves the release or near release of a hazard, or has the potential to precipitate to an emergency, disaster and/or crisis.

INJURY Physical harm or damage to a person resulting from traumatic contact between the body of the person and an outside agency or from exposure to environmental factors.

ISO 9001 International Standard for Quality Systems

ISO 14001 International Standard for Environmental Management Systems

JHA Job Hazard Analysis

[Job Hazard Analysis is a systematic process to evaluate a major phase. Examples are steel erection, pipe fabrication or installation) A team composed of contract/subcontract individuals knowledgeable with the work scope and lead by a competent facilitator performs the review in advance the activity]

JSA Job Safety Analysis

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[Job Safety Analysis is a systematic process to evaluate a specific work activity. (Examples would be erecting the structural steel for a fin fan, or fabricating or installing the cooling tower pipe spools) A team composed of contract workers and supported by the supervisor conducts the in review in advance of the work activity]

LEL Lower Explosive Limit

LEVEL 1 – MED A medical care system capable of providing basic first aid

LEVEL 2 - MED A medical care system capable of providing advanced first aid care.

LEVEL 3 - MED A medical system capable of providing advance life support.

LTIs Lost Time Injuries (LTIs) are the sum of Fatalities, Permanent Total Disabilities and Lost Workday Cases but excluding Restricted Work Cases.

LTIF The Lost Time Injury Frequency (LTIF) is the number of Lost Time Injuries per 200.000 (according to OSHA) exposure hours or per one million exposure hours.

LWC Lost Workday Case

Any work-related injury, which renders the injured person temporarily unable to perform their normal work or restricted work on any day after the day on which the injury occurred. Any day includes rest day, weekend day, scheduled holiday, public holiday or subsequent day after ceasing employment

MED Medical System

MEDICAL TREATMENT CASE (MTC)

Any work-related injury that involves neither lost workdays nor restricted workdays but which requires treatment by a physician or other medical specialist. MTC does not include first aid even if a physician or registered professional person provides this.

SDS Safety Data Sheets

NEAR MISS A Near Miss is an Incident which potentially could have caused Injury or Occupational Illness and/or damage (loss) to people, assets, the environment or reputation, but which did not.

OCCUPATIONAL ILLNESS

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An abnormal health condition or disorder (physical or mental) that is caused or aggravated by exposure to environmental factors associated with the employment, including chemical, physical, biological; or ergonomic factors.

PERMANENT PARTIAL DISABILITY (PPD)

Any Work Injury, which results in complete loss, or permanent loss of use, of a member or part of the body or any permanent impairment of functions of parts of the body.

PERMANENT TOTAL DISABILITY (PTD)

Permanent Total Disability is any work-related Injury which permanently incapacitates an employee and results in termination of employment.

PPE Personal Protective Equipment

PPM Part Per Million

PTW Permit to Work

PTS PENGERANG Technical Standards

RAM Risk Assessment Matrix

REPUTATION The estimation in which persons or organisations are held; character; good name.

RESTRICTED WORK CASE (RWC)

Any work-related injury which renders the injured person temporarily unable to perform all, but still some, of their normal work on any day after the day on which the injury occurred.

RISK Risk represents the probability that an undesirable event will occur, combined with consideration given to the severity of the consequences of the event.

RISK CLASSIFICATION

Risk classification is a rating system used to represent the relative risk associated with a particular hazard. For the Project, the risk rating system shall be as prescribed by Risk Assessment Matrix.

ROAD TRAFFIC ACCIDENT

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An Incident that has involved a vehicle and which has resulted in Injury, Illness and/or damage [loss] to people, assets, the environment or the OWNER's reputation.

SCAFFOLDING Scaffolding is defined as a temporary structure which provides access, or from which persons work, or which is used to support materials, plant or equipment. It can be divided into two types:

• Unit formwork, Kwickstage, All Round or other types of purpose made frames or units.

• Tube & Fittings: Individual tubes, of varying lengths, held together by individual couplers.

SCAFFOLDING TAG A white plastic holder, marked in red, with the international prohibitive sign and the words "Scaffolding tag, Do not use Scaffold", with an insert card, green on one side and yellow on the other (or equivalent system acceptable for CONTRACTOR and OWNER).

SCBA Self Contained Breathing Apparatus

THREATS Threat(s) are defined as having the potential to cause harm, including ill health and injury, damage to property, products or the environment, production losses or increased liabilities.

TLV Threshold Limit Value

TLV-C Ceiling Limit

TRC Total Reportable Cases (TRC) are the sum of Fatalities, Permanent Total Disabilities, Permanent Partial Disabilities, Lost workday Cases, Restricted Work Cases and Medical Treatment Cases.

TRCF Total Reportable Case Frequency

(The Total Reportable Case Frequency is the number of Total Reportable Cases per million Exposure Hours).

TROIF Total Reportable Occupational Illness Frequency.

(The Total Reportable Occupational Illness Frequency is the number of Occupational Illnesses per million Exposure Hours).

TWA Time Weighted Average

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UEL Upper Explosive Limit

WORK-RELATED FATALITY

A work-related Fatality is a death resulting from a work-related Injury or Occupational Illness, regardless of the time intervening between Injury/Illness and death.

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APPENDIX 4: ZETO RULES



Work with a valid work permit (PTW) required by the job

Verify energy isolation before starting work

Obtain authorisation before overriding or disabling safety critical equipment

Obtain authorisation before entering a confined space

Protect yourself against a fall when working at height

Use the correct personal protective equipment (PPE) when handling hazardous chemicals

Obtain authorisation before excavation or entering a trench

Do not position yourself under a suspended load

Do not smoke outside designated areas or bring potential ignition sources into process areas without authorisation

Do not use your mobile phone/walkie-talkie while driving, follow the speed limit and use your seat belt

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APPENDIX 5: PERMIT TO WORK OUTSIDE THE NORMAL SITE WORKING HOURS

Authorization request to Perform Activities Outside the Normal Site Working Hours	
Date:……	
Start time:…….. Finish time:……..	
SUBCONTRACTOR:	
Discipline supervisor:	**Tel No.:**
HSE Officer:	**Tel No.:**

Lower Tier Subcontractor (if applicable):	
Expected number of workers:	
Discipline Supervisor:	**Tel No.:**
HSE Officer:	**Tel No.:**
Area & Location:	
Detailed work description	
We kindly request CONTRACTOR to carry out the above described activities outside the normal Site Working Hours	
	SUBCONTRACTOR stamp & C M signature

CONTRACTOR Discipline supervisor:	**Tel No.:**
CONTRACTOR HSE Officer:	**Tel No.:**
CONTRACTOR Authorization	
CSM	**Site HSE Dept.**

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APPENDIX 6: DRAFT HSE PROGRAM

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PROJECT SPECIFICATION

PRELIMINARY TRANSPORTATION PLAN

AND IMPORT

CUSTOMS PROCEDURE

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1. FOREWORD

The purpose of this document is to define the strategies and the activities which all the involved Parties shall follow to guarantee transport coordination and shipment arrangement of the GOODS from departure place of delivery up to the WORKSITE located in Johor State, Pengerang area, Malaysia.

2. DEFINITIONS

For the purpose of this procedure, the terms which are herewith applied, shall have the following meaning assigned to them:

OWNER: means Pengerang Energy Complex Sdn BHD (PEC) which includes its representative, successors, nominees and permitted assigns and shall where the context so admits and requires, also include its employees, agents and designated representative.

CONTRACTOR: means Tecnimont S.p.A. (TCM)

MMTO: means Malaysia Multimodal Transport Operator, appointed by CONTRACTOR who, in compliance with the requirements of the purchase order for transport services, will perform under its own responsibility all shipping activities from EXW-FCA/FAS/FOB delivery to CIF destination ports (through a nominated International Freight Forwarder as Partner, previously approved by CONTRACTOR) and then unloading, clearance and transportation from destination port/airport to WORKSITE.

GOODS: mean all materials and equipment to be incorporated into the permanent plant located in Johor State, Pengerang area, Malaysia.

SITE MANAGEMENT: means CONTRACTOR's field organization situated at WORKSITE.

WORKSITE: means the place where the project plant site will be located (Pengerang Site, Johor State, Malaysia).

SC: means CONTRACTOR's Project Shipping Coordinator (both Home-Office and WORKSITE)

PPM.: means CONTRACTOR's Project Procurement Manager.

PACKING LIST (P.L.): means issued by CONTRACTOR's Vendor.

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MBL/HBL BILL OF LADING or AIRWAYBILL (B/L or AWB): issued by the Shipping Company or Airline and submitted by MMTO.

SHIPPING STATUS REPORT (S.S.R.): issued by CONTRACTOR and MMTO.

3. DELIVERY TERM WITH OWNER

DAP (INCOTERMS 2010) WORKSITE, including import customs clearance, excluding import taxes/GST which are under OWNER responsibilities.

CONTRACTOR'S LOGISTICS responsibility shall be completed upon arrival of GOODS at WORKSITE (excluding discharge from trailer at WORKSITE which is under Site Management/Construction responsibility).

4. WORKSITE LOCATION AND DISTANCES

WORKSITE will be located in Pengerang, Johor, Malaysia.
For easier understanding of the transport distances, please see below.
The proposed seaports of entry will be introduced in their turn in section 5.

Distances from WORKSITE:

- Pasir Gudang Port approx 85 km
- Tanjung Langsat Port approx 80 km
- Jurong Port (Singapore) approx 160 km
- Port Kelang approx 450 km
- Tanjung Pelepas Port approx 150 km
- Ramunia MOLF approx 20 km
- Setapa MOLF adjacent to WORKSITE (<5km)

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- Kuala Lumpur Airport approx 450 km
- Changi Airport (Singapore) approx 160 km

5. SEAPORTS OF ENTRY

In perspective of the activities related to this project and the kind of goods, the possible ports of entry in consideration of feasibility of unloading operation and road transportation to WORKSITE are described here below.

On the basis of actual weight/dimensions of the goods, origin and shipping scheduling, the best solution and strategy will be evaluated by CONTRACTOR in coordination of MMTO during Project execution phase.

5.1 Pasir Gudang / Johor Port

Pasir Gudang / Johor Port is located in the Pasir Gudang Industrial Estate, approximately 85 km from WORKSITE. The port services allow arrival of both Container and Breakbulk vessels.

The port's linear berthing length stretches to 2,400m with a maximum draft of 13.5 m.

The Pasir Gudang port is equipped with 2 x 350 Tons cranes, for the incoming shipments of oversize cargo wharfs no. 7, 8, 9 and 10 would be suitable to receive it. However, due to the maximum static load permitted on the wharf, cargo cannot exceed weights of 3-4 MT per square meter.

Local storage facilities for break bulk cargo cover over 230,000m2.

Johor Port is expected to suffer traffic and congestion in the next 2-3 years, due to the huge quantity of cargo coming for the PENGERANG Project from many EPC Contractors.

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5.2 Tanjung Langsat

Tanjung Langsat Port is located only approx 80km from WORKSITE, but is a port serving the various industries operating in the 5,000 acres of the Tanjung Langsat Industrial Complex, catering for Oil & Gas activities in the region.

Despite the fact that this port is concentrating on the oil and gas activities it is worth mentioning that there have been recent developments creating two berths for dry cargo which are capable of handling up to 40,000 dwt vessels with a maximum draft of 9.5m, with a berth length of 200m each. In times of congestion at Johor or Singapore, Tanjung Langsat could be considered as an an alternative port of entry.

5.3 Jurong Port (Singapore)

The Jurong Port is Singapore's leading international multi-purpose port, having well-equipped facilities, deep water berths, a large number of special handling equipment for all types of cargo and regular shipping services.

The port is approx 160 km from the WORKSITE, which, in consideration of the regular shipping services to Singapore, make it an attractive alternative. Singapore port is serviced by Break Bulk Liner Services from the most cargo origins.

There are 30 break bulk berths which can accommodate a maximum vessel size of 150,000 dwt with a maximum draft of 15,7m. The total length of the berth is 5,629m.

Jurong has about 25 warehouses covering an area of 174,000 square meters. In addition 215,000 square meters of open yard storage are available.

Jurong is a very busy port, however, due to its size and efficient planning, normally it is not congested.

5.4 Port Kelang

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Port Kelang is situated on the west coast of Peninsular Malaysia, about 450 km away from WORKSITE. The port has both Conventional and Container berths and is a busy crossing point for the Europe – Far East sailings, also serviced by several Break Bulk Liner Carriers.

The distance from Port Kelang to WORKSITE makes it less attractive as a port of entry, despite the service level which the port can offer. There are various obstacles en-route, such as bridges and overhead structures, so the feasible transport height of cargo is restricted to 4.5 meters due to permanent existing structures.

This port could be used only as a contingency plan to avoid congestion in other ports.

5.5 Tanjung Pelepas

Tanjung Pelepas Port is located approx. 150 km from WORKSITE and could be considered an alternative entry port only for containerized cargo. The port does not offer berthing for general cargo vessel.

5.6 Ramunia MOLF

The Ramunia MOLF is located about 20km east from WORKSITE and is presently under operation. Its location has plenty of open storage area which would be suitable for temporary laydown. The Ramunia MOLF consists of 4 berths, 2 of which suitable for RO-RO discharge. Sea draft is about 5 meters. Cargo up to 100 Tons and containers can be also discharged by one available crane. Ground capacity is from 7 up to 10 tons/sqm, depending on the berth.

Ramunia MOLF could operate also during night hours.

5.7 Setapa MOLF

Setapa MOLF has a sea draft of about 10 meters consequently self-geared ocean vessels carrying heavy-lift equipment can berth.

Ground capacity is about 10 tons/sqm

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Road distance from Setapa MOLF up to PENGERANG Project Site is about 5 Kms.

Contrary to Ramunia, Setapa MOLF has a limited laydown area.

6. TRANSPORTATION OF GENERAL CARGO

As regards general cargo, shipment can be organized in container and/or breakbulk vessels.

For both method of shipment the best port of destination are Pasir Gudang/Johor port while PTP port will be utilized only for shipment in container.

From both ports, for safety conditions of roads, the prosecution of containers and breakbulk cargo to WORKSITE could be arranged by sea utilizing the JPB services by barge to RAMUNIA MOLF.

In case materials are urgently required at WORKSITE and the schedule of departure of the barges is not in compliance with the WORKSITE progress of erection activities, CONTRACTOR could request to OWNER a waiver to use barges service and explaining the reason of such request.

7. HEAVY AND OVERSIZE CARGO TRANSPORTATION

One of the important factors while selecting a MMTO suitable to handle this type of shipments is the analysis of its previous track record and its experience with heavy lift and oversize transport engineering.

While determining shipping and logistics methodology for each item in this category, destination port facilities / limitations, compliance to OWNER and CONTRACTOR's standards and insurance terms and conditions are the major factors for the technical evaluation of the carrier and marine vessel.

Before shipment, MMTO shall issue the method of statement of the oversize and heavy-lift cargo transportation which will be checked and approved by CONTRACTOR and OWNER.

7.1 Highlights of Heavy Lift / Oversize Transport:

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- Shipment of Heavy lifts / oversize cargo will require advance study and planning, i.e. trailer selection, route selection, port selection, vessel selection and also availability of lifting equipment.
- CONTRACTOR will provide to the MMTO the transport drawings of equipment showing dimensions, centre of gravity and information to allow a safe transportation of each piece.
- Configuration of the trailer necessary to transport the heavy lift / oversize shall be worked out with heavy lift specialists.
- A 'route survey' shall be arranged to ensure that equipment can reach WORKSITE safely or if any route alteration / adjustment is required.
- For inland transport, necessary transport permission shall be obtained in due time from relevant Authorities.

7.2 Method of statement for Transportation of Heavy Lift/Oversize

The Method Statement intends to provide general methodology and criteria for transportation of Heavy Lift / Oversize cargo from Point of Origin to Destination.

The MMTO with its Heavy Lift Transport Engineer is required to monitor and update relevant changes and also to jointly develop the following points pertaining to the shipments:

- Sea-fastening criteria and design, including studies of acceleration force
- Coordination with appointed marine warranty surveyor, if any
- Stowage plans
- Loading/Unloading method, including berthing/mooring studies and configurations
- Voyage route/plan identifying any safe ports of refuge en-route
- Stability Calculations
- Shipping Procedures
- Check Lists

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- Discrepancy /Damage Reports
- Safety Procedures.

7.3 Road Transportation Procedure

Road Transportation will be required from both the VENDOR's facilities to the Port of Loading and from the Port of Discharge/MOLF to the WORKSITE. Procedure for each area will be similar and therefore this section will include both areas:

a. Identify suitable transport equipment and prime mover based on the cargo specification.

b. As mentioned in Art. 6.1, the route survey shall be arranged and shall take into consideration the following:

- Maneuvering space
- Height restriction
- Maximum Gross Vehicle Weights and Load per axle
- Specific limitation at Culvert and Bridge crossing, if any
- Power lines crossing, if any, and ground clearance
- Road sections that require temporary removal or modification
- Transit limitations e.g. speed, hours of operation per day and seasonal factors.
- Driving time per day, escorts etc.

c. Cooperation with all local authorities for obtaining necessary permits and, if required, organize escorts/convoy till the cargo is delivered at the load port/WORKSITE.

d. In accordance with the agreed schedule, the suitable road transport equipment (such as modular trailers) will be arranged by the Operator and Heavy Lift Engineer which will supervise the loading of the cargo.

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e. Any change to route or transport configuration will be informed to CONTRACTOR.

f. The Operator and Heavy Lift Engineer will ensure that goods are loaded on to the road transport equipment without any damage. In case of any minor damage, CONTRACTOR will be promptly informed and the transport will proceed only upon getting authorization.

g. A proper “Damage Report” will be issued to both Vendor and CONTRACTOR explaining the condition of the goods.

h. When goods are secured to the trailer with the approval of the Heavy Lift Engineer, shipment will proceed directly to the Load Port/WORKSITE.

i. Upon completion of Road Transport, goods will be inspected once again and a report will be issued mentioning details of damages, if any.

7.4 Transport Management Control

In order to control complete transport to WORKSITE, following control system will be applied:

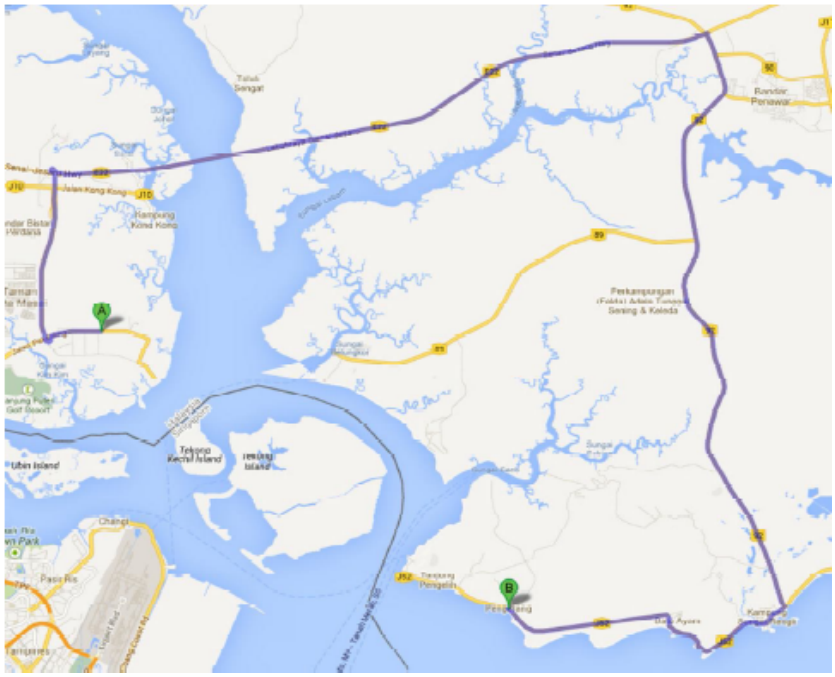
- Time and location from Origin point
- Route Plan
- Expected ETA of each transport section
- Contact Telephone Numbers of WORKSITE
- Contact person’s names to coordinate the movement of HL/OS Cargo
- Details of drivers /cargo

Transport Manager will be appointed to ensure smooth handling of cargo during mobilization.

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In addition, CONTRACTOR, directly or through nominated MMTO, will implement the PENGERANG Control Tower software.

7.5 Heavy Lift / Oversize Transport from Unloading Ports to Worksite.



- **From Pasir Gudang / Johor port**

The port itself is well equipped to handle also Heavy and Over Dimensional cargo. The route to WORKSITE is also in moderate condition, as a large part of the road has been recently paved.

The route holds some obstacles in the form of utilities (pipelines crossing over the road, traffic signals, road signs, toll booths) and constraints such as bridges with weight limitation and flyovers.

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All GOODS exceeding the following dimensions will be delivered to WORKSITE through the 2 existing MOLFs unless the cargo originates from an on-land Malaysian manufacturer making the barge use impractical or unless CONTRACTOR has obtained prior approval and waiver for the use of the barges:

LxWxH 13 M (length) x 3.2 M (width) x 4.5 M (height, including trailer)

Anyway the transport by road to WORKSITE is subject to a dedicated road survey.

- **By barge from POD to Ramunia MOLF**

The new road to access the WORKSITE has been designed to sustain 10T/m2 cargo weight, with the width at 9 meters, paved shoulder at 2 meters each side, without restrictions to height.

- **From Setapa MOLF**

The Setapa MOLF is the jetty to be utilized for extreme heavy-lift /oversize units for the PENGERANG PROJECT. It is located in Tanjung Setapa, adjacent to the WORKSITE.

CONTRACTOR would consider to handle heavy lift / oversize items through the main general cargo ports, either for delivery by road or by barge to Ramunia MOLF. Based on final dimensions and weight of cargo and shipping schedule, CONTRACTOR will evaluate the opportunity to utilize Setapa MOLF.

8. SHIPPING ACTIVITIES

MMTO shall take care of obtaining necessary licenses, if any, on behalf of CONTRACTOR and preparing, assembling and submitting to customs all documents required for importation of materials and equipment at the points of entry in Malaysia.

SC shall notify the MMTO about the estimated total weight and volume of GOODS and delivery time according to the preliminary Delivery Schedule submitted by PPM

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After the GOODS have been packed by the Vendor (as per CONTRACTOR's Packing Specifications) and positively inspected, PPM issues a Release for shipment to SC together with the packing list received from the Vendor.

The SC collects and prepares all shipping documents (packing list, Shipping Invoice and any other documents required) and submits them to the MMTO together with shipping instructions.

MMTO, according to CONTRACTOR's instructions, shall utilize first class shipping companies and ocean vessels that have been in service for less than 15 years. All carrying vessels shall be in class Lloyds 100A1 or equivalent and shall be ISM Code certified.

GOODS will be shipped by "breakbulk" vessels or by "container" vessels, if dimensions of packages allow it.

SC shall receive from PPM, at least 2 months before the estimated date of shipment, the transport drawings of OS/HL equipment evidencing final dimensions/weight as well as centre of gravity and lifting points and send them to the MMTO in order to make proper arrangement for transportation.

CONTRACTOR shall make the MMTO responsible for the following activities:

- to keep in contact with all the suppliers of "Oversize/Heavylift" items;
- to follow the loading and lashing of materials on the trailer, even if executed by the suppliers;
- to guarantee the presence of a transport specialist during the transportation execution and at the loading and unloading port.

MMTO will constantly inform the SC about shipping situation and booking details and provide to communicate any development.

CONTRACTOR shall send to OWNER/PMC a pre-shipping advice notifying the expected date of departure of cargo as follows:

- 15 days in advance for general cargo to be shipped by full container vessels
- 30 days in advance for general cargo to be shipped by breakbulk vessel
- 60 days in advance for oversize/heavy-lift items

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MMTO shall collect the GOODS from the Vendor (in case of FCA delivery term) and transport them to the loading port and will be in charge of performing the export customs formalities.

In case of FOB delivery term, the Vendor will arrange inland transport to the loading port as per instructions received by SC and/or MMTO.

MMTO shall submit to CONTRACTOR the stowage plan and in, case of necessity to load “on deck” some heavy-lift/oversized package, MMTOS will require the authorization to SC which will evaluate together with PPM if technical characteristics of GOODS allow the loading “on deck” and will inform the MMTO accordingly.

The final stowage plan shall be uploaded by MMTO together with copy of the shipping documents into the PENGERANG Control Tower.

In case of shipment by sea of a considerable entity, with heavy-lift and/or oversize packages, SC could supervise the loading/unloading operations on/from the vessel.

MMTO, for materials and equipment to be imported on permanent basis into the Project, will request the issue of Bill of Lading according to CONTRACTOR’s instructions:

SHIPPER: TECNIMONT SpA

CONSIGNEE: Pengerang Energy Complex Sdn Bhd, Malaysia

1ST NOTIFY: MMTO

MARKED: FREIGHT PREPAID

If applicable, REL (Pengerang Exemption List) Position and description of GOODS in compliance with the REL will be indicated.

Immediately after departure of vessel, MMTO will notify by e-mail all shipping details to CONTRACTOR, OWNER/PMC through the SHIPPING NOTICE, declaring cargo details and ETA at destination Port.

MMTO will make available on weekly basis the “Shipping Status Report” (SSR) to CONTRACTOR, OWNER and to SITE Management, with the updated shipping details, customs clearance date, ETD of the barge (if applicable), ETA Ramunia MOLF and delivery status of the GOODS to WORKSITE.

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CONTRACTOR and/or MMTO will arrange, before the starting of shipments, a survey at unloading ports in order to verify local regulations and transport limitation rules.

MMTO will coordinate inland transport by ensuring proper loading, lashing and securing on transport means.

MMTO will implement the PENGERANG Control Tower system with transport details from arrival port up to WORKSITE.

MMTO, for transportation of oversize/heavylift equipment, shall provide in due time the necessary transport means so that such equipment can be transferred from the vessel to the trailer or to the barge, according to the discharging port facilities, rules and regulations.

- CONTRACTOR'S PROJECT SHIPPING COORDINATOR (AT WORKSITE):

One or more Logistics Coordinators are usually assigned at WORKSITE to fulfill the following activities:

- Coordination of CIDB Authorities and MMTO
- Coordination with MMTO for transportation of project equipment and materials including Out of gauge and Heavy lift equipment
- Monitoring of all deliveries with MMTO and WORKSITE Management in order to ensure availability of discharging equipment
- Reporting and updating of Shipping Status Report
- Supervising of loading/unloading operations vessels/barges/trucks
- Issuing of letter of complaint to MMTO, in case of damages
- When applicable, coordination with SITE Management/MMTO to fill in the "farming out" forms for the application to Customs.

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9. IMPORT CUSTOMS CLEARANCE

9.1 EXEMPTION OF CUSTOMS DUTIES AND TAXES

For PENGERANG Project, OWNER could be granted with a tax exemption for Import Duties and tax for importation of GOODS belonging to the OWNER.

Importation taxes are under OWNER responsibility.

Disassembled machinery items in particular may be cleared on partial delivery basis, which is subject to the approval of Customs Authorities through the MMTO prior to the first partial delivery.

Technical specifications and drawings have to be submitted to prove and identify the partial delivery of one main equipment.

9.2 EXEMPTION APPROVAL APPLICATION

In case OWNER will be granted with import customs duties and tax exemption, CONTRACTOR shall support OWNER for the preparation of the Master Exemption List (PEL – PENGERANG Exemption List) to be approved by the Royal Malaysian Custom for the exemption application under BLANKET APPROVAL or CASE BY CASE APPROVAL.

CONTRACTOR shall submit to OWNER the following information:

- Description of Equipment and Materials to be imported (according to (PEL – PENGERANG Exemption List))
- Estimated Time of Arrival
- Quantities
- Customs Tariff
- Price of Equipment and Materials
- Port of entry
- Estimated Time of Arrival

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- Country of origin
- Technical documents (catalogues/drawings) if required

9.3 DOCUMENTATION FOR CUSTOMS CLEARANCE IN MALAYSIA

For importing materials to Malaysia, the following documents are required:

a. The original Bill of Lading (express Bill of Lading is also acceptable)

b. CONTRACTOR's shipping invoice

c. Packing list

d. AP (Import Permit) for piping

e. CIDB/COA approval, when applicable by CIDB regulations

f. Certificate of origin (when applicable, based on MMTO advance instructions).

For all GOODS which require the approval from CIDB to allow importation into Malaysia (such as pipes, steel structures, gratings, handrails, ladders etc) the COA application is done by MMTO.

The process to obtain all necessary documents (MTC, TPIB forms, FTTR) and obtain approval from CIDB, is supervised by PPM/PPC strictly in contact Vendors, accredited Third Party appointed by CONTRACTOR, MMTO and Logistics Dept.

COA application can be done only after departure of vessel and obtainment of Bill of Lading, which is one of the documents to be submitted together with Shipping Invoice, Packing List, Exporter's Letter, Containerized list, FTTR, CIDB application letter.

COA verification takes about 7 working days, subject to Officers availability - COA expires in 2 weeks once approved.

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10. INSURANCE CLAIMS PROCEDURE

CONTRACTOR could provide to cover 110% of the value of GOODS with an “all risks” Marine, Land and Air Insurance policy, at its own expense. A project Insurance claims procedure shall be provided in due time.

CONTRACTOR shall make the MMTO responsible for the following activities, during receiving of GOODS at the discharging port/airport:

- MMTO, according to the shipping documents received by CONTRACTOR, shall check the number of packages according to P.L., verifying the good conditions of the packing and/or the equipment that, for transport requirement, are unpacked.
- MMTO, in the event of loss or damage, has to notify the relevant reserves, explaining the actual conditions of the cargo received.
- Furthermore, MMTO must obtain the "DAMAGED” and/or “SHORT LANDED CARGO LIST" duly signed by the responsible parties (Shipping Line’s Agents, Port Authorities).

Said document will report the list of the damage/short landed packages, brief description of damages and number and net/gross weight for each package.

The MMTO, shall provide to send immediately a letter of complaint to all involved parties (Carriers, Port Authorities, Shipping Line's Agencies, Captain of the vessel), with copy to OWNER, CONTRACTOR, explaining the facts and holding them responsible for any shortage or damage and obtain an acknowledgement of receipt. If required, MMTO shall co-operate in debate with the Survey Agent, in order to define the entity of damages and relevant repairing or replacement of GOODS.

According to the common rules, the following documentation, where applicable, shall be sent by the MMTO to the OWNER and CONTRACTOR for the adjustment of claims:

- copy of the SHIPPIG INVOICE along with the P.L.;
- B/L or other transportation document;
- Short and/or Damage Report;

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- correspondence with the Carriers and others involved parties, regarding their liability for the loss or damage.

CONTRACTOR through SITE MANAGEMENT shall be responsible for the following activities at the moment of receiving of GOODS at the WORKSITE:

- SITE MANAGEMENT, according to the information received by MMTO shall schedule the unloading operations from the trailers, following the specific handling symbols shown on each package.

- SITE MANAGEMENT, when the GOODS arrive at the WORKSITE, shall check the quantity, according to the transport documents and verify the good conditions of the packing and/or the equipment which are not protected by package, due to transport requirements.

- SITE MANAGEMENT, in case of receipt of GOODS without any notation regarding their conditions and quantity, shall indicate on the delivery note the following remark:

- "Packages received in apparent good conditions except the inspection of the contents".

For the GOODS not protected by package the remark will be:

- "GOODS received in external good order and conditions".

- SITE MANAGEMENT, in the event of loss or damage, shall detail on delivery note the relevant remarks, explaining the actual conditions of the GOODS received and will provide photographic evidence.

- The SITE MANAGEMENT shall provide to send a letter of complaint to the MMTO (copy to OWNER and CONTRACTOR), holding them responsible for any shortage or damage and obtain an acknowledgement of receipt.

- According to the common rules, the following documentation, where applicable, shall be sent by the SITE MANAGEMENT to the OWNER, CONTRACTOR, for the adjustment of claims:

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- copy of the shipping invoice along with the Packing-List;
- transportation document (delivery note);
- short and/or damage Report;
- correspondence with the Carriers and others involved parties, regarding their liability for the loss or damage;
- photographic evidence.

- Claims limits:

It is understood that, in case of failing or delay in the notification of damages, according to the International Convention and Clauses concerning the transport of goods by road/sea/air and production of claim's documentation, the right of reimbursement could be extinguished.

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PEC: COVID-19 – Health, Safety and Environmental Risk Assessment

Currently the entire world is facing a pandemic situation due to covid-19 crises and it has major impact on the global economy. Such kind of situation generally faced by mankind in century, and it may change the complete lifestyle of each individual around the world. As this virus (covid-19) is highly contagious disease that can have severe effect on people, especially those who are vulnerable. This virus passes from person to person in communal areas and where it is not possible to maintain safe distancing. If a person is infected in a workplace, he can pass the virus to his families and those who are in close contact with him. The most vicious aspect of this virus is that a person can spread the virus without any symptoms and that make this virus more dangerous.

During the covid-19 pandemic it is essential that the workplace is protected to minimize the risk of the infection spreading.

Various guidelines, control measures, risk assessments at workplace and offering specific activities for essential services norms issued by Ministry of Health from each country. Currently all the countries are racing to develop covid-19 vaccines.

It is therefore, important for PEC to issue the policy and guidelines to deal with covid -19 situations and airborne transmission to prevent virus during the constructions and operations phase of the PEC project.

The following points are the examples of measures that should be considered when undertaking a risk assessment and guideline to be issued for site specific risk assessments procedures for shutdown.

1. **Emergency Planning and Response**
    - Plan for emergencies for unforeseen events such as pandemic disease (covid-19) situation can happen, so it is important to have a protocol in place that clearly outlines contact points and specific steps that must be taken for prick action in the event of an emergency during site inactivity.
    - Designate person for monitoring activities like severe weather condition, inspect critical sumps, gutters, storm water drainage to ensure good operation conditions.
    - Ensure supply for essential services like water management, waste management and installing remote monitoring devices for effective management

2. **Communications**
    - Inform the insurance company that company have unoccupied construction site and advise them of the precaution company is taking to reduce and mitigate the risk at site. Review insurance policy to make sure that site is properly covered. Review and update contact name and numbers to report a claim.
    - Ensure insurance coverage for the first party claims such as workers compensation for such pandemic and covering the aspect of builder’s risk

related to procurement and supply chain disruptions are likely to causes delays to schedules and substantial or final completion of project.

- Notify local authorities and emergency responses organizations including police, fire department, local hospital that construction site is unoccupied. Provide them the contact information in case of emergency.
- Update post emergency contact numbers regularly and make sure the availability on the gate and along the perimeter fences.
- Providing updated information, guideline for all the people with various communication methods.

3. **Site Security**
    - Identify potential safety hazards in terms of unknowing public, unknown vehicles and trespassing that may come in contact with the work site.
    - Secured the entire site premises and install perimeter fences and repair if necessary.
    - Install CCTV cameras with remote monitoring, where applicable, make sure the lighting protection system and ensure security alarm system / monitoring in place and working.

4. **Site Supervision**
    - Conduct frequent regular site visits of the unoccupied property at different times of the day to note any changes.
    - Checking of all site equipment's, non-essentials machinery, tools, ladders and scaffolding to be removed from the site.
    - All sources if water for non-essential applications should be turned-off unless lack of water would cause damage to equipment or building systems. Water to essential services such as fire protection and life system should be maintained in full service.

5. **Offices / Materials and Vehicles**
    - Maintain housekeeping in good order and removal of all the hazardous and chemical items from the site.
    - All the office equipment, computer, copiers should be securely locked.
    - Securely lock all the construction vehicles and key will be at the security gate. All the batteries to construction vehicles kept onsite should be disconnected.

Constructions or Operations Risk Assessment

If company need to slow down the operations for run the site operations, if that case scenario company need to do the risk assessment and control measures to deal with covid-19 situations

Hazard	Risk	Control measures	Persons at risk
Exposure from others due to: 1) Living with someone with a confirmed case of COVID-19. 2) Have come into close contact (within 1 metres for 15 minutes or more) with a confirmed case of COVID-19. 3) Being advised by a public health agency that contact with a diagnosed case has occurred.	High	● Continue following government action of self isolation and only to leave house on the following circumstances: for medical reasons; to shop for necessary food supplies; for exercise; and for work where you cannot do this at home ● Any existing individual risk assessments (disability, young persons or new / expectant mothers) to be reviewed ● Maintain contact with line management and Human Resources (HR) and to follow company policy / guidance. ● Travel is only required where you cannot work from home. Use private transportation, cycle or walk. As a last resort public transport to be used as a minimum and to implement social distancing where possible ● To continue following ongoing government guidance Stay at home and only attend hospital in an emergency. Do not attend GP surgery and phone National Care hotline (1800-202-6868) if further advice is required ● Company to ensure extremely clinically vulnerable persons do not come to work and continue to shield themselves whilst following their specific medical advice issued to them ● Follow good MOH hygiene measures at all times ● Avoid all visitors to your home unless they are providing a medical requirement ● Do not approach delivery staff, allow packages to be left on the doorstep ● Do not take any antibiotics as they do not work against viruses.	Individual workers
Suspected case whilst working on site	High	If a worker develops a high temperature or a persistent cough while at work, they should: 1) Return home immediately 2) Avoid touching anything 3) Cough or sneeze into a tissue and put it in a bin, or if they do not have tissues, cough and sneeze into the crook of their elbow. 4) They must then follow the guidance on self-isolation and not return to work until their period of self-isolation has been completed.	Individual workers

		5) The work area should receive deep cleaning and social distancing maintained	
General travel including foreign travel	High	● Do not travel unless you cannot work from home or deemed a key worker – implement teleconferencing for meetings ● Where an individual has recently travelled abroad, they must self isolate for 14 days ● Please continue to follow any further national government advice provided ● Where an occupational health (OH) service provider has been appointed, please seek additional advice or concerns through this service ● All persons to limit their use of public transport. Where travel is essential, please use private single occupancy where possible, cycle or walk	Individual workers
Access / egress to site	High	Where possible, please consider and implement the following practices: 1) Ensure all extremely clinically vulnerable persons do not attend site 2) Stop all non-essential visitors 3) Log all visitors to site 4) Introduce staggered start and finish times to reduce congestion and contact at all times 5) Monitor site access points to enable social distancing – you may need to change the number of access points, either increase to reduce congestion or decrease to enable monitoring 6) Remove or disable entry systems that require skin contact e.g. fingerprint scanners and look to increase cleaning or removal of common 'touch points' on site 7) Require all workers to wash or clean their hands before entering or leaving the site 8) Allow plenty of space (1 metres) between people waiting to enter site 9) Regularly clean common contact surfaces in reception, office, access control and delivery areas e.g. scanners, turnstiles, screens, telephone handsets, desks, particularly during peak flow times 10) Reduce the number of people in attendance at site inductions and consider holding them outdoors wherever possible 11) Drivers should remain in their vehicles if the load will allow it and must wash or clean their hands before unloading goods and	Individual workers

		materials. 12) Designate walking routes and one way systems with signage to help maintain social distancing 13) Additional parking and cycling facilities to be implemented to encourage those to avoid using public transport when travelling to work	
Inclement weather – cold temperature	Low	● All persons to dress appropriately for the weather ● Welfare facilities provided to shelter from the elements ● Maintain good hygiene measures at all times ● PPE on individual issue basis and not to be shared	Individual workers
Poor hygiene	High	● Wash your hands thoroughly and regularly. Use soap and water for at least 20 seconds. Use alcohol-based hand sanitiser if soap and water is not available and hand washing technique to be adopted as directed by MOH ● Avoid touching your face/eyes/nose/mouth with unwashed hands and cover your cough or sneeze with a tissue then throw it in the bin. ● Provide additional hand washing facilities to the usual welfare facilities if a large spread out site or significant numbers of personnel on site ● Regularly clean the hand washing facilities and check soap and sanitiser levels ● Provide suitable and sufficient rubbish bins for hand towels with regular removal and disposal. ● Sites will need extra supplies of soap, hand sanitiser and paper towels and these should be securely stored. ● Restrict the number of people using toilet facilities at any one time e.g. use a welfare attendant Wash hands before and after using the facilities Enhance the cleaning regimes for toilet facilities particularly door handles, locks and the toilet flush Portable toilets should be avoided wherever possible, but where in use these should be cleaned and emptied more frequently	Individual workers
Canteen - exposure from large numbers of persons	High	1) The workforce can stay on site once they have entered it and not use local shops to limit contact with others. 2) Dedicated eating areas should be identified on site to reduce food waste and contamination	Individual workers

		3) Break times should be staggered to reduce congestion and contact at all times 4) Hand cleaning facilities or hand sanitiser should be available at the entrance of any room where people eat and should be used by workers when entering and leaving the area 5) The workforce should be asked to bring pre-prepared meals and refillable drinking bottles from home 6) Workers should sit 1 metres apart from each other whilst eating and avoid all contact 7) Where catering is provided on site, it should provide pre-prepared and wrapped food only - Payments should be taken by contactless card wherever possible and Crockery, eating utensils, cups etc. should not be used 8) Drinking water should be provided with enhanced cleaning measures of the tap mechanism introduced 9) Tables should be cleaned between each use 10) All rubbish should be put straight in the bin and not left for someone else to clear up 11) All areas used for eating must be thoroughly cleaned at the end of each break and shift, including chairs, door handles, vending machines and payment devices.	
Use of Changing facilities, showers and drying rooms	High	1) Introduce staggered start and finish times to reduce congestion and contact at all times 2) Introduce enhanced cleaning of all facilities throughout the day and at the end of each day 3) Consider increasing the number or size of facilities available on site if possible 4) Based on the size of each facility, determine how many people can use it at any one time to maintain a distance of one metres 5) Provide suitable and sufficient rubbish bins in these areas with regular removal and disposal.	Individual workers
Manual handling - dual lifting	High	1) Always consider if the task can be performed with one person using mechanical aid 2) Ensure the individual(s) are fit for work prior to commencing task 3) Break down the load where possible so that one person can comfortably	Workers

		carry 4) Assess your route so you can maintain 1m social distance whilst moving the load 5) Where dual lifts cannot be avoided, lift facing away from each each or side by side rather than face to face where possible 6) Where teams are used, try to keep to fixed teams / partnering to prevent cross over of workers 7) Where PPE is to be used, this is on an individual issue and items should not be shared	
Taking / accepting deliveries - contact with materials and persons (driver)	High	1) Review logistics plans to ensure safest routes have been identified including implementing one way systems 2) Maintain 1m social distancing when accepting materials 3) Materials to be placed outside of sites to reduce exposure to drivers 4) Review work programme to assess whether 'just in time' arrangements can be made to prevent additional or unnecessary deliveries 5) Hand washing and sanitizer measures available to maintain good hygiene	Individual workers
Working in local vicinity to construction workforce (maintaining 1m distancing)	High	1) Starting and finishing times are to be staggered and reviewed to ensure no build up of staff / teams in areas 2) Workers who are unwell with symptoms of Covid-19 should not attend the workplace 3) Work design to be reviewed regularly to identify any safer ways to move around site 4) Work programme to be reviewed to identify any work reordering that would limit exposure to others 5) Tasks are to be rearranged to enable them to be done by one person or as small number of persons without compromising safety measures. 6) Maintain social distancing measure of 1 metres from each other as much as possible with supervision in place to monitor compliance 7) Avoid skin to skin and face to face contact 8) Stairs should be used in preference to lifts or hoists and consider one ways systems around construction sites 9) Consider alternative or additional mechanical aids to reduce worker	Individual workers, contractors, client

		interface 10) Any additional COVID 19 measures specified by your Principal Contractor's site rules must be followed. Details of this shall be shared at site induction 11) Above hygiene measures and additional cleaning schedules to remain (regularly washing hands for at least 20 seconds with soap and warm water) 12) Any health concern to be raised immediately to line management / principal Contractor	
Working within 1metres of working team	High	1) Always consider if the task can be performed differently without having to breach the 1m social distancing rule 2) Workers are to limit face to face working and work facing away from each other when possible 3) Limit the frequency of working within 1m to an absolute minimum and ensure it is for strictly low intensity, sporadic work where exposure to this distance is less than 15 mins 4) Consider introducing an enhanced authorisation process (permit to work) for activities where less than 1m distance may be required 5) Provide additional supervision to monitor distancing and teams not to be rotated 6) Continue to conduct dynamic risk assessments whilst completing the work and speak up if there is a safer way of completing the task 7) All equipment to be thoroughly cleaned prior and after using it. 8) Increased ventilation will be provided within enclosed spaces 9) Sites can consider face covering however, it is advised to speak to your H&S competent person on these matters and supplies should be reserved for medical staff as it has been documented that the protective effect is minimal and supplies have been difficult to procure 10) Where respiratory protective equipment (RPE) needs to be worn, face fit testing (FFT) must be in place. This equipment is reserved to protect workers from other hazardous substances rather than COVID19 as there is limited evidence that the equipment will offer a high level of	Individual workers

		protection 11) Consideration given to disposable gloves and eyewear to prevent and reduce potential contamination 12) Reusable PPE should be thoroughly cleaned after use and not shared between workers. These should be stored in suitable places 13) Single use PPE should be disposed of so that it cannot be reused and to control potential contamination is controlled (waste removed by a responsible, approved contractor). 14) Workers deemed clinically vulnerable should never work within 2m of persons and preference should be given to whether any change in task can allow an individual to work from home where possible	
First aid - including mental health	High	1) First aid contents to be monitored to ensure adequate supplies remain 2) First aid and cover arrangements to be reviewed 3) First aider certificates to be checked for validity and understand amended practices in regards to attending a casualty during COVID (such as revised CPR methodology) 4) Emergency plans on site and communicated so all staff understand what action to take in the event of a suspected or confirmed case of COVID 19 5) Mental health first aiders to be considered 6) Communicate any occupational health service available to the workforce including any available employee assistance programme (EAP) or public support 7) Line management to regularly communicate to their team(s) 8) Effective reporting system established on site in order to rectify any raised issues or incidents in a timely manner	Individual workers
Dormitories / Accommodation for Foreign Workers	High	1) Comply with the government norms and follow the rules and regulations 2) Controlling Movement of the workers outside dormitory 3) Provide Insolation facilities along with nursing staff and doctors 4) Monitoring and controlling in the premises	Individual workers

Training

Please ensure a manager's brief has been completed alerting to company specific process / procedures

Management

- Please ensure all staff are aware of reporting requirements and that all confirmed cases are escalated to your H&S competent person.
- Information notes are to be sent out and any updates communicated in a timely manner to the workforce.
- This must include letting staff know about symptoms and actions the medical professionals are advising people to take.
- A colleague who has been isolated for 14 days cannot return to work until the appropriate 'fit note' documentation is provided by their GP/healthcare provider to demonstrate they are now fit to return to work.
- Assessments to be reviewed every 6 months or where significant change has occurred
- Please remind staff that in order to minimise the risk of spread of infection, we rely on everyone in the industry taking responsibility for their actions and behaviours.
- Please encourage an open and collaborative approach between your teams on site where any issues can be openly discussed and addressed.

PEC TECHNICAL STANDARDS
HEALTH, SAFETY AND ENVIRONMENT

ENVIRONMENTAL MANAGEMENT PLAN
(Doc.No: PEC-01A1)

PREFACE

PEC Technical Standards (PTS) are based on the experience acquired during the involvement with the design, construction, operation and maintenance of processing units and facilities of Aromatic Complex Project in Singapore. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good technical practice to be applied by PEC' OPUs in oil and gas production facilities, refineries, gas processing plants, chemical plants, marketing facilities or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to users for their consideration and decision to implement. This is of particular importance where PTS may not cover every requirement or diversity of condition at each locality. The system of PTS is expected to be sufficiently flexible to allow individual operating units to adapt the information set forth in PTS to their own environment and requirements.

When Contractors or Manufacturers / Suppliers use PTS they shall be solely responsible for the quality of work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, it is expected of them to follow those design and engineering practices which will achieve the same level of integrity as reflected in the PTS. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the owner.

The right to use PTS rests with three categories of users:

1. PEC and its affiliates.
2. Other parties who are authorized to use PTS subject to appropriate contractual arrangements.
3. Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) and 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

Subject to any particular terms and conditions as may be set forth in specific agreements with users, PEC disclaims any liability of whatsoever nature for any damage (including injury or death) suffered by any company or person whomsoever as a result of or in connection with the use, application or implementation of any PTS, combination of PTS or any part thereof. The benefit of this disclaimer shall inure in all respects to PEC and/or any company affiliated to PEC that may issue PTS or require the use of PTS.

Without prejudice to any specific terms in respect of confidentiality under relevant contractual arrangements, PTS shall not, without the prior written consent of PEC, be disclosed by users to any company or person whomsoever and the PTS shall be used exclusively for the purpose they have been provided to the user. They shall be returned after use, including any copies which shall only be made by users with the express prior written consent of PEC.

The copyright of PTS vests in PEC. Users shall arrange for PTS to be held in safe custody and PEC may at any time require information satisfactory to PEC in order to ascertain how users implement this requirement.

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11.0 ENVIRONMENTAL MANAGEMENT

11.1 PURPOSE

The purpose of Chapter 11 is to outline, describe and define the OWNER's requirements for the environmental quality management (EQM) program and OWNER's environmental statements, as a guideline for CONTRACTOR during the execution of the PEC PROJECT.

11.2 GENERAL INTRODUCTION

CONTRACTOR shall outline and implement an environmental quality management ("EQM") program that details the practices, procedures and counter measures for effective management of environmental impact during and throughout the PROJECT. The EQM program shall conform to OWNER's environment policy statement, LAW and PERMITS, including the Department of Environment's ("DOE") and Department of Drainage and Irrigation legal and permitting requirement, and shall be in accordance with IFC requirements and ISO 14000 or equivalent environmental standard and in line with the OWNER's HSE management system requirements, as described in Section C - Part II - Chapter 10.0 HSSE MANAGEMENT REQUIREMENTS.

CONTRACTOR shall ensure that all environmental considerations are incorporated into its design and execution plan for the PROJECT in order to meet all relevant environmental regulatory requirements as well as to conform to GOOD ENGINEERING PRACTICE, the OWNER's best practices and PROJECT SPECIFICATION.

The EQM program shall give due consideration to environmental protection and conservation of the environmental quality management whilst demonstrating that the risk of environmental pollution is reduced to the lowest practicable level. The impact towards the surrounding environment shall be mitigated by the provision of good practices and pollution control requirements in accordance with GOOD ENGINEERING PRACTICE.

11.3 COMPLIANCE WITH ENVIRONMENTAL LEGISLATION AND REGULATIONS

Environmental Law (including regulatory requirements) requirements shall be complied by CONTRACTOR and shall include, but should not be limited to the following:

- All the environmental related documents, as approved by the relevant agencies, the Department of Environment (DOE) in Malaysia and this includes the Detailed Environmental Impact Assessment (DEIA), DEIA Approval Conditions, OWNER's Environmental Management Plan, OWNER's Erosion and Soil Control Plan, CONTRACTOR's ENVIRONMENTAL MANAGEMENT PLAN, CONTRACTOR's Erosion and Soil Control Plan as well as incorporation of any Best Management Practices ("BMPs"), as approved by DOE together with any restrictions, clarifications and conditions, advised by DOE at any stage of the PROJECT. Those preliminary requirements, expressed by DOE are part of the PROJECT DOCUMENTATION.
- Submission of information with regards to all quality of waste generated from the PROJECT execution, i.e. air emissions, liquid effluents and solid waste, noise and odor generated from CONTRACTOR's activities, as required by DOE and IFC.

- Application and /or permitting procedures required by DOE, Department of Drainage and Irrigation, Local State Authorities, Department of Town and Country Planning or other permitting agencies.
- Incorporation of all the environmental risks, as identified from the FEED ENVID, HAZID, HAZOP and/or any other HSSE design review registers and relevant follow up through actions identified in the documents given to CONTRACTOR to take up and implement.
- All conditions given inside the OWNER's MCF, as given inside the Section D - Appendix 1.6 MANDATORY CONTROL FRAMEWORK and described below in paragraph 11.5 as well as PROJECT SPECIFICATION.

11.4 COMPLIANCE WITH PEC PROJECT DEIA AND OWNER'S EMP & ESCP

CONTRACTOR shall fully comply with the requirements, conditions, recommendations, mitigations, and approval conditions of the PEC PROJECT DEIA.

CONTRACTOR shall develop its own ENVIRONMENTAL MANAGEMENT PLAN according to those documents:

- The PEC PROJECT Detailed Environmental Impact Assessment ("DEIA") and its approval conditions.

The Environmental Management Plan ("EMP") prepared by OWNER and its approval conditions issued by DOE.

- The Erosion and Soil Control Plan ("ESCP") prepared by OWNER as part of the OWNER's Environmental Management Plan submission and the ESCP approval conditions from the Department of Irrigation and Drainage.
- The Air Dispersion Study ("ADS") to be prepared by OWNER.
- Environmental requirements and guidance from International Finance Corporation.
- Environmental and Health Design Specifications.

OWNER will submit the applicable section(s) of the DEIA report to CONTRACTOR and the additional provisions / conditions, imposed by the DOE throughout the various phases of the PROJECT development.

CONTRACTOR shall advise in the earliest reasonable timeframe the impact on cost, design and risks or any changes required in order to meet OWNER'S cumulative impact requirements.

CONTRACTOR shall comply also with all the various monitoring requirements (e.g. emissions, liquid effluents particles etc), imposed by the PEC PROJECT DEIA.

In addition, CONTRACTOR shall develop its own Waste Management Plan, which shall be in line with the OWNER's waste management instructions and as per regulatory waste management requirements in Malaysia, which will be communicated by OWNER to CONTRACTOR, prior entering the WORKSITE.

11.5 CONTRACTOR'S EMP & ESPC

CONTRACTOR shall develop an ENVIRONMENTAL MANAGEMENT PLAN ("EMP") for CONTRACTOR's activities at its battery limit and this shall be submitted to OWNER for

approval not later than sixty (60) days after COMMENCEMENT DATE and in any case prior to the commencement of any CONTRACTOR's activities on the WORKSITE.

The EMP shall comprise of, but not limited to the principles of environmental management and regulatory requirements, as described in this Chapter 11.

CONTRACTOR shall also develop its own Erosion and Soil Control Plan ("ESCP") for activities within the FACILITY Battery Limits and as per requirements of Department of Drainage and Irrigation.

CONTRACTOR shall prepare and submit its own EMP and ESCP to OWNER, prior to submission to the DOE and Department of Drainage and Irrigation respectively, in order to ensure reference and consistency with OWNER's EMP and ESCP.

CONTRACTOR is responsible to submit and obtain official approval for its own EMP and ESCP from DOE and Department of Drainage and Irrigation respectively, covering FACILITY Battery Limits, and from any other regulatory authorities as well as to comply with any approval conditions.

11.6 HSE MANDATORY CONTROL FRAMEWORK

OWNER's HSE Mandatory Control Framework (MCF) contains the mandatory requirements to be implemented by the CONTRACTOR. MCF and its attachment are included in Section D - Appendix 1.6 MANDATORY CONTROL FRAMEWORK within PROJECT DOCUMENTATION. Its main objective is to strengthen environmental compliance through:

- Clear HSE & environmental requirements for effective implementation.
- Consistent implementation of the HSE management system, including environmental management system requirements.
- Expediting the implementation of process & fabrication safety and environmental requirements;
- Effective implementation of HSE assurance (including environmental competence).
- Minimizing environmental impacts in design.

The MCF supports the OWNER's policy for environment and provides the high level framework for the management of environment. The scope and application of the individual control requirements are stated in the respective manuals for each element in this MCF.

The CONTRACTOR's environmental management system shall be aligned with OWNER's HSE MCF, where all the 10 key HSE elements are implemented. Consistent application of this management system will ensure compliance to the requirements of the MCF and, consequently the delivery of improved and sustainable environmental performance and culture.

11.6.1 PLANNING OF ACTIVITIES

All of the environmental aspects and impact of the CONTRACTOR's activities shall be carefully planned to ensure that impacts and risks are reduced to ALARP and that controls and mitigating measures are in place which are in line with the recommended mitigating measures in the PEC PROJECT DEIA report, the DEIA approval conditions, the OWNER's EMP & ESCP and their approval conditions, issued by DOE and Department of Drainage and Irrigation respectively and the PROJECT waste management instructions given by OWNER to CONTRACTOR, prior to entering the WORKSITE.

In the event of a major environmental incidents, these will be managed in accordance with the Project Emergency Response Plan, to ensure timely and effective response to minimize the impacts on the environment and the surrounding public / community.

11.6.2 ENVIRONMENTAL OBJECTIVES & REGULATORY COMPLIANCE

The overriding objective at all times shall be to manage and execute the PROJECT safely and that environmental impacts are reduced to ALARP (as low as reasonably possible).

It is CONTRACTOR responsibility to identify the PROJECT's activities with their associated environmental aspects and impacts, perform environmental risk assessments; environmental impact identification studies ("ENVID") as well as follow up and close out of relevant actions appropriately.

The following table presents the environmental objectives, standards and measurement criteria for the CONTRACTOR's activities. To measure performance against environmental objectives and standards, the CONTRACTOR will need to develop environmental reporting with appropriate environmental key performance indicators ("EKPIs"), against measurable criteria agreed with OWNER, as per following environmental aspects:

Environmental Aspect	Objective	Standards / Plans	Criteria	Reportable Incident
Dust	Minimize impact on Air Quality	• Environmental Quality Act 1974 • Levels of dust • Environmental Policy	• Compliance to air quality and emission limits	Deterioration of air quality Ambient Air Quality and Public Complaints
Surface Water quality: routine waste discharge	Minimise significant impact of routine waste discharge on marine environment	• Environmental Quality Act 1974 • HSE policy • OWNER's waste management instructions	• Compliance with waste management regulations	Release of hydrocarbons or chemical and hazardous material. Discharge of waste to Malaysian waters
Environmental Aspect	**Objective**	**Standards / Plans**	**Criteria**	**Reportable Incident**
Odour	Minimise impact on Air Quality	• Environmental Quality Act 1974 • Environmental Policy	• Compliance with odour at an acceptable level by surrounding public	Ambient air quality and public complaints

Noise	Reduce noise level to allowable standard	• Environmental Quality Act 1974	• Compliance with the noise limits as in the DEIA approval conditions and as per DOE requirements	Exceeding the allowable level
Ground/ water pollution	Minimise waste water discharge into inland water sources Prevent oil or chemical spills	• Environmental Quality Act 1974	• Compliance with allowable levels	Exceed allowable level Major oil or chemical spill
Domestic Waste	Reduce/ Recycle/Reuse	• Environmental Quality Act 1974 • OWNER's waste management instructions	• Disposal at authorised sites	Waste disposed outside of authorised locations, lack of wastes manifests
Scheduled waste	Use less hazardous materials	• Environmental Quality Act 1974 • OWNER's waste management instructions	• Dispose at authorised dump site	Collected by an un-authorised agent. Waste disposed outside of authorised locations, lack of waste manifests
Surface Water quality: routine waste discharge	Minimise significant impact of routine waste discharge on marine environment	• Environmental Quality Act 1974 • HSE policy • OWNER's waste management instructions	• Compliance with waste management regulations	Release of hydrocarbons or chemical and hazardous material. Discharge of waste to Malaysian waters
Accidental release of oil & chemicals	Minimise occurrence and effects of hydrocarbon and chemical spills	• Environmental Quality Act 1974 • This HSE plan • HSE policy • OWNER's waste management instructions	• No significant oil or chemical spill. • All spills reported • Approved ERP in place and followed	Release of hydrocarbons or chemical and hazardous material

Table 1 – Environmental performance objectives, standards & measurement criteria with which CONTRACTOR is expected to comply during EPCC activities

CONTRACTOR shall take into account the applicable Detailed Environmental Impact Assessment ("DEIA"), the OWNER's Environmental Management Plan and its approval conditions from DOE, the

OWNER's Erosion and Sediment Control Plan ("ESCP") and its approval conditions from the Department of Drainage and Irrigation, recommendations which normally will be based on the following documents:

- The PEC PROJECT DEIA report prepared by OWNER and submitted to DOE;
- The PEC PROJECT DEIA approval condition provided by DOE;
- The EMP prepared by OWNER and submitted to DOE;
- The EMP approval conditions provided by DOE;
- The ESCP prepared by OWNER and submitted to the Department of Drainage and Irrigation;
- The ESCP approval conditions provided by the Department of Drainage and Irrigation;
- Any other relevant Malaysian Law and regulatory compliance requirements;

The ENVID actions and finding, when evaluating the environmental risks, as conducted during the FEED phase and provided by OWNER;

- The PROJECT's HAZID and/or ENVID actions during the EPCC phase, as performed by CONTRACTOR.
- Appropriate environmental requirements and guidance as provided by the International Finance Corporation.

Any additional PEC PROJECT DEIA recommendations and additional DOE requirements, which will be provided by OWNER during EPCC phases.

Environmental risk assessment involves:

- Identification of the activity and the environmental aspects associated with it;
- Assessment of the potential environmental effects of those associated environmental aspects;
- Identification of the probability (or likelihood) of occurrence of such associated environmental aspects before and after mitigations have been applied;
- Identification of the severity (or consequence) of the potential environmental aspects;
- Assessment of overall environmental risk levels;
- Reviewing and taking into account the applicable DEIA recommendations, as indicated by OWNER;
- Reviewing and assessing any significant / major changes from the FEED design scope, which have not been included in the previous ENVID sessions;
- Reviewing and assessing ENVID actions which haven't been closed during FEED phase.

Environmental risk management involves:

Risk Management is the process which evaluates how to protect environmental quality. This includes but is not limited to the development of risk mitigation plans. These plans will include identifying the action to be taken, the responsible individuals and the timeframe for addressing the actions. This process will also include monitoring and reporting to ensure that actions are completed on time.

Any environmental incidents will be managed in accordance with the CONTRACTOR's

ENVIRONMENTAL MANAGEMENT PLAN, PROJECT HSE PLAN, Project Emergency Response Plan & Project Incident Notification, Investigation, Classification and Reporting Procedure to ensure a timely and effective response in order to minimise the impacts on the environment.

CONTRACTOR shall have an emergency response team organised which will be ready to manage any environmental incident appropriately in close cooperation and coordination with the OWNER's emergency response team at WORKSITE. This emergency response team shall be as approved by OWNER and in accordance to OWNER's Emergency Response Plan ("ERP") for the PEC PROJECT.

In the event of any environmental incident, CONTRACTOR is expected to notify OWNER immediately in order for OWNER to liaise with the local and national, Malaysian authorities, as required (including DOE, BOMBA, Police Administration Authorities etc.) in accordance with the notification rules of the Project Emergency Response Plan and the Project Incident Notification, Investigation, Classification and Reporting Procedure.

11.6.3 WASTE MANAGEMENT

CONTRACTOR shall develop a Waste Management Plan that describes the methodology and practices to be followed for the waste management and storage on the WORKSITE in accordance with the DOE requirements, DEIA report and approval conditions and OWNER's waste management instructions for PEC PROJECT.

As per OWNER's instructions, the following rules will apply for waste management:

1. Solid waste:

- Non scheduled waste

- CONTRACTOR's domestic waste will be collected in a common area, designed by OWNER and then transferred to a dumping area. CONTRACTOR is responsible to collect and dispose the waste in an appropriate, certified landfill, outside the PEC SITE, and share the cost of transportation and dumping, which will be organised by OWNER.

- CONTRACTOR's debris and construction waste will be collected in an area designed by CONTRACTOR, within FACILITY Battery Limits, and then transferred to appropriate, certified landfill, outside the PEC SITE, by transportation organised by CONTRACTOR and at the cost of CONTRACTOR.

- No packed or wrapped food, bottled water or can beverages are allowed to be brought into CONSTRUCTION sites. Only water or beverages suitably contained in a metal tiffin, thermos or purpose made drinking container (10 liter or larger) are allowed into the site. Food are to be consumed only at designated areas allocated by CONTRACTORS (Canteen)

- Scheduled waste (e.g. polluted empty drums, paint & chemical cans etc) (The terms: Scheduled Waste and Hazardous Waste are synonymous.

- CONTRACTOR's scheduled waste will be collected by CONTRACTOR and will be given to a third party, a hazardous waste management specialist, engaged directly by

CONTRACTOR at the cost of the CONTRACTOR for further processing as per Malaysian LAW in a hazardous waste, certified landfill or treatment area.

2. Liquid effluents:

- Sewage Treatment: Sewage originating from site toilet facilities at CONTRACTORS temporary construction facilities (TCF) shall be channeled to an appropriately size septic tanks for treatment. The design shall conform to local and/or national guidelines and codes. CONTRACTOR shall also be responsible for the general upkeep and arranged for regular di-sludge of the septic tanks whenever necessary or at-least once every 3 months. The sludge shall be sent to an approved receiving facility. The on-spec supernatant is to be channeled CONTRACTOR surface run-off drainage system

- Sanitary / Grey Water, etc; Sanitary / Grey water from the TCF canteen area shall be channeled first to a suitably size grease trap before being directed to the septic tanks.

- pre-commissioning and commissioning effluents: CONTRACTOR is responsible to ensure that effluents generated from the pre-commissioning and commissioning activities such as flushing, hydro-testing, and passivation activities shall be assessed and managed such that impacts and risks resulting from pre-commissioning and commissioning effluents are reduced to ALARP.

Scheduled waste (e.g. potentially contaminated liquid, oils etc); CONTRACTOR is required to collect and give to a dedicated third party, any potentially contaminated liquid (e.g. oily water) at CONTRACTOR's cost and ensure that they are transferred to a hazardous waste, certified landfill or treatment area.

Any storage of hazardous material at FACILITY Battery Limits shall be labeled, stored and handled, as per requirements of OWNER and Malaysian LAW.

3. Medical waste:

- CONTRACTOR's medical personnel is responsible to collect and transport all medical waste, as per instructions of OWNER to OWNER's Main Clinic designed storage area;

- OWNER will either further process the medical waste internally or give it to a dedicated third party, which is specialised and approved for treating the medical waste as per Malaysian LAW. CONTRACTOR will need to share the cost of the third party, as per medical waste produced.

4. Gaseous Emissions:

- CONTRACTOR shall comply with the dust minimisation and vent safe location principles, as per Malaysian LAW;
- CONTRACTOR shall comply with the open burning prohibition of solid and liquid waste, as per Malaysian LAW (Order 2003 / PU (A) 460);
- CONTRACTOR shall ensure that pollutant emissions caused by diesel engines of vehicles and temporary power plants are reduced at sources and that specification limits are complied with, as required by Malaysian LAW and OWNER's expectation;

- CONTRACTOR shall obtain all required licenses for operating any diesel engines at WORKSITE during construction as required by DOE or any other local authority, as required by LAW in Malaysia.

CONTRACTOR shall maintain and submit a scheduled waste inventory and the relevant waste disposal consignment note(s) to OWNER. Domestic and non-scheduled waste produced during the WORK shall be collected and segregated for disposal at a location approved by Local Authority.

CONTRACTOR is required to develop a Waste Management Plan with a forecast of waste to be generated which shall submit to OWNER for review and approval as early as possible, in order to allow OWNER to incorporate the needs and requirements of the OTHER CONTRACTORS onsite and be in line with all environmental requirement, as given inside PROJECT DOCUMENTATION, OWNER's waste management instructions, DOE, DEIA, EMP, EMP's approval conditions and Malaysian LAW.

The CONTRACTOR's Waste Management Plan shall be submitted to OWNER for approval not later than sixty-(60) days after COMMENCEMENT DATE and in any case prior to the commencement of any CONTRACTOR's activities on the WORKSITE.

11.6.4 CHEMICALS HAZARDOUS TO HEALTH

Chemicals hazardous to health shall not be used by CONTRACTOR, where other practicable and safer alternative exists. OWNER approval shall be required for any chemical that is identified as hazardous to health as defined in the Globally Harmonized System of Classification and Labeling of Chemicals. All chemicals purchased and brought to WORKSITE whether by OWNER, CONTRACTOR, SUBCONTRACTORS or suppliers and their respective representatives shall be furnished with Material Safety Data Sheets (MSDSs)(or CSDS) in both Bahasa Melayu and English languages (and any other language required having regard to the nationalities of the personnel). CONTRACTOR shall ensure that the MSDS/CSDS arrive at the WORKSITE accompanying the MATERIALS to which they relate.

A complete and up to date register of all chemicals used in the PROJECT and the Material Safety Data Sheet (MSDS) for each chemical shall be kept by the CONTRACTOR's HSSE manager and shall be readily available for inspection by OWNER. All chemicals used shall be labeled in accordance with Malaysian LAW and any other requirements of OWNER. Copies of the MSDS/CSDS shall also be kept at the storage area with the chemicals. MSDSCSDS shall be available at all times to individuals working with these materials. CONTRACTOR's register of chemicals and MSDS/CSDS shall be available to emergency responders at all times.

CONTRACTOR shall propose and implement a safe system of work and provide all required PPE to ensure that risks associated with the use, handling and disposal of chemicals hazardous to health are reduced to ALARP. An assessment of health hazards arising from the use of chemicals hazardous to health shall be conducted by a competent person approved by the Department of Safety & Health (DOSH) and appointed by CONTRACTOR.

Storage and disposal of all chemicals shall be in accordance with Malaysia regulations, OWNER technical standards and project documentation.

The storage area shall be designed as per instructions given inside the Material Safety Data Sheet (MSDS) and inspected regularly by CONTRACTOR's HSE Manager and HSE Officer(s). The storage area shall have appropriate ventilation and shall ensure appropriate environmental conditions inside for all chemicals under different external conditions.

The disposal of chemicals shall be through a DOE certified and approved, 3rd party, which will take the waste chemicals, a waste and ensure further processing as per local waste management and chemicals management regulations.

OWNER highlights that the use of halon, asbestos or any other banned chemical substances is forbidden on PEC SITE, as per LAW.

OWNER has the right at any time to audit the chemical's storage area and request a record of the disposal notes.

11.6.5 ENVIRONMENTAL COORDINATION

CONTRACTOR shall develop an Environment Coordination Plan ("ECP") that describes the environmental coordination procedures and implementation of the EQM program.

The CONTRACTOR's ECP should be in line with the CONTRACTOR's HSSE management requirements, as spelt out in Section C – Part II - Chapter 10.0 HSSE MANAGEMENT REQUIREMENTS, and this should include, but shall not be limited to, the development of the procedures for reporting any non-conformance, the rectification plan / report and the environmental performance report.

The ECP shall be submitted to OWNER for approval not later than sixty-(60) days after COMMENCEMENT DATE and in any case prior to the commencement of any CONTRACTOR's activities on the WORKSITE.

The plan shall include the procedures of addressing environmental and waste management issues and the methodology, implementation of the environmental protection procedures and measures.

CONTRACTOR shall appoint an environmental specialist with at least 10 years of experience, as part of its own team for the PROJECT, who shall be responsible for the development and implementation of the ENVIRONMENTAL MANAGEMENT PLAN, the Waste Management Plan, the Environmental Coordination Plan and environmental inspection program of CONTRACTOR's activities on WORKSITE.

11.6.6 POLLUTION PREVENTION

CONTRACTOR shall notify and provide to the OWNER a list and of the types of waste to be generated during the PROJECT and CONTRACTOR shall handle and dispose scheduled waste in accordance with the Environmental Quality (Scheduled Waste) Regulations and the requirements specified in the relevant project specification documents related to waste, wastewater and chemical management.

Open burning of refuse, scrap, vegetation, etc. is not allowed on PEC SITE. CONTRACTOR shall not use ozone-depleting substances such as chlorofluorocarbon (CFC) for use as refrigerants, fire fighting agents or for any other purposes in connection with the PROJECT. CONTRACTOR shall comply with the OWNER's Mandatory Control Framework ("MCF") and referenced PTSs relevant to the management of greenhouse gases ("GHGs").

CONTRACTOR shall not use asbestos or products containing asbestos during its performance of the WORK and/or in connection with the PROJECT. Use of asbestos-containing-material for specific application such as gaskets for the process equipment shall be approved in advance by OWNER.

CONTRACTOR shall not use sand containing free silica as an abrasive in any abrasive blasting operations.

CONTRACTOR shall ensure that all work is in compliance with OWNER's ESCP and Malaysia Department of Environment and Department of Drainage and Irrigation regulations to protect all excavated soils and surface waters from the effects of siltation due to heavy rain.

With regard to liquid effluents discharges through the drainage system, CONTRACTOR's drainage design, within CONTRACTOR's battery limits, shall be in accordance with OWNER's expectations and appropriately built to get connected with to the main, overall drainage system managed by OWNER.

CONTRACTOR's discharges monitoring within CONTRACTOR's battery limits, shall be in line with OWNER's monitoring requirements as well as DOE requirements.

In addition to the above, impermeable bunded areas shall be provided for the storage of fuels and chemicals used in connection with the PROJECT. Proper spill containment system, e.g. drip pan, collection pit, etc., shall be provided for mobile construction equipment and refueling outside the bunded area. Refueling & bunkering operations shall be managed carefully at CONTRACTOR's battery limits and refueling process shall be managed as per instructions given by OWNER. CONTRACTOR shall provide appropriate training to fuel handlers to prevent spillage.

11.6.7 ENVIRONMENTAL MONITORING AND AUDITING PROGRAM

It needs to be noted that environmental monitoring for the PEC SITE, will be carried out by OWNER and OWNER's REPRESENTATIVE, which will be appointed to collect the information required by DOE.

CONTRACTOR's environmental monitoring and audit program ("EMAP") shall be limited to CONTRACTOR's activities and FACILITY Battery Limits.

The CONTRACTOR's EMAP shall be in line with the OWNER's Environmental Management Plan ("EMP") monitoring requirement and results of the Air Dispersion Study ("ADS") performed by OWNER. CONTRACTOR's environmental monitoring and auditing results shall be provided to OWNER and OWNER'S REPRESENTATIVE, appointed to collect the information required by DOE.

The monitoring and audit program may be required to cover issues, such as the ones below, but not limited to:

a. Noise level;

b. Spill prevention and response;

c. Odour management;

d. Waste;

e. Air pollution which include dust and particulate matters emission;

f. Ground water;

g. Effluent discharges from the FACILITY Battery Limits into the receiving water bodies;

h. soil erosion, dust and sedimentation control.

CONTRACTOR shall comply with the OWNER's Mandatory Control Framework ("MCF"), the "*Gap Analysis File between MCF and EPCC Phase HSE requirements*", as given in Section D - Appendix 1.6. and PROJECT SPECIFICATION.

CONTRACTOR shall submit its own environmental monitoring and audit report to OWNER and OWNER's REPRESENTATIVE, appointed to collect the information required by DOE, as required.

CONTRACTOR shall permit free access at all time to OWNER or OWNER'S REPRESENTATIVE or Malaysian, State or National environment authorities for the environment inspections relevant to CONTRACTOR's activities and DEIA monitoring requirements.

CONTRACTOR shall develop procedures to address these WORKSITE visits and shall immediately notify OWNER's supervisory personnel of the correspondence with any environmental regulatory authorities.

11.7 PROJECT CLOSE OUT

A close out meeting will be held at the completion of the CONTRACTOR's activities and following PROVISIONAL ACCEPTANCE of the whole of the WORK to evaluate the performance of the environmental management system, including but not necessarily limited to:

- Performance against HSE / Environmental objectives and targets;
- Any trends of non-conformance (including conformance with MCF);
- Identifying continual improvement measures;
- List and description of all the environmental incidents occurred onsite, including non-conformities or notices from the DOE;
- Environmental trend analysis and environmental statistics;
- Waste management delivery manifest and invoice sheets;
- Lessons learnt for future construction;
- Any issue relevant to actions required by the DOE and especially DEIA requirements during operations of the FACILITY;
- All environmental actions closed out as per ENVID, HAZOP, HAZID and any other risk register, as per OWNER's Hazard and Effect Management Plan ("HEMP") requirements, at the various phases of the PROJECT;
- Any other issue indicated or requested by OWNER's environmental specialist.

11.8 PTS & PROJECT'S REFERENCE TO BE GIVEN TO CONTRACTOR BEFORE EFFECTIVE DATE

The following documents can be used as reference documents by CONTRACTOR for the development of their own environmental management system:

- *"HSE Mandatory Control Framework (MCF)",*

- *"MCF Requirements for PEC Project - Gap Analysis File between MCF and EPCC Phase HSE requirements",*

As well as the following PEC Technical Standards (PTS)

- Management of HSE Complaint;
- Incident Classification, Investigation and Reporting;
- Hazard Identification (HAZID);
- Electrical Safety;
- Lifting;
- Fatigue Management;
- Communicable Diseases;
- Health Assessment for Fitness to Work;
- Food Safety;
- Medical Emergency Management;
- Working at Height;
- Entry into Confined Spaces;
- Scaffolding Safety;
- Working in Inert Space;
- Personal Protective Equipment;
- Excavation;
- Ignition Source Control;
- Process Safety Information;
- Process Hazard Analysis;
- Design Integrity;
- Proprietary and Licensed Technology Assessment;
- Pre-Activity Safety Review;
- Waste Management;
- Environmental Aspect and Impact Assessment;
- Greenhouse Gas Accounting and Reporting;
- Environmental Hazardous Substances;
- Integrated Environmental Site Management;
- Environmental, Social and Health Impact Assessment;
- Air Emission Management.

PROJECT's design specification & other important references of OWNER:

- *"Project HSE & Security Requirements for EPCC CONTRACTORs";*
- *"Project Specification – Environmental & Health Design Basis";*
- *"Project Specification – ENVID Review at FEED Phase";*

As well as any other applicable HSSE document as given inside PROJECT DOCUMENTATION.

Note: OWNER will decide which of the above mentioned references will be given to each CONTRACTOR, as per applicable CONTRACTOR's activities.

11.9 DOCUMENTATION TO BE GIVEN TO CONTRACTOR UPON AWARD OR DURING THE EXECUTION OF THE WORK

After EFFECTIVE DATE or during execution of the WORK, CONTRACTOR may be given by OWNER, additional environmental documentation / guidelines / requirements, as applicable to CONTRACTOR's activities and as per requirements of the PROJECT's Detailed Environmental Impact Assessment (DEIA) as well as OWNER's Environmental Management Plan (EMP), for compliance and implementation.

11.10 ENVIRONMENTAL DELIVERABLES TO BE DEVELOPED BY CONTRACTORS

The CONTRACTOR shall develop a full environmental management system with environmental procedures and specifications.

The CONTRACTOR shall ensure that the following environmental deliverables are produced for OWNER's information, review and/or approval, to ensure appropriate environmental control and waste management on WORKSITE, as a minimum, but not limited to:

- ENVIRONMENTAL MANAGEMENT PLAN;
- Waste Management Plan;
- Emergency and Spill Response Plan;
- Incident Notification, Classification, Investigation and Reporting Procedure;
- Environmental Coordination Plan;
- Erosion and Soil Control Plan;
- Chemical Management Procedure;
- The Environmental Quality Management Program;
- ENVID Procedures and Reports;
- ENVID Closeout Reports.

As well as any other environmental procedure, specification, templates or guideline, as required by OWNER.

END OF CHAPTER

PENGERANG ENERGY COMPLEX SDN BHD

Human Resources Policy Manual

		Signature
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Issued date	1 July 2020	
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INTRODUCTION

PENGERANG ENERGY COMPLEX

Pengerang Energy Complex Sdn Bhd (PEC) has been established in Malaysia to develop one of the largest and most competitive Aromatics Plants in the World, to be located in the strategic Pengerang Refinery and Petrochemicals hub in Johor, Malaysia, at the tip of the Malaysian Peninsula and directly opposite the City State of Singapore, sharing its attributes as a central trading hub and deep-water port.

PEC is supported by expertise, specialist advice, and assistance of project developer ChemOne from Singapore, the party that conceived, developed and arranged the finance for the Jurong Aromatics Complex in Singapore.

PEC has been conceived as an Owner and Operator of strategically located World Class Refinery, Aromatics and Petrochemicals Facilities to serve the Asian Markets.

We expect the gestation of our business to be in phases, with the initial focus of our business being on the Development of a world scale Aromatics Complex strategically located to serve the growing demand for such products from the East Asian Markets.

We are backed by a strong team of industry experts with extensive experience in commercial, technical and finance, as well as a strong knowledge of the market in which we operate. As part of ChemOne group as strategic partners, offers expertise in orchestrating complex business structures and solutions, thereby ensuring a high success rate for our projects.

The contents of this policy shall apply to all employees of PEC stationed in Singapore and Malaysia office. While every effort is made to ensure these guidelines reflects the formal HR policy in every aspect, some simplification and exclusion of details are unavoidable. If you have any doubts, please refer to the Human Resource Department for clarification. The Company reserves the right to interpret the policies as presented while at all times respect each employee's right to a conducive working environment.

OUR VISION, MISSION AND GOALS

OUR VISION

To be the leading owner in developing and operating environmentally and economically sustainable world scale state-of-the-art facilities.

OUR MISSION

We are an international company providing innovative industrial project solutions with our partners, adding value in the energy, petrochemical and natural resources sector.

OUR GOALS

Grow a sustainable business based on one comprehensive integrated strategy.

Expand our business by establishing world scale production facilities utilizing state of the art technology.

Develop and strengthen our strategic business partnerships with regional governments and reputable industry majors to mitigated investment risks.

OUR VALUES

To place safety, health and the environment first in every aspect of our work, with zero work related injury.

To maximize the deployment of human, capital, financial, production and intellectual assets of the company, generating return on equity employed commensurate with the risk on capital employed for the chemical industry.

To honour and value people with dignity and respect through development and training in ethics, responsibility, skill, experience, leadership and servitude.

To deliver value to our customers and stake holders and to be responsive and responsible to our host communities.

PURPOSE

All organizations must function in accordance with a set of guidelines that will provide direction and ensure that fundamental decisions are made consistently.

These guidelines is therefore created so that policies, procedures are clearly understood by all employees. Hence, the purpose of these guidelines is to communicate these policies, procedures to ensure that all employees conform to the standard practices laid down at all times.

Human Resource Department is responsible for administration of the policies and procedures. If further information is needed, please do not hesitate to approach the Human Resource Department. You may also consult your immediate superior on any matter that you may require clarification.

SCOPE

The contents of these guidelines shall, unless otherwise stated, apply to all employees, irrespective of position. While every effort is made to ensure this process reflects the formal corporate policy in every aspect, some simplification and exclusion of details are unavoidable. If you have any doubts, you should refer to the Human Resource Department for clarification. The Company reserves the right to interpret the policies as presented while at all times respect each employee's right to a conducive working environment.

CODE OF BUSINESS CONDUCT

The Company maintains high standards of integrity, ethics and professional conduct for employees as our work brings us into frequent contact with clients, prospective clients, vendors etc. Employees are the Company's representatives to the outside world and their professional conduct reflects the value system of the Company. The code of conduct aims at creating and building employees' core values, determining best-in-class practices and establishing centres of excellence in the Company. It emphasizes the Company's goal of striving to attain the highest ethical standards when resolving potential or actual conflicts of interest.

The following clauses are by no means inclusive of the circumstances an employee may encounter during the course of his / her employment with the Company. An employee who is unsure of how to proceed when faced with a particular situation must discuss the matter with Human Resources prior to taking any action. Management expects all employees to exercise the highest degree of professional business ethics in all actions they undertake on behalf of the Company. All employees are expected to adhere to the code of conduct. Any contravention of the clauses mentioned herein could result to disciplinary action up to and including termination / dismissal.

Avoid Conflict of Interest

Employees must avoid any interest, influence or relationship that conflicts with the best interests of the Company. No Company asset or resource is to be used for personal gain, benefit or any other illegal purpose.

Avoid Questionable Gifts or Hospitality

Employees must apply this code in good faith to ensure gifts and hospitality may not accept nor offer gifts or favours which include that create, or suggest any improper business relationship.

Employee must ensure that hospitality is only offered or accepted if:

- There is legitimate business interest in doing so
- It remains one-off or irregular in nature
- It is in the form of locally hosted meal, attendance at or participation in an organized team building occasion, local industry award local industry award ceremony, business site visit or similar responsible activity
- Usual business contacts from PEC and other parties are physically present.

Protect Confidential Information

Employees are responsible for protecting proprietary or confidential information of the Company, which may not be given to any individual or organization without permission.

Discipline

Proper conduct at the workplace is based on mutual respect for each individual and compliance with Company's policies and regulations. In this regard, employees shall comply with the Company's disciplinary policy at all times.

Employees are expected to maintain acceptable standard of performance or conduct. An employee will be guilty of misconduct if he/she is found to have committed any of the following offences:

General Misconduct:

- Bad timekeeping and persistent lateness
- Absenteeism without approval or reasonable excuse
- Loitering or loafing or spending unnecessary time away from job during working hours
- Failure to observe company regulations or company safety practices
- Not co-operative at work with other colleagues and/or supervisors
- Using obscene, abusive language, malicious gossip and/or the spreading of rumours
- Quarrelling which may have subversive effect on Company discipline
- Making private phone calls at Company's expense
- Sleeping on the job
- Smoking within unauthorized areas

Serious Misconduct

- Dereliction and general neglect of duty
- Falsification of time, activity and / or expense reports
- Willful disregard of Superior's instructions
- Willful damage to machinery or materials or Company's property
- Gambling, betting and / or operating raffles and lotteries in Company's premises

Gross Misconduct

- Willful disregard of safety, health and environment rules
- Theft or attempted theft of property belonging to the Company or fellow employees
- Absent from work for more than 2 consecutive days without notifying the Company or without reasonable excuse
- Intimidation or physical violence on a fellow employee
- Possession or use of any illegal drugs or substances in Company's premises
- Drunkenness or in any state of drunkenness
- Unauthorized disclosure of proprietary or confidential information of the Company
- Commitment of a criminal offence or any attempt to commit a criminal offence

The responsibility for carrying out fair and consistent discipline rests with all Supervisors and Managers.

An employee should be counseled in an appropriate place by his supervisor when the employee commits any of the general misconduct on the first occasion. Repeated general misconduct will receive a verbal warning and the warning will be recorded and kept in the personnel file. A written warning shall be issued by the Departmental Manager and a copy of the warning letter will be sent to the Human Resource Department when an employee commits general misconduct on 3 or more occasions.

For any violation of any serious or gross misconduct, the Company may, after due inquiry, issue an employee with a final written warning or dismiss an employee without notice on grounds of misconduct. Where dismissal is unavoidable, employees are assured that careful investigation and consideration of all facts and circumstances have been made before implementation.

An employee can be dismissed if the seriousness of the offence warrants it even though he may not have been given written warning before. A dismissal action in normal situation would be preceded by the holding of a disciplinary inquiry.

GRIEVANCE PROCEDURE

We recognize the value and importance of full discussions in clearing up misunderstanding and preserving harmonious working relations. Thus, employee is encouraged to discuss aggrieved issue with their immediate superior at the earliest possible date.

If such conflicts / grievance are not resolved within one week, the employee may raise the issue to their Department Head.

If the issue is still not resolved within 3 working days, the employee may raise the issue to the attention of the Human Resource Department.

If the grievance is still not resolved after this step, HR may arrange for the employee to meet up with the Chairman & CEO with the view to resolve the matter equitably. The decision of the Chairman & CEO shall be final.

FEEDBACK CHANNEL

As a communicative and responsive company, we encourage you to send us all your work-related feedback, questions, responses, compliments, concerns, suggestions, complaints or critiques to address any issues where change can / should be made; for example – workplace safety, best practices and / or any other issues of concern to Management either through your Department Head or directly c/o Human Resource Department. All communication will be kept in strict confidence.

POLICY EFFECTIVE DATE & VARIATION CLAUSE

This policy manual shall be effective from 1 July 2020 and shall remain so thereafter. The Company may from time to time amend, modify, delete or add to the provisions of this Manual.

POLICY ON PREVENTION OF BRIBERY & CORRUPTION

1. Objective

It is our policy to conduct all our businesses in an honest and ethical manner. We take zero-tolerance approach to bribery and corruption and are committed to acting professionally, fairly and with integrity in all our business dealings and relationships wherever we operate. We will uphold all laws relevant to countering bribery and corruption in all the jurisdictions in which we operate.

2. Coverage

All employees of PEC including its affiliates, "the Company", outsourced personnel working in the Company premises, consultants, suppliers, partners, distributors and vendors associated either directly or indirectly with the Company.

3. Policy

a) Bribery

Bribery generally involves paying or offering money, or providing anything else of value, to obtain or retain an improper advantage, or to induce or reward someone for acting improperly. Bribes often involve payments (or promises of payments) but may also include providing lavish / inappropriate gifts and hospitality. It is immaterial if the advantage or reward is being given to someone other than the person giving the bribe as bribery includes advantages provided directly as well as indirectly through an intermediary.

Giving or receiving a bribe: It is an offence to give, offer or promise any financial or other benefit to another person in order to influence them to do their job or exercise their powers in a particular way. It is also an offence to seek or receive such a benefit.

Bribing a public / private / commercial / government official: It is an offence to give, offer or promise any financial or other benefit to a person in a public, private or commercial office with the intention of influencing that person's performance of their official functions. Public offices include but are not limited to government department, state-owned corporations and international organizations.

Failing to prevent bribery: It is an offence for the Company to fail in preventing bribery being committed by itself, or by its associates. An "associate" is any person or entity that performs services for or on behalf of the organization, and includes the organization's employees, subsidiaries and agents. It is not an excuse that the senior managers did not authorize, or are unaware of, the bribery, so long as the bribery was committed for the benefit of the business. The only defense available to a business is to show that it has adequate procedures to prevent bribery by its associates.

b) Obligations to the Company / Risk Scenarios

Apart from being directly involved in giving, promising, offering, seeking or receiving of a bribe, there are a number of other situations that are potentially risky, and one should be vigilant in detecting these:-

Facilitation Payments: Facilitation payments or "grease payments" are payments made with the purpose of expediting or facilitating the performance by a public official of a routine governmental action. Facilitation payments are typically demanded by officials to obtain services which, under normal conditions, should be provided in any event. Facilitation payments (whether directly or indirectly) are a form of bribery. The employees are expected not to condone them, and if a government official asks (directly or indirectly) for such a payment, not to pay it.

Transactions undertaken through Agents: Employees should not hire an agent, consultant, vendor or other intermediary / third party if they have reason to suspect that they will pay bribes on behalf of the company. Employees should seek to ensure that any third parties that are hired will not make offer, solicit or receive improper payments on behalf of the company. Prior advice must be sought from the legal team on the level of due diligence required before entering into any such engagement.

c) What Conduct is Prohibited

- Offering, promising, giving or authorizing, directly or indirectly, any bribe or kickback to or for the benefit of any person which includes the activities related to money laundering (whether in the public or private sector) in order to obtain or retain any business or other advantage for the company, for self, family, friends, or associates;
- Soliciting, accepting or receiving or agreeing to receive (whether for benefit of the company, benefit of self or that of family, friends or associates) any bribe or kickback from any person (whether in the public or private sector);
- Acting as an intermediary for a third party in the solicitation, acceptance, payment or offer of a bribe or kickback; or
- Otherwise using illegal or improper means (including bribes, favours, blackmails, financial payments, inducements, secret commissions or other rewards) to influence the actions of others.

Breach of record keeping requirements: This includes failure to maintain accurate records and books of account as well as a system of internal accounting controls. By extension, manipulation of any kind of sales, pricing, expenses or any such unethical conduct is prohibited.

4. Contracts

It is imperative to insert appropriate provisions in all contractual agreements of the company with third parties to ensure compliance with the policy. Hence all contracts that the company enters into include a clause expressly addressing the no payment of bribes, commissions and kickbacks.

5. Ethics Officer

An Ethics Officer is a corporate executive charged with the responsibility of overseeing all aspects of operations to ensure that they are consistent with the Company's policy on Prevention of Bribery and Corruption.

Each country shall have an Ethics Officer, nominated by the Executive Committee of the Company. All the Ethics Officers shall report to the "Chief Ethics Officer" who shall be appointed by the Board of Directors of the Company.

He would be authorized by the Management of the Company for the purpose of receiving all complaints for the respective country under this policy and ensuring appropriate action in seven working days on receiving the complaint.

6. Submission of a Complaint / Process of Investigation

Employees are encouraged to raise concerns about any issue or suspicion of malpractice at the earliest possible stage. Any doubts or malpractice should be raised with the supervisor at the very first instance. If for any reason it is not possible or appropriate to bring the matter to the supervisor's attention, or the employee thinks that it should be reviewed outside his department, the matter should be brought to the attention of the Ethics Officer of the respective location.

An employee can write to the Ethics Officer at enquiry@chemoneholdings.com about any of the unethical / inappropriate practices, if any, happening in the Organization. In case an employee is not willing to write, he / she can also meet the Ethics Officer and explain the case.

It is the responsibility of the Ethics Officer to investigate the complaints of such nature and advise the course of action to the Country / Business HR Head.

Below mentioned points should be complied with in order to ensure effective execution of this policy, whether or not it involves the employee directly:

- Keep the instance confidential from other parties (including colleagues).
- If possible, the concern should be raised before the potentially non-complaint transaction has occurred.
- If the employee is directly involved, it is advisable to not proceed with the transaction even if a clearance is obtained to do so.

Every complaint will be investigated immediately and a decision will be made as to the best method of handling the issues raised in the complaint. Disciplinary action may be required to ensure an effective resolution and compliance with this policy. The complainant will be advised of the results of the investigation by the Country / Business HR Head.

Ethics Officer shall keep the Country / Business HR Head informed of such complaints and take necessary consultation as required.

The Ethics Officer will prepare and submit a report of the resolved and findings of pending complaints to the Country / Business HR Head on a quarterly basis.

7. Punishment for Committing Bribery, Money Laundering and Corruption

The Management depending on the severity of the offence and degree of involvement of the employee, established by thorough investigation, can impose the following penalties which are indicative and not exhaustive on an employee who is found guilty of committing the act of bribery and corruption:

- Withholding of performance based pay awards, AWS and bonus
- Withholding of promotion
- Termination of service

This is not withstanding the appropriate proceedings that may be followed against the employee for committing the offence as per law of land. The Country / Business HR Head will inform the law enforcement agencies for appropriate action as per the law of land.

8. Non-Retaliation Policy

No employee will be retaliated against because he / she filed a complaint. In addition, no associate who has provided information or otherwise cooperated with the investigation of a complaint will be retaliated against. In the event of such instances occurring and being proven, Management will take appropriate disciplinary action against the concerned employee.

9. Amendment

The Company reserves its right to amend or modify this policy in whole or in part, at any time without assigning any reason whatsoever. Any violation of this policy or its clauses shall be immediately reported to the CEO by the respective Country / Business HR Head.

TERMS AND CONDITIONS OF EMPLOYMENT

EMPLOYMENT

All applications of employment shall be carried out either through the completion of the standard application of employment form issued by the company or by writing personally to the Company.

After interview, the successful candidate shall be issued a Letter of Appointment where the candidate will sign off as an acceptance of employment.

Thereafter, the employee will be required to undergo a pre-employment medical examination conducted by the Company's appointed doctor. Pending receipt of the results of medical examination, the employee is allowed to commence his / her probationary period but his / her services will be terminated if the result of his / her medical examination is unsatisfactory. However, the employee will still be paid for the period that he / she has worked under this clause on a pro-rata basis.

As part of talent acquisition process, company will conduct the third-party background verification process for key role / senior management level. These checks include reference checks, documents verifications, criminal records and credit records. If at any time, the Management finds any information given by the employee with regard to his / her employment is false, he / she may be terminated without notice.

PROBATION

All newly appointed employees shall serve a probationary period of 3 months for juniors and executives, and 6 months for managers. This period of time has been designated as a fair and reasonable time for both the Company and the employee to determine the suitability of the placement. On completion of the probationary period, the employee's performance will be appraised by his superior to determine whether

- he / she is confirmed; or
- his / her probationary period to be extended to a further period of up to 3 months; or
- his / her service with the company is terminated.

However, subject to a satisfactory work performance, the employee shall be given a letter of confirmation in writing.

WORK WEEK / HOURS OF WORK

For Office staff:

The number of workweek days is five days. The hours of work from Monday to Friday are 0900 hours to 1800 hours (with an hour lunch break).

PERFORMANCE OF DUTIES

Employee shall devote their full time and attention to his / her duties with the Company and shall at all time faithfully and diligently performed in compliance with the Company's policy and procedures, which may be revised from time to time.

Employee will also at all times and to the best of his / her ability, endeavour to protect the interest of the Company.

PERFORMANCE APPRAISAL

Performance Appraisals will be conducted on or before January of each year. Appraisal period is from 1 January to 31 December. Each Department Head shall evaluate every one of his subordinate's work performance and he / she will then submit the forms to the Human Resource Department for onwards processing.

NON-COMPETITION

During the course of employment and 6 (six) months after the cessation of employment, employee shall not be directly engaged in any trade, business or occupation in Singapore or any other country in which the Company has business or clients, in any capacity whatsoever (and whether on your own behalf or on behalf of any other person) which is in direct or indirect competition with the Company or which may be detrimental to the interest of the Company.

CONFIDENTIAL INFORMATION

Employee will not during employment or after leaving the Company, use any of the secrets, confidential knowledge or information or any financial or trading information relating to the Company or any of its subsidiary or associated companies that may have come to his / her attention whether for his / her own benefits or the benefits of any other person or disclose to any person, in any manner whatsoever.

In the event of the cessation of employment, for whatsoever reason, employee will return to the Group any papers, files or documents relating to the Group's affairs, which might be in his / her possession and acceptance of offer of employment constitutes an undertaking that he / she will not remove or copy any such papers, files or documents for his / her subsequent use.

CONFLICT OF INTEREST

During employment, employee shall not introduce to any other person, company or organization business of any kind with which any company within the Group is able to deal with and employee will not have any financial interest in or derive any financial or other benefit from contracts or transactions made by the Group with any third party without first disclosing such interest or benefit to the Group and obtaining its approval thereto.

TRANSFER

Employee is advised that a condition of employment with the Company is that you are liable to be transferred to work in any section, department or division of the Company, or to be transferred to work in any property to which this Company may be associated, connected or affiliated with at the absolute discretion of the Company.

This is, in part for operation exigencies and in part to realize your potential elsewhere, allowing you to gain experience in other areas as a way to develop your skills for career advancement. A transfer does not necessitate a change in salary and benefits status, unless appropriate.

TERMINATION OF SERVICE

Employee who intends to resign from service shall give adequate notice as follows:

Job Category	Notice Period During Probation	Notice Period After Confirmation
Group Executive Management Grade • Executive Director (ED) • Project Director (PD) • Consultant (C) • Advisor (A)	1 month	1 month
Management Grade • Senior Manager (M3) • Manager (M2) • Assistant Manager (M1)	1 month	1 month
Executive Grade • Senior Executive (E2) • Executive (E1)	1 month	1 month
Non-Management Grade (L)	1 week	1 month

Vice versa, for termination of employment, the Company will be required to give adequate notice as stipulated above.

Employee must serve the full requisite notice period. Waiver of resignation notice or use of unconsumed vacation leave to offset resignation notice is subject to the approval of the Company. Equivalent salary in-lieu of notice is payable for any outstanding period of notice.

SALARY AND BENEFITS

SALARY PERIOD

Salary period is from the first day of the calendar month to the last day of the calendar month.

OVERTIME PERIOD

Overtime period is from the 16th day of the previous month to the 15th day of the current month.

PAYMENT OF SALARY

The payment of salary, including overtime payment, will be made once a month on the 30th day of each month. If the scheduled payday is a Sunday or Public Holiday, pay will be credited one day before. Any irregularities in the payroll should be reported to the Human Resource Department for verification within three working days.

COMPUTATION OF SERVICE

Computation of service will be based on days of completed service. The formula shall be used to compute merit increment, bonus payment, AWS, annual leave entitlement, etc.

ANNUAL WAGE SUPPLEMENT (AWS)

As per employment contract, the Company will pay AWS equivalent to one month's basic salary to an employee who has completed a full 12 months credited service as at 31st December of each year and has not violated the terms and conditions of employment. Employees who have not completed one year of service shall be given AWS, if any, on a prorated basis.

Employee who leaves the service of the Company prior to 31st December will not be eligible to receive payment.

The AWS shall be based on the salary as of 31st October of each year. Employees not on the payroll as of 31st October are not eligible to receive the AWS.

CENTRAL PROVIDENT FUND (CPF) CONTRIBUTION

CPF contributions are payable for all full time and part time Singaporeans and SPR employees at a rate gazette by the Singapore Government. Company is exempted from making mandatory CPF contributions for foreign employees on employment pass or work permit.

ANNUAL MERIT INCREMENT

All confirmed employees shall be eligible for salary review by the Company each year. The Employee's performance will be taken into consideration and increment shall be pro-rated starting from the date of employment for confirmed employees who worked less than one year.

PERFORMANCE BONUS

Performance bonus is an incentive payment to confirmed employees as a reward for their contributions towards improving the Company's business performance. The quantum varies and is dependent on Company's financial performance as well as the individual performance. It may also be integrated into any future Company's share option scheme.

TRANSPORT REIMBURSEMENT

Reimbursement for transportation is based on the principle of incremental expense incurred for business requirements. The most economical and safe mode of transport shall prevail at all times.

To and from Work Place

Travel from home to work place and vice versa is strictly personal. Where business requirements call for a detour between home and workplace, the incremental mileage or expenses incurred shall be reimbursable.

Employees who are given special transportation allowance will not be reimbursed for taxi claims to and from workplace in the event that employees use such transportation to and from workplace.

On Official Company Business

Where employees are requested to perform official Company business within or outside their scheduled working hours using their own transportation, the following reimbursement shall apply:

- The mileage rates established by the Company from time to time for every business kilometer covered when the employee drives a car or uses a motor scooter or motor-cycle.
- Actual expenses incurred where the employee uses other means of transportation e.g. MRT, buses or taxi etc.
- Any parking and ERP fees incurred in the course of such business commitment.

Claims Procedure

Such claims are to be submitted using the appropriate expense claim forms and are to be substantiated with original receipts stating details of date, place, purpose and business contacts.

Note: Officers and Confidential staff who are eligible for transport reimbursement due to overtime shall be covered under a separate policy. Please refer to Human Resource Department for details.

MEALS REIMBURSEMENT

The meal expenses incurred during breakfast / lunch / dinner also known as working breakfast / lunch / dinner will be reimbursed by the company if the meals are part of a meeting or activity that includes clients or customers and the focus of the activity is to support the business of the company.

Working breakfast / lunch / dinner expense claims between colleague / staff is strictly not allowed; unless the official meetings are extended beyond reasonable hours. In such event, the meals will be provided by the Company through the Secretary, whenever possible.

Meal expenses with clients or customers must not be extravagant and the reimbursements are submitted in a timely and detailed manner.

Employees who wish to make the claims have to fill in the expense claim form and submitted for approval with actual receipts.

Please state clearly the name and company of your clients or customers for identification and its purpose.

All such meal claims must be approved and signed by your immediate supervisor prior to submission to Human Resources or Finance personnel (to ensure that the claim is in line with the company's policy).

Finance personnel will then reimburse the claimant accordingly with the Chairman & CEO's approval.

MOBILE PHONE REIMBURSEMENT

Employees who are required to remain contactable at all times due to job requirements may be granted a mobile phone and subscription to the Corporate Plan. The monthly subscriptions and the telephone charges incurred for business shall be reimbursed by the Company. The list of job positions eligible for such reimbursement shall be approved by the Chairman & CEO.

Employees who have to make business calls occasionally, and thereby incurred telephone charges, may claim reimbursement for such charges. However, subscription fees are not eligible for the reimbursement.

TRAVEL & ENTERTAINMENT - POLICY & PROCEDURES

This policy applies to all employees. Our company travel policy outlines our provisions for company-related travel such as outstation business assignments, overseas meetings, training and conferences.

Travel refers to a business trip to a different city than the one you are in. This also includes any car, train or bus trip that lasts longer than an hour.

Travel Approval

All overseas travel requests must be authorized by your Department Head. The Chairman & CEO or his assignee shall be the final approval for all overseas travels.

Travel requests must be made through the official Travel Request Form and no bookings of flights or accommodation is allowed prior to the approval of the travel. All airline tickets arrangement is centralized with the Company's authorized personnel.

When traveling for company purposes, you are entitled to company-paid plane tickets. Your travel must be booked at least (two weeks) in advance unless it is an unforeseen trip. All unused tickets must be returned to the authorized personnel for cancellation to obtain a refund at the earliest opportunity.

All employees are to travel on lowest available fare of economy class for all flights for date of travel; and for all flights less than 8 hours. Travel for more than 8 hours by air continuously without stopover are eligible for either premium economy or business class base on the followings Grades of employees. (Exceptional case must obtain prior written approval from the Chairman & CEO).

Company will not bear any increase in cost of air tickets should the employee choose to travel in a different class of travel other than what is stipulated by the Company. Such increase will be borne by the Employee.

Staff Grade	**Class of Travel**
Directors and Consultants • Executive Director (ED) • Project Director (PD) • Consultant (C) • Advisor (A)	Business Class
Managers • Senior Manager (M3) • Manager (M2)	Premium Economy Class

Personal entertainment expenses, including in-flight movies, in-flight WiFi, headsets and related incidental costs will not be reimbursed by the Company.

Ground Transport

Local public transportation should be used whenever practical. In general, use of taxis should be confined to short trips in situations where it is not suitable or reasonable to use local public transportation to move around the area for business purposes. We will not reimburse transportation expenses for trips to museums or other places for personal purposes. Always ask for receipts and we will reimburse fares for traveling:

- From airport / train stations to your hotel and back.
- To and from every place you go for company purposes (like conference halls, lunches with clients or client offices).

You may also rent a car if you plan to do many trips within the city (for example, if you are planning to see a large number of customers). In these cases, you can either talk to our Company's authorized personnel so she can rent a car for you or you can rent your own from the city you will travel to (you must buy insurance too). Keeping in mind, we will reimburse fees for a rental car that is (compact, two-doors or four-doors, automatic transmission, petrol-fueled).

Accommodation

When traveling for company purposes, you are entitled to stay at a 4 star rated hotel. Prior approval is required if staying at hotels rated above 4 star. All accommodation arrangement is centralized with the Company's authorized personnel or the Host Country.

Entertainment / out-of-pocket expenses

Travelers are eligible to claim actual expenses incurred during the business trip. However, the expenses incurred must be reasonable. Actual receipts must be produced, where possible, for the claims.

During a business trip, you are entitled to reimbursement for meal expenses. Meals (breakfast, lunch and/or dinner) should be reasonable during the period from the commencement to the end of the travel. Where breakfast is included in the hotel room charges, no additional breakfast expense will be claimable.

Business meals or entertainment may not be lavish and must be necessary to conduct business. When it comes to meetings with clients or other key stakeholders (like dinners), we will reimburse the whole of the bill including tips. The most senior employee participating in the meeting should pay the bill and submit the expenses for reimbursement. We count on you to place reasonable orders. Detail listing of the persons and the business reason for the meals must be clearly stated in the claim form.

If you exceed (S$150) per person for one meal, you must get approval from our (CFO) to expense the cost. It is the responsibility of the approving manager to review, check and validate the reasonableness of each expense item. Any exceptions must be substantiated and a second level of approval is required.

Passport and Visa

Employees are to ensure that their passport has at least 6 months validity from the date of travel. The Company will only reimburse passport renewal and visa application charges due to business travel requirements.

Business Travel Insurance

Employees who are required to travel for business assignments, overseas meetings, training and conferences are covered under the Group Business Travel Insurance.

The general terms and conditions as stipulated in the Group Business Travel Insurance apply to business travels only.

Tips

In countries where tipping is the culture, the company will reimburse tips where the amount is reasonable.

Telephone Calls

Employee may claim for business related calls only.

Winter Clothes

Business travels to countries where the temperature is at 15°F or below, purchases of appropriate winter clothes are reimbursable. Winter clothes would include:

a) winter jackets
b) long trench suit
c) long johns
d) woolen sweater, gloves, hats or caps
e) windbreaker
f) leather boots

The maximum amount for reimbursement is S$500 for a period of 3 years. Actual receipts must be attached to the Travel Expense Claim Form and submit to Human Resource Department for review and processing. Reimbursements will be via the monthly payroll.

Non-Reimbursable Expenses

The Company will not pay for the following expenses

- Airline club membership fees.
- Purchase of luggage, briefcase, clothing, toiletry items or others supplies.
- Additional optional travel or baggage insurance or personal insurance.
- In-flight or in-room movies and video rental or similar services.
- In-flight WiFi, headsets and related incidental costs.
- In-room or mini-bar food, beverages or refreshments.
- Laundry / dry cleaning for trips less than 3 business days.
- Recreational activities (e.g. fitness center, golf, massages, etc.).
- Expenses related to vacation or personal days taken before, during or after a business trip.
- Other personal expenses.

Travel and hotel reservation which is not booked by the Company's authorized personnel due to traveler's preference are consider non-reimbursable personal expenses.

Others

For those matters concerning overseas work attachments or temporary overseas assignments, please refer to the Human Resource Department.

Claims Procedure

Such claims are to be submitted using the appropriate travel expense claim forms and are to be substantiated with original receipts stating details of date, place, purpose and business contacts. All travel expense reports must be completed and submitted for approval within fifteen (15) working days after the business trip.

Travel Expenses are to be submitted to Finance Department for processing.

Winter Clothes claims are to be submitted to Human Resource Department for processing into payroll.

LEAVE

Annual Leave

Employees, with at least three months service, shall be eligible for paid annual leave per completed year of service as follows:

Job Category	Year of Service					
	1st	2nd	3rd	4th	5th	6th
Group Executive Management Grade • Executive Director (ED) • Project Director (PD)	15	16	17	18	19	20
Management Grade M3, M2 & M1 • Senior Manager (M3) • Manager (M2) • Assistant Manager (M1)	15	16	17	18	19	20
Executive Grade • Senior Executive (E2) • Executive (E1)	15	16	17	18	19	20
Non-Management (L)	14	14	14	16	16	18

For those who has completed less than 12 months of continuous service in any year, he / she will be entitled to annual leave in proportion for that year.

Computation of leave shall be based on the anniversary date of employment.
Employee should apply for leave at least seven days in advance. No employee is to proceed on annual leave without prior approval of his immediate superior.

The minimum amount of annual leave taken at any one time is half a day. For those on office hours, the working hours for a Half Day Leave are as follows

- First Half - 0900 hours to 1300 hours (no lunch break)
- Second Half - 1400 hours to 1800 hours (no lunch break)

An employee is only allowed to defer and carry over to the following year annual leave balances up to a maximum of one year's entitlement. Any annual leave days in excess shall be forfeited at the time of accumulation (i.e. January 1 of each year).

Encashment of annual leave is only permitted upon cessation of employment.

Medical Leave

All employees shall be eligible for paid medical leave as follows

- Sick Leave - 14 days per calendar year
- Hospitalization Leave - 60 days per calendar year (Inclusive of 14 days sick leave)

Qualification for the above leave is subject to the production of a medical certificate issued by a local government registered doctor.

Dental illness or treatment certified by a registered Dental Surgeon shall be regarded as normal medical/sick leave.

Employees who are granted medical / sick leave in accordance with the above provision shall inform his immediate supervisor immediately. Upon returning to work, he / she should submit the medical certificate to his immediate superior for endorsement before forwarding it to Human Resource Department for administrative purpose.

No-Pay Leave

Employee is only eligible for no-pay leave if he / she is certified to be medically unfit and has already exhausted his / her annual leave eligibility. Applications for no-pay leave for reasons other than this shall be granted entirely at the discretion of the Company, depending on the merits of each case.

Examination Leave

Confirmed employee will be eligible for one-day paid leave on the day of exam if he / she is required to sit for a work-related examination subject to the maximum of 7 working days in a calendar year.

Compassionate Leave

Employee will be eligible for paid compassionate leave in the event of the following circumstances:

Death of employee's immediate family members, i.e., spouse, child, parents or parents-in-law	4 working days
Death of siblings, grandparents or grandparents-in-law	2 working days

Employee should notify his / her immediate supervisor of the reason for such absence. When he / she returns to work, he / she shall submit the Leave Application Form supported by documentary proof such as death certificate, etc to cover the absence.

Maternity Leave

Female employee who has completed at least 3 months' of service with the Company will be eligible for maternity leave of 16 weeks for mother with Singapore Citizen births. This would be regardless of the birth order of the child (excluding adopted children and stepchildren). You may take the 16 weeks of maternity leave from work continuously, starting from 4 weeks before delivery. The last 8 weeks (9^{th} to 16^{th} week) of maternity leave can be taken flexibly, within 12 months from the birth of the child subject to the approval of her Department Head. Otherwise, it has to be taken continuously after the first 8 weeks. Application for leave shall be made not later than one month prior to the expected delivery date. Unused maternity leave cannot be encashed.

Medical leave taken due to miscarriages or abortion shall be treated as medical leave. However, should the female employee miscarry at seven (7) months of pregnancy, such leave would be considered as maternity leave. In this case, maternity leave is up to 8 weeks.

Maternity leave would include all Company's rest days and public holidays, i.e. if the public holiday falls within the maternity leave period, the Company shall not grant another day in lieu.

Childcare Leave

Employee who is lawfully married to the child's other parent is eligible for six days paid childcare leave per calendar year if he / she has:

a. completed at least 3 months of service
b. your child (including legally adopted children and step-children) who is below or turns 7 years of age as at 31 December of the calendar year
c. your child is a Singapore Citizen

The above leave is granted on per employee basis, regardless of the number of children the employee may have.

Employees who do not serve the full 12 months in the relevant period will be eligible for pro-rated child care leave, subject to a minimum of 2 days.

Employee who is a foreigner with a non-Singapore Citizen child will be eligible for 2 days of paid childcare leave if you meet the other qualifying criteria. You will not be eligible for the extended childcare leave.

Unused leave cannot be accumulated to the next calendar year or be encashed.

Extended Childcare Leave

Employees who is lawfully married to the child's other parent is eligible for two days paid childcare leave per calendar year if he / she has:

a. completed at least 3 months of service
b. your child (including legally adopted children and step-children) is aged 7–12 years (inclusive); and the adoptive/step parents were lawfully married at the time of adoption
c. your child is a Singapore Citizen

Paternity Leave

Employees will be eligible for two weeks of Government-Paid Paternity Leave for all births if

a. completed at least 3 months of service before the birth of your child
b. your child is a Singapore Citizen
c. you are lawfully married to the child's mother between conception and birth

Application for leave must be supported by the birth certificate of the child to be submitted when it is available.

Marriage Leave

Confirmed employee will be eligible for three paid days leave on the occasion of his/her first legal marriage while in service. A copy of the marriage certificate must be attached together with the leave application as evidence.

National Service Leave

The Company will grant National Service Leave to employees upon production of satisfactory documentary evidence that such leave is necessary at least 3 months in advance. All affected employee are required to submit to Human Resource Department their Call-Up Notice, completed Make-Up Pay Form and completed & approved Leave Application Form in order for the Company to process the application accordingly.

GAZETTE STATUTORY / PUBLIC HOLIDAYS

Employee in service will be granted 11 days of paid statutory / public holidays as gazette by the Singapore Government, as follows:

Statutory / Public Holiday	No of Days
New Year's Day	1
Chinese New Year	2
Hari Raya Puasa	1
Good Friday	1
Labour Day	1
Hari Raya Haji	1
Vesak Day	1
National Day	1
Deepavali	1
Christmas	1

Where the public holiday falls on the off-day or rest-day and provided the employee is not given another day's rest in substitution for the public holiday, the employee will then have one day credited to his annual leave entitlement.

In order to receive this additional day leave or pay, the employee must not absent himself / herself from work on the working day immediately before or after the holiday without the Company's consent or without reasonable excuse.

MEDICAL BENEFIT

Employee may seek and be reimbursed for medical treatment by any registered medical practitioner for self and immediate family (defined for this purpose as spouse & children for married employee and parents for single employee) subject to the following:

a. Maximum cap for the various job category as follows :

Job Category	Maximum Claim Per Calendar Year
Group Executive Management Grade • Executive Director (ED) • Project Director (PD)	S$600
Management Grade • Senior Manager (M3) • Manager (M2) • Assistant Manager (M1)	S$600
Executive Grade • Senior Executive (E2) • Executive (E1)	S$300
Non-Management Grade (L)	S$300

b. For employee related claim, the Company will bear 80% of the total medical bill while the employee will bear the cost of the remaining 20%.

c. For immediate family related claim, the Company will bear 70% of the total medical bill while the employee will bear the cost of the remaining 30%.

d. Claims relating to hospitalization shall not be reimbursable under this scheme.

e. Immunization expenses incurred will be reimbursed in full for employees who are required to travel on Company Business (e.g. prevention against cholera, typhoid, flu, Hepatitis A and Hepatitis B).

f. Immunization expenses for personal reasons and for family members will be on co share basis and shall be subject to the maximum claim limit per calendar year.

g. All claims must be substantiated with an official receipt from any registered medical clinic (regardless of government or private clinic, general or specialist practitioners). Such claims must be submitted not more than 3 months after the consultation date.

h. Medical benefit under this scheme cannot be traded off or transferred to dental benefit.

i. The maximum claim limit shall be prorated accordingly for employee with less than 12 months of service.

The Company shall however not be responsible for the payment of any costs or medical expenses arising from or related to any of the following:

- medical consultation and treatment for pre-existing illnesses.
- house-calls made by general practitioners.
- medical, surgical, optical or dental appliances.
- cosmetic / acne or related consultation and treatment.
- self-inflicted injuries or unlawful acts, provoked assault or any venereal diseases, as well as injuries received by participating in riots and unlawful assemblies.
- illness or disablement arising from attempted suicide and use of drugs not prescribed by a registered medical practitioner.
- medical expenses arising out of participation in or attending hazardous sports or pursuits or pastimes.
- treatment or medicines when these become necessary as a result of the misconduct, excessive use of alcohol, carelessness, indiscretion or negligence on the part of yourself.
- pregnancy, confinement, abortion, miscarriage, family planning checkup and PAP smear test.
- cost of treatment in mental cases or functional disorders of the mind, which have been certified by a Government Medical Officer or any registered medical practitioner.
- health screening.
- medical claims submitted after 3 months from the consultation date will not be reimbursed.

DENTAL BENEFIT

Employee may seek and be reimbursed for dental treatment by any registered dental surgeon for self and immediate family (defined for this purpose as spouse & children for married employee and parents for single employee) subject to the following:

- Maximum cap for the various job category as follows :

Job Category	Maximum Claim Per Calendar Year
Group Executive Management Grade • Executive Director (ED) • Project Director (PD)	S$400
Management Grade • Senior Manager (M3) • Manager (M2) • Assistant Manager (M1)	S$400
Executive Grade • Senior Executive (E2) • Executive (E1)	S$200
Non-Management Grade (L)	S$200

- Dental benefit constitutes dental treatment confined only to extraction, amalgam filling, oral surgery or specialist dental treatment and does not include dental appliances, dentures or dental fixtures.

- For employee related claim, the Company will bear 80% of the total dental bill while the employee will bear the cost of the remaining 20%.

- For immediate family related claim, the Company will bear 70% of the total dental bill while the employee will bear the cost of the remaining 30%.

- All claims must be substantiated with an official receipt from any registered dental clinic (regardless of government or private clinic). Such claims must be submitted not more than 3 months after the consultation date after which such claims will not be reimbursed.

- Dental benefit under this scheme cannot be traded off or transferred to medical benefit.

- The maximum limit shall be prorated accordingly for employee with less than 12 months of service.

GROUP INSURANCES

Group Accidental Death & Dismemberment Insurance

The above insurance provides cover against accidental bodily injury. Basis of cover for the above insurance is as follows:

Job Category	Sum Assured
Group Executive Management Grade • Executive Director (ED) • Project Director (PD)	S$150,000
Management Grade • Senior Manager (M3)	S$150,000
Management Grade • Manager (M2) • Assistant Manager (M1)	S$100,000
Executive Grade • Senior Executive (E2) • Executive (E1)	S$50,000
Non-Management Grade (L)	S$50,000

The beneficiary of the above insurance is the Company, who will in turn pay the amount awarded to the beneficiary (ies) elected by the employee as per his / her nomination.

For further details on Group Accidental Death Insurance, please refer to the Human Resource Department.

Group Term Life/Total Permanent Disability Insurance

The above insurance provides cover against death or total permanent disablement due to any cause. Basis of sum insured is as follows:

Job Category	Sum Assured
Group Executive Management Grade • Executive Director (ED) • Project Director (PD)	36 times basic monthly salary
Management Grade • Senior Manager (M3)	36 times basic monthly salary
Management Grade • Manager (M2) • Assistant Manager (M1)	24 times basic monthly salary
Executive Grade • Senior Executive (E2) • Executive (E1)	12 times basic monthly salary
Non-Management Grade (L)	12 times basic monthly salary

The beneficiary of the above insurance is the Company, who will in turn pay the amount awarded to the beneficiary (ies) elected by the employee as per his / her nomination.

For further details on Group Term Life Insurance, please refer to the Human Resource Department.

Group Hospitalization and Surgical Insurance

The above insurance provides cover for reimbursement of hospital and/or surgical fees incurred in respect of any illness, surgery, day surgery or arising from an accident. Benefit schedule for the above insurance is as follows:

Job Category	Plan Covered	Room & Board
Group Executive Management Grade • Executive Director (ED) • Project Director (PD)	Plan 1	Single Bed
Management Grade • Senior Manager (M3)	Plan 2	Single Bed
Management Grade • Manager (M2) • Assistant Manager (M1)	Plan 3	Single Bed
Executive Grade • Senior Executive (E2) • Executive (E1)	Plan 4	Four Bed
Non-Management Grade (L)	Plan 4	Four Bed

For further details on the hospitalization and surgical benefits schedule, please refer to the Human Resource Department.

Group Business Travel Insurance

The above insurance provides 24 hours regional and international countries whilst on overseas business trip. Regional countries in this case refers to Australia, Bangladesh, Brunei, Cambodia, China, Hong Kong, India, Indonesia, Japan, Korea, Laos, Macau, Malaysia, Myanmar, New Zealand, Pakistan, Philippines, Sri Lanka, Taiwan, Thailand and Vietnam.

International countries include Regional countries and the rest of the world such as the Middle East, UK, Europe, USA. It does not cover travel in, to, or through Cuba, Iran, Syria, Sudan, North Korea, or the Crimea region.

Under the existing travel insurance policy, the maximum period of any one trip must not exceed 90 days. Employee who intends to travel beyond 90 days within a single trip must discuss this with the Human Resource Department to make alternative arrangement with the insurer.

For further details on the Business Travel Insurance or for travellers who intends to visit countries not listed in the regional cover, please refer to the Human Resource Department.

Insurance Claim

Employee must make attempt at the earliest opportunity possible to inform the Human Resource Department or their Supervisor for any insurance claim so that assistance can be coordinated. Human Resource Department will assist in submitting the insurance claim form to the insurance company within 30 days from the date of occurrence.

PROLONGED ILLNESS / MEDICAL RETIREMENT

In case of illness of a prolonged nature based on the prognosis of the Company Appointed Doctor, subject to the approval of the CEO, the employee will be granted sick leave with pay in accordance as follows:

Employee's Service At Date Prolonged Illness Leave Commences	**Maximum Sick Leave in Calendar Months**			
	With Full Pay	**With 75% Pay**	**With 50% Pay**	**With 25% Pay**
< 1 year	0	0	0	0
= or > 1 year but < 2 years	1	1	1	0
= or > 2 years but < 3 years	2	2	2	0
3 years and above	3	3	3	3

Employee who has consumed all the prolonged leave but is still certified to be unfit for employment may be medically boarded out as duly determined by the Company's appointed panel of doctors, subject to review and approval by HR and the Chairman & CEO.

In the event that the employee has to leave the Company's service on medical retirement, he / she shall be eligible for the balance of any of the prolonged illness leave entitlement. Should there be no prolonged illness leave entitlement, he/she shall only be eligible for the notice period specified under resignation and notice period stated in this handbook.

EMPLOYEE WELFARE

As a gesture of concern, the Company shall arrange for an appropriate arrangement for the following occasion:

Occasion	Type	Value
Birth	New born gift hampers	S$120
Hospitalisation	Floral/fruit basket	S$120
Bereavement	Wreath	S$120

OTHERS

CHANGES IN PERSONAL PARTICULARS

Employees are to notify the Human Resource Department of any change in personal particulars, for example, changes in residential address, emergency contact person / number, residential telephone number, marital status, academic / professional qualification, etc.

OFFICE EQUIPMENT, TOOLS AND SYSTEMS

Office equipment, tools and systems, etc. are provided to employees to enable them to perform their work duties. Employees should not and should refrain from using such equipment, tools and systems, etc. for their personal usage.

OFFICE SOFTWARE

Only Company approved software are to be installed and used in the office. Care must be taken so as not to expose Company's computer / laptop / software to contamination.

ELECTRONIC MESSAGING

Email is a valuable business asset, provided at Company's expense, to be used strictly by Authorised Users to transmit business information for business related purposes only. Employee must ensure that this asset is used in a constructive and productive fashion, in compliance with applicable statutes, regulations and laws of the respective country.

The Company retains the right and capability to access, monitor, review, copy and delete any messages sent, received or stored in the Company's Email System, and to disclose them to any party which the Company deems appropriate.

RETURN OF COMPANY'S PROPERTIES

On the last day of service, employees are required to complete clearance (returning of company properties and staff identification card, etc.) with the relevant department as per the following sequence:

1. Own Department
2. Finance and Accounting Department
3. IT Department, and lastly
4. Human Resource Department

Payment of final salary will only be made after all company properties and clearance formalities have been completed.

DISCLAIMER

This Employee Handbook supersedes all previously issued Employee Handbooks and inconsistent verbal or written policy statements.

The Company reserves the right to revise, delete and add to the provisions of this Employee Handbook.

None of the Company's personnel documents and benefit plans including this Employee Handbook, constitutes, or is intended to constitute, an express or implied contract guaranteeing continued employment for any Employee.

No part of this Employee Handbook may be reproduced in any form or by any electronic or mechanical means, including information storage and retrieval systems, without permission in writing from the Human Resource Department. Not all Company policies, procedures and practices are set forth in this Employee Handbook.

If you have any questions or concerns about this Employee Handbook or any other policy or procedures, please contact the Human Resource Department.

PENGERANG ENERGY COMPLEX SDN BHD

ANTI-HARASSMENT POLICY AND COMPLAINCE PROCEEDURES

SCOPE

We strive to create and maintain a work environment in which people are treated with dignity, decency and respect. The environment of the company should be characterized by mutual trust and the absence of intimidation, oppression and exploitation. We will not tolerate unlawful discrimination or harassment of any kind. Through enforcement of this policy and by education of employees, we will seek to prevent, correct and discipline behavior that violates this policy.

All employees, regardless of their positions, are covered by and are expected to comply with this policy and to take appropriate measures to ensure that prohibited conduct does not occur. Appropriate disciplinary action will be taken against any employee who violates this policy. Based on the seriousness of the offense, disciplinary action may include verbal or written reprimand, suspension, or termination of employment.

Managers and supervisors who knowingly allow or tolerate discrimination, harassment or retaliation, including the failure to immediately report such misconduct to human resources (HR), are in violation of this policy and subject to discipline.

PROHIBITION AND COMPLIANCE

We, in compliance with all applicable federal, state and local anti-discrimination and harassment laws and regulations, enforce this policy in accordance with the following definitions and guidelines:

1. Discrimination

It is a violation of our policy to discriminate in the provision of employment opportunities, benefits or privileges; to create discriminatory work conditions; or to use discriminatory evaluative standards in employment if the basis of that discriminatory treatment is, in whole or in part, the person's race, color, national origin, age, religion, disability status, gender, sexual orientation, gender identity, genetic information or marital status.

Discrimination of this kind may also be strictly prohibited by a variety of federal, state and local laws. This policy is intended to comply with the prohibitions stated in these anti-discrimination laws.

Discrimination in violation of this policy will be subject to disciplinary measures up to and including termination.

2. Harassment

We prohibit harassment of any kind, including sexual harassment, and will take appropriate and immediate action in response to complaints or knowledge of violations of this policy. For purposes of this policy, harassment is any verbal or physical conduct designed to threaten, intimidate or coerce an employee, co-worker, or any person working for or on behalf of PEC.

The following examples of harassment are intended to be guidelines and are not exclusive when determining whether there has been a violation of this policy:

- Verbal harassment includes comments that are offensive or unwelcome regarding a person's national origin, race, color, religion, gender, sexual orientation, age, body, disability or appearance, including epithets, slurs and negative stereotyping.
- Nonverbal harassment includes distribution, display or discussion of any written or graphic material that ridicules, denigrates, insults, belittles or shows hostility, aversion or disrespect toward an individual or group because of national origin, race, color, religion, age, gender, sexual orientation, pregnancy, appearance, disability, sexual identity, marital status or other protected status.

3. Sexual Harassment

Sexual harassment is a form of unlawful employment discrimination and is prohibited under our anti-harassment policy. We define sexual harassment to be "unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature ... when ... submission to or rejection of such conduct is used as the basis for employment decisions ... or such conduct has the purpose or effect of ... creating an intimidating, hostile or offensive working environment."

Sexual harassment occurs when unsolicited and unwelcome sexual advances, requests for sexual favors, or other verbal or physical conduct of a sexual nature:

- Is made explicitly or implicitly a term or condition of employment.
- Is used as a basis for an employment decision.
- Unreasonably interferes with an employee's work performance or creates an intimidating, hostile or otherwise offensive environment.

Sexual harassment may take different forms. The following examples of sexual harassment are intended to be guidelines and are not exclusive when determining whether there has been a violation of this policy:

- Verbal sexual harassment includes innuendoes, suggestive comments, jokes of a sexual nature, sexual propositions, lewd remarks and threats; requests for any type of sexual favor (this includes repeated, unwelcome requests for dates); and verbal abuse or "kidding" that is oriented toward a prohibitive form of harassment, including that which is sexual in nature and unwelcome.
- Nonverbal sexual harassment includes the distribution, display or discussion of any written or graphic material, including calendars, posters and cartoons that are sexually suggestive or show hostility toward an individual or group because of sex; suggestive or insulting sounds; leering; staring; whistling; obscene gestures; content in letters, notes, facsimiles, e-mails, photos, text messages, tweets and Internet postings; or other forms of communication that are sexual in nature and offensive.
- Physical sexual harassment includes unwelcome, unwanted physical contact, including touching, tickling, pinching, patting, brushing up against, hugging, cornering, kissing, fondling, and forced sexual intercourse or assault.

Courteous, mutually respectful, pleasant, noncoercive interactions between employees that are appropriate in the workplace and acceptable to and welcomed by both parties are not considered to be harassment, including sexual harassment.

Consensual Romantic or Sexual Relationships

We strongly discourage romantic or sexual relationships between a manager or other supervisory employee and his or her staff (an employee who reports directly or indirectly to that person) because such relationships tend to create compromising conflicts of interest or the appearance of such conflicts. In addition, such a relationship may give rise to the perception by others that there is favoritism or bias in employment decisions affecting the staff employee. Moreover, given the uneven balance of power within such relationships, consent by the staff member is suspect and may be viewed by others, or at a later date by the staff member, as having been given as the result of coercion or intimidation. The atmosphere created by such appearances of bias, favoritism, intimidation, coercion or exploitation undermines the spirit of trust and mutual respect that is essential to a healthy work environment. If there is such a relationship, the parties need to be aware that one or both may be moved to a different department or other actions may be taken.

If any employee of PEC enters into a consensual relationship that is romantic or sexual in nature with a member of his or her staff (an employee who reports directly or indirectly to him or her), or if one of the parties is in a supervisory capacity in the same department in which the other party works, the parties must notify the HR director or other appropriate corporate officer. Because of potential issues regarding quid pro quo harassment, PEC has made reporting mandatory. This requirement does not apply to employees who do not work in the same department or to parties where neither one supervises or otherwise manages responsibilities over the other.

Once the relationship is made known to PEC the company will review the situation with human resources in light of all the facts (reporting relationship between the parties, effect on co-workers, job titles of the parties, etc.) and will determine whether one or both parties need to be moved to another job or department. If it is determined that one party must be moved, and there are jobs in other departments available for both, the parties may decide who will be the one to apply for a new position. If the parties cannot amicably come to a decision, or the party is not chosen for the position to which he or she applied, the HR department and senior management will decide which party will be moved. That decision will be based on which move will be least disruptive to the organization as a whole. If no other jobs are available for either party, the parties will be given the option of terminating their relationship or resigning.

RETAILATION

No hardship, loss, benefit or penalty may be imposed on an employee in response to:

- Filing or responding to a bona fide complaint of discrimination or harassment.
- Appearing as a witness in the investigation of a complaint.
- Serving as an investigator of a complaint.

Lodging a bona fide complaint will in no way be used against the employee or have an adverse impact on the individual's employment status. However, filing groundless or malicious complaints is an abuse of this policy and will be treated as a violation.

Any person who is found to have violated this aspect of the policy will be subject to discipline up to and including termination of employment.

Effective August 01, 2020.

CONFIDENTIALITY

All complaints and investigations are treated confidentially to the extent possible, and information is disclosed strictly on a need-to-know basis. The identity of the complainant is usually revealed to the parties involved during the investigation, and the HR director will take adequate steps to ensure that the complainant is protected from retaliation during and after the investigation. All information pertaining to a complaint or investigation under this policy will be maintained in secure files within the HR department.

COMPLAINT PROCEEDURE

PEC has established the following procedure for lodging a complaint of harassment, discrimination or retaliation. The company will treat all aspects of the procedure confidentially to the extent reasonably possible.

1. Complaints should be submitted as soon as possible after an incident has occurred, preferably in writing. The HR director may assist the complainant in completing a written statement or, in the event an employee refuses to provide information in writing, the HR director will dictate the verbal complaint.

2. Upon receiving a complaint or being advised by a supervisor or manager that violation of this policy may be occurring, the HR director will notify senior management and review the complaint with the company's legal counsel.

3. The HR director will initiate an investigation to determine whether there is a reasonable basis for believing that the alleged violation of this policy occurred.

4. If necessary, the complainant and the respondent will be separated during the course of the investigation, either through internal transfer or administrative leave.

5. During the investigation, the HR director, together with legal counsel or other management employees, will interview the complainant, the respondent and any witnesses to determine whether the alleged conduct occurred.

6. Upon conclusion of an investigation, the HR director or other person conducting the investigation will submit a written report of his or her findings to the company. If it is determined that a violation of this policy has occurred, the HR director will recommend appropriate disciplinary action. The appropriate action will depend on the following factors:

    a) the severity, frequency and pervasiveness of the conduct;

    b) prior complaints made by the complainant;

    c) prior complaints made against the respondent; and

    d) the quality of the evidence (e.g., firsthand knowledge, credible corroboration).

If the investigation is inconclusive or if it is determined that there has been no violation of policy but potentially problematic conduct may have occurred, the HR director may recommend appropriate preventive action.

7. Senior management will review the investigative report and any statements submitted by the complainant or respondent, discuss results of the investigation with the HR director and other management staff as appropriate, and decide what action, if any, will be taken.

8. Once a final decision is made by senior management, the HR director will meet with the complainant and the respondent separately and notify them of the findings of the investigation. If disciplinary action is to be taken, the respondent will be informed of the nature of the discipline and how it will be executed.

Alternative legal remedies

Nothing in this policy may prevent the complainant or the respondent from pursuing formal legal remedies or resolution through local, state or federal agencies or the courts.

PEC TECHNICAL STANDARDS

HEALTH, SAFETY AND ENVIRONMENT

Health, Safety, Environment and Security GUIDELINES FOR CONTRACTORS

(Doc.No.: PEC-03C1)

PREFACE

PEC Technical Standards (PTS) are based on the experience acquired during the involvement with the design, construction, operation and maintenance of processing units and facilities of Aromatic Complex Project in Singapore. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good technical practice to be applied by PEC' OPUs in oil and gas production facilities, refineries, gas processing plants, chemical plants, marketing facilities or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to users for their consideration and decision
to implement. This is of particular importance where PTS may not cover every requirement or diversity
of condition at each locality. The system of PTS is expected to be sufficiently flexible to allow individual operating units to adapt the information set forth in PTS to their own environment and requirements.

When Contractors or Manufacturers / Suppliers use PTS they shall be solely responsible for the quality
of work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, it is expected of them to follow those design and engineering practices which will achieve the same level of integrity as reflected in the PTS. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the
owner.

The right to use PTS rests with three categories of users:

1. PEC and its affiliates.
2. Other parties who are authorized to use PTS subject to appropriate contractual arrangements.
3. Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) and 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

Subject to any particular terms and conditions as may be set forth in specific agreements with users, PEC disclaims any liability of whatsoever nature for any damage (including injury or death) suffered by any company or person whomsoever as a result of or in connection with the use, application or implementation of any PTS, combination of PTS or any part thereof. The benefit of this disclaimer shall inure in all respects to PEC and/or any company affiliated to PEC that may issue PTS or require the use of PTS.

Without prejudice to any specific terms in respect of confidentiality under relevant contractual arrangements, PTS shall not, without the prior written consent of PEC, be disclosed by users to any company or person whomsoever and the PTS shall be used exclusively for the purpose they have been provided to the user. They shall be returned after use, including any copies which shall only be made by users with the express prior written consent of PEC.

The copyright of PTS vests in PEC. Users shall arrange for PTS to be held in safe custody and PEC may at any time require information satisfactory to PEC in order to ascertain how users implement this requirement.

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1.0 INTRODUCTION

Pengerang Energy Complex (PEC) (hereinafter defined as COMPANY) has a well-meaning policy on Health, Safety & Environment (HSE) and runs a comprehensive program for its implementation. The policy requires all COMPANY Contractors to maintain similar, if not better HSE standards.

This Guideline supplements and not supersedes the Contract's terms and conditions relative to HSE issues. Several standards included in this document (HSE Guidelines for Contractors) are described in more detail in other COMPANY Regulations, Guidelines, Procedures, Safe Work Practices and Policy Statements. PEC HSE Documents are available in HSE department. If there is a requirement for more information on a particular subject, CONTRACTOR should contact the COMPANY Representative.

CONTRACTOR herein shall mean an entity with whom the COMPANY has entered into a contract / agreement / purchase order and shall include within the definitions, without limitation, all its contractors, consultants, suppliers / vendors, etc.

Following the requirements in this Guideline does not guarantee compliance with all applicable legal and regulatory requirements. Compliance with the applicable requirements is the sole responsibility of the CONTRACTOR and cannot be assumed by the COMPANY.

CONTRACTOR, and CONTRACTOR employees, shall make themselves familiar with this HSE Guidelines for Contractors prior to commencing work at COMPANY premises.

2.0 OBJECTIVES

This guideline is intended to make prospective CONTRACTORS aware of the basic HSE requirements of the COMPANY. This document shall be classified as generic guidelines that shall be applied to all type and classification of contracts in the COMPANY. It shall form part of every tender document, including Loaned Personnel Agreement.

3.0 SCOPE AND APPLICATION

CONTRACTOR is responsible for compliance with these Guidelines, the Contract Terms and Conditions, and all Governmental or Civil regulations. All references to CONTRACTOR and CONTRACTOR employees equally apply to Subcontractors and Subcontractor employees. CONTRACTOR shall ensure that Subcontractors are informed of the need to comply with all aspects of these guidelines.

CONTRACTORS are expected to be familiar with, understand, and apply the information in these Guidelines, along with all other HSE requirements. These guidelines are supplementary to other COMPANY HSE documents such as HSE Management System, Procedures, Rules, Guidelines and Safe Work Practices. The CONTRACTOR will have full access to these documents, which are available on COMPANY intranet and can be accessed with the permission of the COMPANY representative. If there is a need for additional information, or have any questions about performing work in a safe manner, CONTRACTOR employee should consult their supervisor or a COMPANY Representative.

An updated version of any COMPANY HSE documents and release of new COMPANY HSE Management System, Guidelines, Procedures, Standards and Safe Work Practices shall

automatically supersede any applicable clause(s) of this document (HSE Guidelines for Contractors).

The work shall be performed by CONTRACTOR without delay in a workmanlike manner, in accordance with the good practice of the trades involved, and completed, ready to serve in the manner indicated or manifestly implied, irrespective of whether or not full details of such workmanship, practices, or completeness are contained herein. Unless otherwise provided herein, equipment, materials, and articles, which CONTRACTOR may be required to furnish for the work, shall be new or in excellent condition and of the most suitable type, size, and quality for the purpose intended.

Mandatory rules (or 'must') are characterized by the word 'SHALL' throughout the text. Advisory rules or recommendations are indicated by the word 'SHOULD'.

4.0 GENERAL HSE REQUIREMENTS

4.1 COMPANY REPRESENTATIVE

Unless otherwise specified, the COMPANY representative hereinafter defined is the COMPANY Superintendent of the Contract.

A COMPANY Representative will be assigned to represent COMPANY in all matters relative to CONTRACTOR's activities in all company premises. All questions concerning the performance of CONTRACTOR's work shall be referred to the COMPANY Representative. The COMPANY Representative will assist with:

a) Communications between CONTRACTOR's Field Representative and COMPANY

b) Work Permits

c) COMPANY provided materials

d) CONTRACTOR's work schedule

e) COMPANY drawings, specifications, and other information

f) Known potential fire, explosion, reactive chemicals or toxic release hazards related to the CONTRACTOR's work and the process (for Contractors working on or near a process containing hazardous substances)

g) Quality, progress, and HSE inspections and Audits

h) Field changes, material substitutions, or other matters where COMPANY approval is required

i) Authorization for signing the Waste Transport Manifest

j) HSE Procedures

k) Method Statement Review

l) HSE design standard implementation review and verification during the execution of the project

m) HSE audit procedure and schedule verification report review

4.2 CONTRACTOR REPRESENTATIVE

CONTRACTOR shall maintain a Representative in the field at all times who shall be in full charge of CONTRACTOR's employees and maintain field liaison between CONTRACTOR and COMPANY Representatives. CONTRACTOR's Representative is responsible to:

a) Maintain liaison between CONTRACTOR and the COMPANY Representative

b) Receive COMPANY- provided materials and assure proper material handling

c) Represent CONTRACTOR in matters pertaining to work quality, performance, scheduling, tests, etc.

d) Represent CONTRACTOR in making field changes, or materials substitutions, and in determining compensation adjustments

e) Provide COMPANY Representative with a Daily Report, listing at a minimum, the number of employees (crafts), and types of equipment on site

CONTRACTOR's Field Representative shall meet with the COMPANY Representative prior to the start of the work to review job requirements, COMPANY Rules and Safety Regulations and to establish a work schedule. CONTRACTOR shall not commence work until authorized to do so by the COMPANY Representative.

4.3 RESPONSIBILITIES

Unless otherwise specified in any sections of this document, the following responsibilities shall be applied:

(a) The COMPANY Representative (Superintendent of the Contract) shall be accountable for ensuring the compliance of CONTRACTOR to this guideline and shall continuously monitor the CONTRACTOR's HSE performance.

(b) CONTRACTOR is responsible for strict compliance to this guideline and for informing CONTRACTOR's employees and Subcontractor's employees of the requirements in these guidelines and all specific instructions pertinent to the work.

4.4 LANGUAGE REQUIREMENT

All of CONTRACTOR employees shall be capable of communicating in a satisfactory manner with the COMPANY Representative in connection with the work. All

CONTRACTOR employees must be able to follow emergency instructions, both written and oral.

CONTRACTOR personnel are required to understand English sufficiently to comply with all COMPANY HSE Procedures, Guidelines, Safe Work Practices and Signs.

4.5 HEALTH, SAFETY AND ENVIRONMENT (HSE) PLAN

As part of contract tendering process, the Contractor shall demonstrate compliance with the HSE tender documentation requirements and illustrate its process by preparing and submitting its HSE Plan within the required framework in its tender. This written HSE Plan shall be appropriate to size, complexity and risk of the contract and shall meet the requirements stipulated in COMPANY HSE Guidelines for Contractors document. Appendix-I may be used as reference on HSE requirements' applicability for different types of works in PEC. Appendix-L depicts the Generic HSE Plan Checklist.

The CONTRACTOR shall be able to demonstrate how the personnel and equipment provided can meet the relevant requirements of the COMPANY HSEMS and its HSE objectives and how these are to be communicated to the contractor and subcontractor personnel.

The HSE Plan shall demonstrate how:

- The contractor and subcontractor has an effective HSEMS applicable to the specific work contracted appropriate to the complexity and the phase of the contract.

- Hazards and effects of, and to, the people, the environment, assets and reputation associated with the contracted work have been identified, assessed and controlled and recovery measures are in place when required.

- The responsibilities for the execution and maintenance of all control and recovery measures relating to the contracted work are assigned to specific, named designated persons throughout the phases of contract.

- Risks have been evaluated and measures taken to reduce the risks to a level that is 'As Low as Reasonably Practicable (ALARP)' and acceptable to the COMPANY.

The CONTRACTOR HSE Plan shall be completed and finalized in accordance with the terms of the contract post-award. This HSE Plan shall define the interfacing of COMPANY, CONTRACTOR and Sub-Contractor activities. The CONTRACTOR shall ensure that the COMPANY-approved HSE Plan is available for implementation at least one month before the start of manpower and equipment mobilization to COMPANY sites.

The CONTRACTOR HSE Plan shall be updated yearly (or 6-monthly if required by the COMPANY) and shall be presented in a workshop that will be organized in coordination with the Contract Custodian.

4.6 PRE AND POST-MOBILIZATION HSE AUDIT

The CONTRACTOR shall ensure that the relevant aspects of the contract risk assessment and the requirements of the HSE Plan are communicated and understood by all parties prior to implementation of the contract and that any remedial actions required to be completed before mobilization are identified and agreed.

CONTRACTOR's compliance on the application of this document shall be reviewed periodically based on COMPANY Performance Standard for Inspection of Contractor's Compliance to Pre & Post-Mobilization HSE Requirements. The compliance review shall be carried out in two parts as follows:

Part I : Review on Contractor's compliance to Pre-Mobilization requirements. The checklist in Appendix-K1 may be used for guideline.

Part II : Periodic review on Contractor's compliance to Post-Mobilization (Contract Duration) requirements.

Post-award HSE meeting will bel held immediately after contract award and before the execution of any work. The meeting should cover the following topics:

- A review of associated major risk controls
- Confirmation that the activities / deliverables described in the HSE Plan for completion and pre-mobilization will be satisfactorily implemented including confirmation that roles and responsibilities have been clearly defined and understood.
- Confirmation of personnel competence and adequate manpower including subcontractors. This includes both COMPANY and CONTRACTOR personnel who are exposed to workplace hazards as defined in the scope of work and risk assessment phases. Also it includes competent supervision for all works and provision of HSE personnel as per the contract requirement.
- Confirmation of benchmarking and any HSE Key Performance Indicators (KPIs)
- Distribution and explanation of the QHSSE Policy statement, basic HSSE rules and work procedures as defined in the HSE Plan.
- Confirmation of the scope and schedule of HSE activities, e.g. HSE meetings, audits and reviews.
- Interaction of COMPANY and CONTRACTOR's emergency response plans
- Confirmation that HSE induction and training plans are in place and ready for start-up
- Briefing of sub-contractors management on HSE requirements
- Incident Reporting and investigation procedures
- Process for agreeing upon, reporting, tracking and closing out non-compliance

- Incentive and penalty scheme
- etc.

A Contract HSSE Readiness for Commencement Certificate will be issued by the company.

4.7 DEMOBILIZATION AND SITE RESTORATION

The CONTRACTOR shall assure that the demobilization is conducted according to the HSE Plan, and that roles and responsibilities are clearly understood and complied with throughout this phase. The hazards associated with demobilization shall be reassessed, and any new hazards identified and controls implemented to minimize the risks. The HSE plan shall be modified accordingly. Assurance shall be sought that the appropriate organizational structures remain intact until associated activities have been completed.

An HSE Clearance Certificate for Site Restoration will be issued by the COMPANY.

4.8 FINAL HSE EVALUATION AND CLOSE-OUT REPORT

The COMPANY and CONTRACTOR representatives will evaluate contractor's HSE Performance jointly. Contracts shall be closed out with a report of HSE Performance and lessons learned, providing feedback for future knowledge and improvements. Refer to Appendix-S for the guidance template for 'HSE Performance / Close-out Report'.

The HSSE close-out data shall be recorded and made accessible for future reference. A documented record of HSE performance shall be kept for each Contractor.

The CONTRACTOR will be advised that the overall performance and HSSE record will be taken into account when being considered for future work.

4.9 WORK STOPPAGE

The COMPANY Representative, designated HSE personnel / coordinator or a senior personnel (i.e. above unit supervisor/engineer's level) in the company premises may stop CONTRACTOR's work which is considered hazardous (violates COMPANY, or other standards). Failure to comply with these Guidelines, or any action or inaction by the CONTRACTOR that causes or results in injury to personnel or damage to COMPANY equipment, may result in:

a) Completion of the work by a third party at CONTRACTOR's expense.

b) Cancellation of the contract.

4.10 ENTRY TO COMPANY PREMISES

CONTRACTOR shall allow only its employees, Subcontractors, and suppliers directly connected with the work, to enter A COMPANY premises. Visitors are subject to the following conditions:

a) COMPANY approval is required

b) Visitors must attend the COMPANY HSE Orientation program

c) Entry/exit is through the COMPANY designated gate

d) CONTRACTOR must escort visitors for the duration of their visit

e) Visitors are not allowed freedom of movement in COMPANY premises. Visitors shall visit only those area specifically permitted by Company

4.11 CAMERAS

Photography is prohibited in all COMPANY controlled areas unless authorized. CONTRACTOR shall not take photographs without approval of the COMPANY Representative. CONTRACTOR shall obtain written authorization from COMPANY Representative and concerned government authorities. Camera gate pass shall be obtained from Security Division. Appropriate Work Permit shall be obtained and COMPANY employee (directly involved in the job) should accompany the photographer.

4.12 HOUSEKEEPING AND HYGIENE

During the performance of the work, CONTRACTOR shall keep a reasonable degree of order by disposing of accumulated rubbish and excess material. Disposal of solid wastes generated by the CONTRACTOR shall be in accordance with the COMPANY Procedure for Solid Waste Management.

At the completion of the work, CONTRACTOR shall clear the site of all debris, leftover, tools, consumable supplies, and materials. Any site remediation required due to CONTRACTOR's activities shall be his responsibility.

Where CONTRACTOR, after due notice, fails to keep the area of its work reasonably clean and safe, or fails to clean this area at the completion of the work or during the execution of work as and when required, COMPANY may perform this work and deduct the cost from the sum due or to become due to CONTRACTOR. This is also applicable for Contractor's yard / site.

4.13 DAMAGE TO COMPANY EQUIPMENT OR PROPERTY

CONTRACTOR shall promptly notify the COMPANY Representative, as per COMPANY Incident Reporting Procedure, in the event CONTRACTOR damages COMPANY equipment or property.

4.14 CONTRACTOR'S EQUIPMENT

CONTRACTOR's engine driven equipment shall be equipped with COMPANY approved type of spark arrestor and wiring in good operating condition before it can enter the Refinery and other COMPANY premises. All battery boxes shall be covered and all gasoline lines and carburetors free from leakage. A current and valid COMPANY Safety Certificate shall be attached to all applicable engine driven equipment entering the Refinery. Operation of engine driven equipment must comply with COMPANY Procedures, Guidelines and Safe Work Practices.

Articles and devices, which CONTRACTOR may be required to furnish for the work, shall be new or in satisfactory operating condition and of the most suitable type, size, and quality for the purpose intended.

4.15 THIRD PARTY CERTIFICATES

4.15.1 CONTRACTOR shall secure COMPANY approved Third Party 'Test Certificate' (before using any) of the following CONTRACTOR's equipment / equipment accessories:

a) Lifting appliances of crane, boom truck, relamping truck, jig lift, forklift, lifting tackles, etc., as defined in relevant COMPANY procedures and safe work practices.

b) Safety valves on mobile equipment, e.g. air compressor, hydrotest machine, vacuum truck etc., as defined in relevant COMPANY procedures and safe work practices.

c) Cargo tank of tank vehicles, e.g. fuel tanker, vacuum tank or pressurized tank, etc., as defined in relevant COMPANY procedures and safe work practices.

d) All pressure vessels, e.g. compressor's air receiver, etc.

e) CONTRACTOR shall have valid approval from K-EPA for use of vacuum trucks / other trucks for movement of hazardous waste.

4.15.2 CONTRACTOR's Crane Operators, Rigging Engr., Rigging Supervisor, Riggers and lifting appliances' Operators shall be trained and certified by PEC approved Third Party Agency.

4.15.3 PEC approved Third Party Agency shall be as per the approved V&CEC Contractor's list for Third Party Inspection (Local/International).

4.16 FORKLIFTS, INDUSTRIAL TRUCKS, CRANES AND OTHER CONSTRUCTION EQUIPT.

Only persons holding appropriate Malaysia / Singapore Driving License, Certification from PEC approved Third Party Agency, and COMPANY Authorization may operate forklifts, industrial trucks, cranes, pallet trolleys, and other construction equipment. Personnel are not permitted to ride on forklifts, industrial trucks and cranes. Detailed requirements and safe work practices shall be referred from HSE document .

4.17 SANITARY FACILITIES

Contractor shall comply with PEC norms on required sanitation facilities. The contractor shall provide drinking water, sanitary toilets, urinals, washing faucets or washbasins, dressing lockers, change rooms, separate eating place and rest room for the use of employees. Drinking water points should be located closer to workers. Common cups should not be used to serve drinking water. Washing faucets and urinals must be located closer to workers, besides the toilet rooms. Shower baths must be provided if employees come in direct physical contact with chemicals. Toilets, lockers and eating- places must be kept clean. Liquid soap in dispensers or soap cake and individual paper towels should be available all the time. A shelter room with cool drinking water should be provided closer to employees exposed to heat stress.

For shutdown and project work, CONTRACTOR shall furnish its employees with toilet and hygienic washroom facilities that should be acceptable to COMPANY. Sewage generated by the CONTRACTOR shall be disposed in a manner acceptable to the COMPANY.

Contractors' dining facility shall be provided with tables, chairs and air-conditioning system. Dining room shall be cleaned and maintained in good hygienic condition.

4.18 THEFT OR VANDALISM

Any occurrence of theft or vandalism shall be reported immediately to the COMPANY Representative and the Security Officer. Thieves and vandals may be prosecuted.

4.19 STORING FUEL AND REFUELING ON COMPANY PREMISES

CONTRACTOR shall not store fuel for refuelling (vehicles & equipment) inside COMPANY premises without COMPANY Safety Representative approval.

CONTRACTOR shall not transport fuel on vehicles or containers not approved for that purpose. Contractors shall not use COMPANY's fuel pumps unless agreed to in writing by the COMPANY and CONTRACTOR.

4.20 CELLULAR PHONES, NOTEBOOK PC AND PERSONAL GAS MONITORS

Cellular phones shall not be used in operating areas / hazardous areas unless they have been classified as 'intrinsically safe' for use in that atmosphere. Cellular phones brought in by visitors may be left with the Security at the Main Gate until the visitor has signed out of the plant area.

CONTRACTOR's key personnel (Contract Manager, Safety Engineer / Officer and other designated supervisory personnel) are required to carry essential personal gas monitors at all times while in the Refinery / Aromatic. All contractor employees shall carry H2S personal monitor while at operation sites and other hazardous areas (e.g. pits, offsite manifolds, etc.). The gas monitors shall be maintained and calibrated as

per the company's 'Guidelines for Portable Gas Detectors' Testing, Calibration and Certification'. In their absence, the personal gas monitor shall be turned over to another responsible party.

CONTRACTOR's personal gas monitors and gas meters (O2, CO, H2S, LEL, etc.) shall conform to COMPANY Specifications. COMPANY Instrument Maintenance Division of PEC aromatic complex shall approve sample before procurement.

Carrying of cellular phone and notebook PC (or laptop computer) in company premises is restricted. Contractor's key personnel intending to carry cellular phones and notebooks shall apply for passes through the Company representative to the Security Division.

4.21 COMPANY WRITTEN PROCEDURES

CONTRACTOR is responsible for acquiring from its COMPANY Representative copies of relevant "Refinery Instructions", "Engineering Instructions", and HSE Procedures/ Guidelines / Standards.

4.22 COMPLIANCE WITH THE LAW

CONTRACTOR, CONTRACTOR's employees, all Subcontractors and all employees of Subcontractors shall comply with all Malaysian laws and regulations relating in any way to the performance of the work.

5.0 ADMISSION TO COMPANY PREMISES

5.1 ADMISSION TO COMPANY PREMISES, ACCESS BADGES

CONTRACTOR shall ascertain from the COMPANY Representative the designated gate through which CONTRACTOR's employees shall enter and leave the COMPANY premises.

CONTRACTOR's employees will be issued an Access Control Badge (Personnel Gate Pass) that permits entry into COMPANY premises. The issuance of the badge is a privilege, not an obligation of COMPANY, and this privilege must not be abused. CONTRACTOR will be responsible for the care, use, and replacement of the badge if lost or damaged. CONTRACTORS are responsible for distributing badges to their employees and informing their COMPANY Representative if new employees need badges. The CONTRACTOR is responsible to return badges to COMPANY Security Division for employees no longer working in the COMPANY premises.

Contractor shall not tamper/modify the gate passes, like changing photograph, using someone else gate pass, etc. If any contractor's employee found tampering gate pass,

strict action to the extent of demobilization and blacklisting of the concerned employee shall be enforced. Contractor shall ensure their employees are working under same project for which gate pass is issued.

If this Contract expires for any reason and is not immediately renewed or extended by COMPANY, it is CONTRACTOR's sole responsibility to secure all Access Control Badges from its own employees and the employees of its Subcontractors, and immediately return them to the COMPANY Representative. CONTRACTOR shall pay COMPANY for each badge damaged or not returned as provided herein, a 50 Malaysia Ringgit (MYR. 50/-) replacement fee. Failure of CONTRACTOR to abide by COMPANY's Access Control Procedures may result in CONTRACTOR's future COMPANY privileges being revoked or the termination of this Agreement by COMPANY.

CONTRACTOR's employees will be admitted to COMPANY's premises only if they are in compliance with the Access Control Procedures established by the COMPANY Security Division. Contractor employees shall carry their badge at all times while at work sites / company premises.

CONTRACTOR shall contact its COMPANY Representative prior to performing any work under this contract in the COMPANY premises unless other arrangements have been made between the respective parties.

5.2 VEHICLES AND PARKING

CONTRACTOR shall furnish transportation for all of CONTRACTOR's employees from the designated entry gate to the job site and return. The COMPANY Representative will designate the routes and parking areas to be used by CONTRACTOR's vehicles in COMPANY premises. CONTRACTOR shall observe all of the COMPANY's traffic regulations at all times while in the refinery and other COMPANY premises.

CONTRACTOR's vehicles will normally be allowed in the Refinery and other COMPANY restricted premises only for the purpose of delivering workmen, equipment, or supplies to the job site. Where work location and circumstances warrant, CONTRACTOR's vehicles may be allowed in the Refinery and other COMPANY restricted premises to transport CONTRACTOR's authorized management personnel for inspection of the work. Prior COMPANY approval must be obtained for the use of any CONTRACTOR's vehicle in the Refinery and other COMPANY restricted premises. All CONTRACTORS owned, rented, or leased vehicles or equipment (i.e. air compressors, generators, welding equipment, forklifts, cranes, etc.) entering the Refinery and other COMPANY premises shall be properly identified and has a valid Safety Certificate and Gate Pass. As a minimum, both the driver's side and passenger doors on vehicles shall have permanent markings (12" X 10") indicating CONTRACTOR's name or insignia and contract details. All equipment brought into the refinery, whether owned, rented or leased shall be marked in the same manner as vehicles, clearly showing the CONTRACTOR's name. Failure to properly mark the equipment will result in its removal from the COMPANY premises.

Only vehicles required for execution of work are allowed in the Refinery and other COMPANY restricted premises; all other vehicles shall be parked outside the Refinery or COMPANY restricted premises.

5.3 TRAFFIC REGULATIONS

Cellular phones should not be used while driving in any COMPANY premises. Seat belts shall be used while driving within COMPANY access roads. All traffic signs, signals, and road markings must be obeyed.

CONTRACTOR shall only utilize an approved type of vehicle in transporting personnel. Carrying of persons at the back of pick-up is prohibited unless a permit is obtained from Malaysia Government Traffic Department. The permit shall be displayed in the vehicle. CONTRACTOR shall comply with the Site Transportation Plan

All trucking on COMPANY's premises shall be in accordance with all laws covering fastening of loads, use of red warning flags, and placards, etc. applicable to such trucking or, in the absence thereof, all such laws that would be applicable to such trucking if it were on public roadways.

5.4 SEARCH

With or without prior announcement, and at any time, COMPANY or its authorized agents may carry out reasonable searches of individuals and their personal effects when entering COMPANY premises, while on COMPANY premises, and when leaving COMPANY premises. COMPANY may require CONTRACTOR to search its employees before entering COMPANY premises, engaging in COMPANY business or operating COMPANY equipment. Entry onto COMPANY premises constitutes consent to search the person and his/her personal effects, including, without limitation, packages, briefcases, purses, lunch boxes and vehicle, or any office, locker, closet or desk. Refusal to cooperate shall be cause for not allowing that individual on COMPANY premises.

6.0 DEPARTING COMPANY PREMISES

All CONTRACTOR and Subcontractor personnel may be required, at the request of any COMPANY Security Representative, while exiting the Refinery and other COMPANY restricted areas to have their lunch boxes and/or other packages open for inspection.

All CONTRACTOR employees and Subcontractors driving a vehicle out of the Refinery or other COMPANY restricted premises may be required, at the request of any COMPANY Security Representative, to open their automobile trunks, or truck-mounted equipment boxes, for inspection.

CONTRACTORS removing equipment, materials, tools or supplies from COMPANY premises must possess a "Gate Pass", authorized and signed by a COMPANY Representative and approved by COMPANY Security representative, identifying the material permitted to be removed.

7.0 HEALTH, SAFETY AND ENVIRONMENTAL MANAGEMENT SYSTEM (HSEMS)

Besides meeting COMPANY and other regulatory HSE provisions, CONTRACTORS must have a written HSE Management System and shall be approved by HSE Department prior to commencement of work at Company site. The actual HSE Management System (HSEMS) that shall be prepared by the CONTRACTOR will depend on variables such as size of the firm, size of the project, nature of activities and the location. CONTRACTOR and SUBCONTRACTOR

HSEMS shall be in line with the Company’s Rules and Procedures that basically include the following elements:

- Leadership, Commitment and Accountability
- Management System, Metrics and Audit

- Safety Work Practices, Permits, Standards
- Training and Competence
- Environment
- Information and Documentation
- Contractors & Material procurement
- Roles, Responsibilities & assignments
- Behavior
- Occupational Health
- Emergency preparedness
- Incident Reporting & Investigation
- Risk Assessment and Management of Change
- Mechanical and Operating Integrity

Appendix - N provides a generic guidelines in the preparation of HSEMS. The CONTRACTOR shall submit to HSE department a copy of the final approved HSEMS. The CONTRACTOR Management shall commit resources and all necessary support to ensure the HSEMS is implemented to the satisfaction of the COMPANY. CONTRACTOR shall ensure adherence to all laws, rules, regulation, and notification of various government departments pertaining to health, safety and environment.

7.1 SITE HSE ORGANIZATION AND RESPONSIBILITIES

The CONTRACTOR'S HSE program should establish responsibilities for managers, engineers, supervisors, safety representatives, and the employees.

The CONTRACTOR'S HSE program should also include site HSE organization with respect to the overall site organogram. The CONTRACTOR's employee in-charge of HSE should be among the top in the organogram and should have authority over other activities. For contract having more than 30 manpower, there should be at least one dedicated qualified and experienced CONTRACTOR's HSE Engineer or Supervisor exclusively responsible for HSE implementation / co-ordination. Depending upon the nature and size of the job, minimum strength of the CONTRACTOR's HSE personnel shall be as indicated in Appendix - O.

In addition to the required HSE personnel, CONTRACTOR shall make arrangement for additional Safety Engineer / Safety Supervisors that shall serve as replacement(s) for Contractor HSE staff that will proceed on annual leave or other absences. Vacation / leaves of Contractor HSE personnel shall be with prior approval from COMPANY HSE Department. The number of employees mentioned in Appendix-O represents the maximum number of contractor employees estimated to be engaged at the site on any day (i.e. including all 24-hours shifts manpower, base manpower, work order manpower and lumpsum manpower) by the contractor and their sub-contractor. In case of block shutdown or turnaround when the

CONTRACTOR is required to bring in additional manpower, the number of CONTRACTOR HSE Personnel shall be increased as per Appendix-O.

In case of multiple sites or nature of work (such as common contracts in the refineries, LM, etc.), the COMPANY may ask for posting additional number of CONTRACTOR HSE Personnel irrespective of the total number of CONTRACTOR employees. No compensation will be made by the COMPANY for the deputation of additional Contractor's HSE Personnel.

Contractor HSE personnel shall be mobilized before commencing any activity at PEC site. On the non-conformity or failure to meet this requirement, a penalty of MYR. 2000/- per person per working day delay on the mobilization of HSE personnel shall be imposed to the Contractor.

Any exemption or deviation on Contractor's HSE Manpower requirements shall be approved by COMPANY HSE Manager.

7.2 HSE ORIENTATION

New CONTRACTOR's Key personnel (i.e. supervisors, engineers and managers) shall receive induction training from COMPANY HSE Department, as per applicable HSE Training Performance Standard. In turn, these trained Contractor's key personnel shall conduct orientation to their respective employees prior to job site mobilization / beginning work on the project. Such orientation should include provisions of the written HSE program and procedures applicable to the CONTRACTOR's scope of work, and also should include the following:

a) Clarification of the HSE responsibilities for contractor, subcontractor, employee and all construction site personnel.

b) Clarification of HSE expectations of the employee.

c) HSE rules within company and that for any owner /client rules.

d) The location (and proper use) of first aid facilities

e) The procedure / responsibilities on Incident reporting for personal injuries, occupational illnesses, fire incidents, property damage incidents, environmental incidents, traffic incidents and near-miss incidents

f) Toolbox meeting schedule, agenda and attendance mandatory requirement

g) The mandatory use of personal protective equipment on various specific activities

h) Prompt reporting of unsafe acts or conditions

i) Overview of COMPANY's emergency response plans and the CONTRACTOR employees action in case of an emergency/drill

j) Waste Segregation, Handling and Disposal and follow PEC Solid Waste Management procedure for filling Waste Transportation Manifest (WTM)

k) Company HSE Policy. EMS and HSEMS Awareness

l) Unit specific hazards

m) Roles and responsibilities of employees

n) Identify all Environmental Aspects related to contract activities and prepare / maintain Environmental Aspect Register.

COMPANY access control badge will only be issued to CONTRACTOR's key personnel after completing the HSE Induction Training conducted by COMPANY HSE Department. The same applies to CONTRACTOR's employees and employees of the Subcontractors, where the HSE Induction Training will be conducted by the 'COMPANY-trained' CONTRACTOR's key personnel. Records of 'Induction Training' for Key Personnel shall be maintained by Company HSE Department, Superintendent of the Contract, and Contractors. The Induction Training Record for all contractor and subcontractor employees shall be maintained by the concerned Contractor.

In the application for new employee's Gate Pass, the contractor/subcontractor shall ensure that the employee has completed the HSE 'Induction Training'. The employee's record for HSE Induction Training shall be submitted and counterchecked by the Superintendent of the Contract before approving the 'Gate Pass application' for the new contractor/ subcontractor employee(s).

7.3 CONTRACTOR'S HSE MEETINGS AND TRAINING

7.3.1 CONTRACTOR's HSE MEETINGS

CONTRACTOR shall hold at least monthly HSE meeting that will be chaired by the CONTRACTOR Site Manager and attended by representatives for each level of CONTRACTOR employees. The meeting agenda should include HSE records and activities, statistics, incidents, personal protective equipment and other employees' concern on safety at work. Minutes of meeting shall be prepared and issued to COMPANY Representative and copied to Team Leader, Safety.

On some HSE subjects, safety talks and toolbox meetings are the primary source of communicating safe work practices to Contractor and Subcontractor employees. CONTRACTOR should conduct the meeting daily, before work begins for the day or shift. It should be conducted for each craft by their supervisor at a predetermined place. Consideration should be in place to group the employees based on the language they understand (e.g. Malay, English, Hindi, Tamil, Chinese etc.). CONTRACTOR's higher site management and Safety Engineer shall demonstrate their support by attending these meetings periodically.

7.3.2 CONTRACTOR's HSE AND COMPETENCY TRAINING

CONTRACTOR Management responsibilities include establishing practices and procedure and ensuring that each CONTRACTOR's employee is provided a structured HSE and job competency training program as mentioned below. To ensure consistency in training needs identification, CONTRACTOR management can utilize the generic Training Needs Assessment Process guideline in appendix - J. Also, Contractor must maintain a training facility (i.e. classroom that shall be furnished with training equipment and materials such as laptop, projector, sound system, and training visual aids).

(a) HSE Training

Contractor shall identify HSE training needs for each craft / category and shall develop his own HSE Training matrix in line with the COMPANY HSE Training Matrix. Where available, key personnel of the contractor shall attend applicable HSE training imparted by HSE Department and in turn train all the remaining employees. Contractor should use available PEC training materials to train their respective employees and ensure that no aspect of the required training is missed out or omitted.

(b) Technical Training

The contractor shall provide Technical Training as required for each craft of the employee within the scope of contract. In this training program, CONTRACTOR employees shall be trained on all technical aspects of performing the task / operating the equipment, associated job hazards and the methods by which these hazards can be controlled.

(c) Certified training

Based on the scope of work of the contract, contractor custodian department should identify and develop Certified Training requirement for each craft / category of employees. The same shall be provided to each employee through PEC approved Third Party / Agency and shall include, but not limited to the following:

- Certified Trainers
- Crane Operator
- Forklift Operator
- Riggers and Rigging Supervisor
- Scaffolder and Scaffolding Supervisor
- Aerial Platform / Truck-mounted Lift Operator
- Fire Equipment Maintenance Technician
- Gas Testers & Detector Maintenance Technician

The CONTRACTOR shall arrange the above-mentioned training at their own cost and maintain documentation of the same. The documentation should include the names of those trained, course content, date and time and the names of the instructors. The COMPANY will periodically review the CONTRACTOR's training quality and records to verify that training is being conducted which meets the criteria, as per COMPANY Procedure on Development, Delivery & Monitoring of HSE Training.

The CONTRACTOR should provide a HSE Training Passport to all CONTRACTOR's employees which will keep register for the employee's record for training, medical check- up, among other things. The passport design should preferably COMPANY HSE Training Passport.

7.4 HSE COMMUNICATION AND COORDINATION

CONTRACTOR shall prepare and submit HSE Key Performance Indicators (KPIs) Scorecard as per the template at Appendix - A2. The HSE KPIs shall be utilized in the periodic Contractor's HSE Performance Review meetings. The KPIs will be issued by HSE Department every year after finalization of the Corporate KPIs for the concerned year. CONTRACTOR's Site Manager, HSE Engineer and Safety Supervisor shall attend COMPANY periodical meetings as required by COMPANY Representative or HSE Department. For all practical purposes, it should be the responsibility of the CONTRACTOR to have all its Subcontractors, Consultants, Suppliers/Vendors, etc. informed and involved in various HSE communication and coordination activities. These meetings should include the following:

a) CONTRACTOR's HSE Orientation

b) CONTRACTOR's Monthly HSE Communication Meeting

c) CONTRACT Manager HSE Performance Review Meeting

d) Zone/Area/Divisional HSE Committee Meetings

e) Project's Weekly Progress Meeting

f) Pre-Start-up meetings

g) And other HSE Meetings, as progressively required by the COMPANY

h) All salient points / critical issues discussed in the above quoted meetings should be submitted to PEC in written form

i) Records of these meetings should be available in a register for audit reference by authorized PEC HSE personnel

Respective CONTRACTOR's data and information relative to the following agenda should be presented in the meeting:

a) HSE performance in terms of accident / incident statistics of previous month and cumulative data for the fiscal year

b) HSE Training activities for previous month and planned training sessions for succeeding months

c) HSE Promotion and Awareness Campaigns

d) Job Inspections Schedule and compliance

e) Safety Performance Improvement Plans

f) CONTRACTOR's Safety Violations Record

g) Announcement on any Incentive Awards

CONTRACTOR shall track all HSE related recommendations to closure and periodically update COMPANY Representative and Safety Division on any action taken until the recommendation is completed or closed.

7.5 HSE INSPECTION / AUDIT

Formal and informal HSE inspection/audit may be conducted without notice by COMPANY. CONTRACTOR should fully participate in these audits and correct deficiencies identified during the inspection/audit. CONTRACTOR is required to make HSE documents and records available to COMPANY Representative upon request. These include, but are not limited to work procedures, training records, performance records, environmental records, licenses, permits, registrations and compliance plans.

Job HSE inspections/audits are visible signs to employees that HSE issues are appropriately addressed and managed. In addition, they provide for the identification of areas of potential loss and can be used to constantly monitor the effectiveness of the HSE Program. As with all HSE activities, the inspection/audit process needs to have well- defined objectives and designated participant, as follows:

a) CONTRACTOR's Top Management shall conduct periodic HSE visibility audit at their worksites. An annual schedule of this HSE visibility audit shall be prepared and submitted along with their HSE Plans at the initiation of the contract. The audit reports and report on tracking to closure on the gaps identified during the audits shall be submitted to the Superintendent of Contract during their performance feedback.

b) CONTRACTOR's Corporate Manager should carry out an annual assessment of their site supervision's HSE Performance and provide a written report to the COMPANY representative.

c) CONTRACTOR's Corporate Manager shall carry out 6-monthly audit on their Training Programme and activities and ensure that training quality and records meet COMPANY requirements and criteria.

d) CONTRACTOR's Job Managers (Site Engineer / Manager) should make a safety audit of the work area at least once a week using an inspection guide.

e) All CONTRACTOR'S Safety Personnel, including designated Safety Representatives, should make daily inspection of the work area. The inspection should be routine, planned, and designed to include communications with specific people in the work place, and not just a visual site visit.

f) CONTRACTOR'S Job Supervisors also should make daily inspection of their work areas for the specific purpose of correcting unsafe acts or hazardous conditions and for proper storage & disposal of the waste.

g) Contractor's Environment Engineer should make daily inspection of the work area. The inspection must include communications with specific people in the work place, and not just a visual site visit. Also, ensure Environment Management System (EMS) is followed/practiced.

CONTRACTOR's regularly planned inspection and audit should go beyond routine visual site checks. The result of these inspections/audits should be used for setting goals for future improvements. A written Inspection report shall be prepared and distributed to COMPANY Representative and HSE department.

These CONTRACTOR's inspections and audits should make use of detailed checklists, developed for each item such as electrical facilities, lock-out systems, scaffolding, industrial hygiene, occupational health, waste management, releases and emissions, fire prevention, personal protective equipment, training, hazardous material handling, housekeeping, hand and power tools, maintenance practices and machine or equipment guarding. There should be effective systems for monitoring the progress on action plan that was developed based on the inspections / audits.

7.6 RECORDKEEPING AND DOCUMENTATION

Records are required to support activities of Contractor HSE programs for both control and audit purposes. Records that shall be maintained and retained within the contract duration at the job site should include the following:

(a) First aid log of all first aid cases reported and treated, showing date, name of injured, job nature of injury and type of treatment given.

(b) All incident investigation report (i.e. injury, illness, traffic, property damage, environmental incident and as well as Near Miss Incidents).

(c) HSE meetings or toolbox meeting records or minutes showing date of meeting, who attended, the subjects discussed and who conducted the meeting.

(d) Job site inspection / Tool Inspection / audit reports and status of the action plans.

(e) Records to show dates, name of participants and subject of training programs.

(f) Lifting tackles and crane or equipment inspection records, 3rd party certificate.

(g) Infringement Reports and traffic violations

(h) Maintain all EMS required documents & records such as Environmental Aspect Register, Environment Incidents Reports, ISO 14001 Audit Reports, Environment Inspection Reports, Waste Transportation Manifest Records, Contractor Environmental Monthly Reports, EMS Training Records, EIA Study Recommendations, etc.

(i) Work Permit Risk Assessment

(j) Maintain Contractor's OHS Risk Register (i.e. in addition to PEC Custodian OHS Risk Register) and training records for OHSAS awareness to Contractor employees

(k) Medical Examination Records

(l) Monthly KPI Reports

7.7 CONTRACTOR HSE HANDBOOK / MANUAL

The CONTRACTOR should prepare an Employee HSE Handbook / Manual and issue to all of their employees at site. The CONTRACTOR handbook/manual should contain a statement of their respective Company Management Policy on HSE, the employee's HSE responsibilities and the HSE responsibilities of supervisors. If appropriate, important HSE procedures may also be included as well as information on such items as pictures of warning signs and hand signals for use in the operation of cranes. Written operating procedures as applicable should also be included in the HSE handbook/manual, giving a step-by-step procedure of carrying out the following activities (whichever are applicable):

1	Work Permit System & Awareness	16	Heavy Lifting Practices
2	Emergency Response	17	Handling and Storage of Hazardous Materials
3	Personal Protective Equipment	18	Accident Investigation and Reporting
4	Lock out / Tag out Procedure	19	Pollution Prevention, Waste Handling and Disposal
5	Gas Cutting & Welding	20	Significant Environmental Aspects related to Contractor's activity
6	Handling Compressed Gas Cylinder	21	Apex Manual for Environmental Management System (ISO-14001-2004)
7	Scaffolding and Ladders	22	Air Pollution Monitoring & Control
8	Electrical Safety	23	Monitoring of Wastewater Treatment & Disposal
9	Hand and Power Tools	24	Environmental Objectives & Targets
10	Radiation Safe	25	Guideline for Handling of Sludge
11	Occupational Health	26	PEC Environmental Legislative Register
12	Behavior Based Safety	27	Procedure on Environmental Impact Assessment
13	Excavation	28	Solid Waste Water Management Procedure
14	Barricades and Signs	29	Environmental Guidelines During Shutdown/ Startup
15	Surface Preparation and Painting		

The handbook should also stipulate the mandatory / optional HSE courses that shall be attended by each level of contract employee, and where these courses will be provided. The

first page of the handbook / manual may be perforated and used as a receipt showing that the employee has signed and received the HSE handbook. In addition, space should be provided for employee's record on training programs, orientation and safety talks.

8.0 SAFETY RULES AND PROCEDURES

CONTRACTOR should refer to applicable COMPANY Safe Work Practices and Procedures that are related to his contract and activities.

8.1 WORKING CONDITIONS

CONTRACTOR shall be responsible for ensuring safe working conditions of its employees and for correcting any hazard that arises in the performance of the Work. CONTRACTOR shall perform all work in safe manner and shall ensure to assess and assign the required number of supervisors as per the job requirements.

8.2 CRITICAL TASKS PROCEDURE

In coordination with the Superintendent of the Contract, the CONTRACTOR shall identify all critical tasks in the scope of their contract with the COMPANY including the conduct of Risk Assessments to identify hazards associated with such work.

The CONTRACTOR must develop Work Procedures for Safe Performance of these critical tasks, prepare Competency Training Matrix to carry out these critical tasks, and submit them for approval of Company at the initiation of the contract. The approved Critical Task Procedure shall be translated in the work group language as practicable. In addition, the CONTRACTOR shall take action to update/modify appropriate sections of the document (Critical T ask Procedure) based on updated Safety Studies, recommendations including 'Risk Assessment Exercises'.

For Projects Department contracts, Method Statements (in lieu of critical task procedure) shall be prepared for all critical tasks.

8.3 PERSONAL PROTECTIVE EQUIPMENT (PPE)

CONTRACTOR is responsible in providing CONTRACTOR employees the appropriate personal protective equipment. CONTRACTOR employees should be trained in the proper use and maintenance of PPE.

(a) CONTRACTOR shall provide CONTRACTOR's employees with the mandatory personal protective equipment and the personal protective / safety equipment as specified in the work permit. The contractor shall also provide additional PPE, if instructed for safe execution of the job. This will include respiratory equipment with the fit-test requirement and personal gas monitor. The mandatory PPE shall be periodically replaced with new ones, as deemed necessary.

(b) CONTRACTOR's PPE and other safety equipment shall conform to COMPANY Specifications and sample shall be approved by COMPANY Safety representative before procurement. Sufficient stock of mandatory PPE shall be kept and maintained at site.

(c) CONTRACTOR's Supervisor shall ensure that PPE are correctly used and maintained in good condition.

(d) CONTRACTOR shall strictly enforce all relevant requirements in compliance to COMPANY PPE Management System.

(e) CONTRACTOR employees and employees of Subcontractors shall wear safety helmet and flame-resistant coverall of the same color with logo/emblem of the main CONTRACTOR.

(f) CONTRACTOR shall ensure that PPEs have shelf life covering the duration of contract and shall replace expired PPEs with ones having sufficient shelf life with respect to project execution duration.

8.4 WORK AND SAFETY PROCEDURES INSPECTION

To ensure that CONTRACTOR's employees are performing the work in a proper and safe manner as required by the Contract, COMPANY representative may inspect CONTRACTOR's work and safety procedures including the use of protective equipment. If it is determined that the work is being performed in an unsafe manner, COMPANY representative shall require CONTRACTOR to stop the affected work and correct the unsafe condition immediately.

8.5 SMOKING AND CARRYING OF MATCHES / LIGHTERS

Smoking is prohibited in all COMPANY Restricted Areas except in authorized smoking areas/shelters. Approved smoking area shall be clearly identified.

Carrying of matches and lighters into the Hazardous Area is prohibited. Violators will be refused entry into the Restricted Area and shall be dealt administratively on the first violation.

The following rules apply to smoking in the Refinery and other COMPANY restricted areas:

a) Smoking is only permitted at designated "Smoking Area/Shelter".

b) There must be a sand bucket at the "Smoking Post."

c) Smoking privileges may be revoked indefinitely during emergencies.

d) Smoking in unauthorized areas will result in automatic dismissal.

CONTRACTOR shall be responsible for strict adherence to these Regulations by CONTRACTOR’s employees or the employees of CONTRACTOR’s Subcontractors.

8.6 BATTERY OPERATED AND ELECTRICAL ITEMS

Non-intrinsically safe battery operated items e.g. flashlights, mobile phone, etc. are not permitted inside the Hazardous Area.

Electrically operated tools & equipment should be suitable for use as per the area classification. Refer to relevant HSE documents such as Hand and Portable Power Tools Safe Work Practices, Work Permit System, Fire Prevention and Electrical Safety.

8.7 FIRE FIGHTING EQUIPMENT

CONTRACTORS shall furnish all portable fire extinguishers and safety equipment required at construction / maintenance sites during construction / maintenance job. The fire extinguishers shall be certified by COMPANY Fire Section and proper tag / sticker shall be provided by the CONTRACTOR.

CONTRACTORS shall not use, alter, or move COMPANY firefighting equipment. Firefighting equipment shall be accessible at all times. In the event of a fire, CONTRACTOR shall move CONTRACTOR's employees away from the vicinity of the fire and out of the way of firefighting activities in an orderly manner.

8.8 SCAFFOLDING AND LADDERS

All scaffolds shall be erected by competent and qualified personnel and shall conform to requirements of COMPANY Guidelines and Safe Work Practices for Scaffolds and Ladders. These requirements include the mandatory inspection, tagging, approval, and certification of erected scaffold before use.

CONTRACTOR's scaffold material samples shall be approved by COMPANY Engg. & Services Division (or equivalent Division for Projects & LM) based on third party certificates prior to procurement.

8.9 USE OF RADIOACTIVE MATERIAL

Only authorized personnel holding valid 'Radiation Work Permit License' issued by Ministry of Health / Radiation Protection Division shall handle radioactive material.

CONTRACTOR shall comply with all HSE precautions and requirements as specified in relevant clauses of COMPANY Procedures and Guidelines on Work Permit System, Handling and Storage of Hazardous Materials and Environmental Guidelines / DOE Regulations / MOH Regulations.

CONTRACTOR shall ensure that the following basic rules are strictly enforced:

a) The ionizing radiation source shall not be left unattended

b) Radiation film badge / Dosimeter shall be used

c) The exposure area shall be clearly identified, barricaded by rope or other effective means and radiation warning signs posted

d) CONTRACTOR shall coordinate with COMPANY Inspection Representative to ensure that, the Dose Rate at the barricade does not exceed 0.25 milirems per hour

e) CONTRACTOR shall ensure availability of radiation survey meter at work site of radiography

f) CONTRACTOR shall give 12 hours prior notice to COMPANY Team Leader Inspection & Corrosion before starting any radiography work inside refinery

8.10 COMPRESSED GAS CYLINDERS

CONTRACTOR shall comply with the COMPANY requirements for storing, handling, transporting and using of compressed gas cylinders.

8.11 OVERHEAD WORK

When working overhead, the area below shall either be barricaded and posted with a sign indicating "DANGER - WORK ABOVE", or someone shall be stationed at ground level to caution persons approaching the area where work is being done overhead. The following rules shall be adhered to:

a) Climbing on valves and equipment, instead of setting up ladders or scaffolding, is not permitted.

b) Walking on pipe ways, unless dictated by the work being performed, is prohibited.

c) Walking on conduit or insulated piping is not permitted.

d) Oxygen and acetylene bottles shall not be used from baskets or manlifts and may not be hoisted uncapped.

e) Use of fall protection is required when working aloft (see PPE).

8.12 LOCKOUT / TAGOUT, EQUIPMENT ISOLATION

Lockout/Tagout is the de-energizing, isolating, and securing of all energy sources of equipment in a safe position before beginning work, to protect from the unexpected energization of that equipment.

COMPANY's Lockout/Tagout procedures must be followed before making any repairs or adjustments to electrical, pneumatic, hydraulic, thermal, gravity, or radiation equipment. CONTRACTORS can only tag and lock out equipment as instructed by the appropriate COMPANY authorized personnel.

8.13 ROADWAYS

No roadway may be barricaded or blocked in any way without written approval from the COMPANY’s Safety Representative. Use of a flagman is required to direct traffic around congested areas. Road workers and workers on roadsides shall wear reflective orange color coverall or jacket.

Barricades, temporary walkways, signs, etc. should be provided for the safety of pedestrians and roadside facilities. Barriers shall be equipped with reflectors or lights so that it is readily discernable at night.

Closure / detour of critical roads shall be scheduled on weekends / holidays after securing permission from Safety Division. Hard barricades shall be provided for all excavation nearby roads.

8.14 STAGING AREAS

CONTRACTORS shall obtain written approval from the COMPANY Representative prior to setting up work staging areas.

8.15 REMOVING PROPERTY FROM COMPANY PREMISES

Whenever a property of CONTRACTOR or COMPANY is to be taken outside the COMPANY premises, CONTRACTOR's Site Manager/Engineer shall obtain prior written approval from the COMPANY Representative to remove such property. The approval shall be presented to the guard at the gate where exit is made. For transporting waste outside the refinery premises, the Waste Transportation copy shall be shown to the guard at the gate.

8.16 VEHICLE / EQUIPMENT SAFETY CERTIFICATE

All vehicles and engine driven equipment entering COMPANY premises require a 'Safety Certificate' as such, CONTRACTOR should meet the following general requirements:

CONTRACTOR'S Vehicle or mobile equipment shall be in good condition and meet the requirements of 'Vehicle and Equipment Safety'. The number of vehicles/ mobile equipment shall be kept to the minimum essential for the site personnel and work requirements.

(a) CONTRACTOR'S vehicle or equipment shall be provided with the right type and size of fire extinguisher certified by COMPANY Fire Section.

(b) An approved type of spark arrestor shall be fixed to the exhaust of equipment and vehicles entering hazardous area. Pool cars or buses shall not be allowed to enter hazardous area. Mobile equipment, lifting appliances and vehicles to load or unload material shall only be allowed with work permit and prior authorization.

(c) In addition, CONTRACTOR'S lifting equipment shall have a valid load test certificate from a COMPANY approved third party. Safety valves on mobile equipment shall also be third party certified.

(d) For CONTRACTOR'S vehicle or mobile equipment entry to the refinery, it shall be certified by COMPANY Safety representative and the Safety Certificate shall be made available with the vehicle/equipment.

(e) CONTRACTOR shall maintain a valid Safety Certificate and present to the issuing authority when applying a hot work permit, for writing its number on the permit.

(f) Copy of Safety Certificate shall be attached when applying security gate passes for CONTRACTOR'S vehicles/mobile equipment to enter restricted area. Uncertified vehicles/equipment shall not be permitted to enter COMPANY premises except for one day/ single trip passes issued to vehicles other than cranes, forklifts, boom truck and other lifting appliances.

(h) CONTRACTOR is responsible for maintaining the vehicle/ equipment in "as certified" condition during the validity of the certificate.

8.17 HSE BOARDS AND SIGNS

CONTRACTOR should provide/install proper and appropriate HSE Boards and Signs in their jobsites, yards, workshops, site offices, temporary facilities, roads, transport buses, etc. as per COMPANY HSE Boards and Signs Management System.

Contractor shall provide boards mentioning project details and PEC Contract Custodian with emergency contact numbers at their site offices and yards. HSE statistics shall also be displayed on boards.

8.18 WELDING AND CUTTING

CONTRACTOR should obtain a Hot Work Permit prior to any welding works in COMPANY premises and all requirements pertaining to hot work shall be strictly enforced. Only a COMPANY approved type of Welding Drapes (flame-proof tarpaulin canvass) shall be used.

The welder shall not be allowed to work alone. CONTRACTOR's welder and helper shall be trained on first aid firefighting. CONTRACTOR's two fire extinguishers shall be provided with each welding machine, one to be kept at the work and the other at the machine. COMPANY extinguishers shall not be used for this purpose.

For CONTRACTOR's welding work in running process units or piping, a CONTRACTOR employee shall be assigned as "fire watch" who is familiar with the use of fire equipment provided and have the knowledge of anticipated fire hazards and company's incident reporting procedure.

When welding work is carried out in a workshop or any similar location classified as a permit free area, which is approved by COMPANY Safety, a work permit is not required but the work shall be adequately supervised. The work area shall at all times be kept clean of combustible and flammable material.

8.19 MARINE TERMINAL SAFETY

CONTRACTOR shall ensure the full implementation of all relevant HSE rules and procedures for the operation, maintenance and construction activities at COMPANY Marine Terminals, Intake and Off take activities and also to some extent, the area of Port.

All safety precautions, including the wearing of personnel protective equipment, that are applicable to onshore are applicable to offshore and any site connected to the shore.

9.0 ENVIRONMENT RULES AND PROCEDURES

CONTRACTOR should be familiar and continuously comply with all applicable HSE codes, standards, and Malaysia Environmental laws and regulations applicable to the work. In the event CONTRACTOR has any questions about its responsibilities under such laws, CONTRACTOR shall contact the COMPANY Representative or Environmental Division.

The CONTRACTOR should adhere to applicable national and international Environmental Regulations and COMPANY Procedures while carrying out job in COMPANY premises. The ultimate aim is to control pollution at source, handle and dispose the waste in an environmentally friendly manner thereby protecting the environment.

9.1 LIQUID EFFLUENTS

The liquid effluent generated, while carrying out the contracted job and related activities at work site, shall be routed to designated drainage system as per advice of the COMPANY representative which shall be treated in waste water treatment system.

9.2 HANDLING OF CHEMICALS

The CONTRACTOR shall follow the DOE regulations mentioned under “Chemical Resource Management” and abide by the environmental conditions and criteria stipulated therein.

9.3 AUTO EXHAUST EMISSION

Vehicle used for carrying out the contracted job by CONTRACTORS shall meet the guideline for the motor vehicle exhaust gas and noise emissions standards norms defined by Department of Environment Malaysia.

CONTRACTOR shall ensure those DOE standards/methods in these regards are met. CONTRACTOR has to get the vehicles’ auto exhaust emission done once in every six months or as per DEO requirements, by an DOE approved party and submit report to COMPANY HSE Division through the COMPANY representative.

9.4 WASTE MANAGEMENT SYSTEM

CONTRACTOR shall ensure their full compliance to COMPANY Solid Waste Management Procedure. The following Waste Tracking Scheme shall be administered to effective document (and audit) the record of handling, transfer and disposal of waste substances arising out of Contractor’s activities:

a) A license from DOE shall be obtained by the CONTRACTOR in order to collect and transfer waste as required DOE regulations. The license shall have a validity date.

b) The CONTRACTOR shall ensure that a PEC approved Material Safety Data Sheet (MSDS) is available at work site for all the hazardous material, chemicals, handled by the contractor.

c) Appropriate Waste Transportation Manifests shall be used as per COMPANY Solid Waste Management Procedure. The type of waste and its quantity and quality should be specified in manifest along with other details. Waste shall be transferred to special sites determined by DOE Malaysia.

d) CONTRACTOR should handle the export of dangerous / hazardous wastes (which are generated from the refinery) as per the regulation of DOE Malaysia.

e) CONTRACTOR shall submit necessary record of documents such as weighbridge ticket, waste transportation manifest to COMPANY representative and the same shall be maintained all the time for verification.

9.5 CLEAN-UP ACTIVITIES

The CONTRACTOR is responsible for clean-up or remediation activities and cost incurred in case of any waste (hazardous/non-hazardous) leak or spillage due to their activities within COMPANY premises or outside the road/any other places while shifting the wastes.

The CONTRACTOR will be responsible to contain the releases/pollution caused due to their activities/negligence within COMPANY premises and outside.

9.6 GENERAL ENVIRONMENTAL WORK PRACTICES

a) CONTRACTOR shall only use environmentally friendly material. Guidance on environment friendly building materials (Managing Indoor Environment Quality during Construction, Renovation & Demolition of Buildings) shall be followed.

b) The CONTRACTOR shall follow the Engineering & Environmental requirements of industrial sector (petroleum and refinery industry activities) as mentioned under DOE regulations.

c) The CONTRACTOR shall follow the relevant DOE regulations, i.e. Engineering and Environmental requirements of industries sector depending upon the activities/ job performed by them.

d) Contractor shall review all relevant activities and develop an Aspect Register. All the CONTRACTOR's employees working at site should be aware of environmental aspects of the task and their impact on environment. The CONTRACTOR shall keep a dedicated file for EMS comprising of the following:

- List of significant aspects associated with their activities along with controls.
- Company HSE Policy
- Training records of their employees

e) Besides the abovementioned DOE regulations and other guidelines, all relevant DOE regulations should be followed and complied with by the CONTRACTOR depending upon the task and related activities involved. (CONTRACTOR shall refer regulations and legislations for relevant applicable appendix/articles related to their nature of activities/duties).

f) The CONTRACTOR shall have a periodic environmental awareness programs / schedule to all CONTRACTOR employees. CONTRACTOR has to coordinate and inform COMPANY Environment Division of Refineries or Fire & Safety Section of Local Marketing in conducting these programs.

g) The CONTRACTOR shall be responsible at his own cost for disposal of contractor's activity generated garbage, sewage, waste, solid waste, surplus excavated materials, etc. to dump yard outside the refinery area which is approved by the Company and Malaysia Department of Environmental (DOE). The CONTRACTOR shall take necessary action at his own cost for any treatment required as per DOE and Company Environment Management System and Procedure. A detailed report on this activity shall be submitted to the Company.

10.0 OCCUPATIONAL HEALTH GUIDELINES
10.1 INDUSTRIAL HYGIENE

10.1.1 CONTRACTOR shall make all arrangements for close adherence to Occupational Health requirements and guidelines of Malaysia Labor law, DOE, Ministry of Health and Governmental Agencies and COMPANY standards and guidelines that are already published, and as and when they are amended or come up based on inspection and audits.

10.1.2 Implementation of the above requirements may need qualified personnel, measurement devices and other resources which CONTRACTOR shall arrange at its own expense.

10.1.3 CONTRACTOR shall be responsible for;

(a) Indoor environment quality of buildings under their control shall be as per COMPANY HSE document.

(b) Portacabin and other facilities shall meet COMPANY specifications and shall be approved by Superintendent of Contract prior to site mobilization/ occupation.

(c) Sanitary facilities under their control

(d) Personal exposure monitoring *for exposure to toxic chemicals, dusts, vapors etc.*

(e) Maintenance of industrial hygiene records as per company standards and requirements.

(f) Training and awareness of their employees on occupational hygiene issues.

(g) Participate in occupational health audits, inspections and surveys as per the program laid down by company.

(h) Implementing *all the Industrial Hygiene programs* the program for its subcontractors.

10.1.4 Where required, personnel exposure monitoring shall be done by respective contractor and necessary action shall be taken to control the hazards.

10.1.5 CONTRACTOR shall develop and implement the following programs as per COMPANY standards.

(a) **Chemical Hazard Management Program** : A few major requirements are provided below.

- Contractor shall have all the chemicals (e.g Catalysts, Dosing chemicals, refractory, insulation, paints, thinners, adhesives, varnishes, sealants etc. This is only an indicative list. Detailed information is available and approved by COMPANY HSE Dept. before bringing them inside the company premises. Use these guidance in this regard. In case an already approved chemical is declared as banned by regulatory authorities, COMPANY has the right to enforce the ban on such chemicals.
- Store & handle chemicals as per COMPANY standards.

(b) **Chemical Hazard Communications Program** : Contractor shall ensure compliance to COMPANY's Chemical Hazard Communications Program. A few major requirements are provided below.

- Latest (*dated within 3-years*) Material Safety Data Sheet (MSDS) is available at work place and accessible to all employees.
- Labeling system is applied and followed as per COMPANY standards.
- All employees are trained on MSDS, labeling systems, and handling of hazardous chemicals and training records are maintained.

(c) **Respiratory Protection Program**: Contractor shall comply with COMPANY Respiratory Protection Program. In general, Contractor shall ensure that

- Respiratory hazards are identified at workplace and all employees have been trained and training records are maintained.

- Approved types of respiratory protective equipment are provided to the employees exposed to respiratory hazards.

- Refer to Appendix-P for the requirements for Training, equipment specifications and sample respirator use Authorization card.

(d) **Hearing Conservation Program**: Contractor shall comply with PEC Hearing Conservation Program. Contractor shall ensure that:

- Personal monitoring of all employees working in the identified high noise areas has been done. (Advice of the company representative can be availed if required).
- Approved types of hearing protection equipment are issued to all employees working in high noise areas.
- Employees working in high noise areas are trained on use of hearing protective equipment and the hazards on noise.
- Annual audiometric tests are carried out as per clause 9.2.1 below and records are maintained.

(e) **Ergonomics Program**: Contractor shall comply on Industrial Ergonomics requirements as specified under procedure of HSE. Contractor shall ensure that ergonomic hazards are dealt, personnel are trained, work station and working spaces are ergonomically provided.

(f) ***Thermal Stress Management Program*** *: Implement Thermal Stress Management program as per COMPANY HSE procedure*

10.1.6 CONTRACTOR shall ensure that a copy of COMPANY approved MSDS is available along with the hazardous material when making delivery to any COMPANY premises. The MSDS document shall be a mandatory requirement in the processing of Material Gate Pass application and approval.

10.1.7 CONTRACTOR shall implement control measures as recommended by the COMPANY and Government Authorities.

10.2 OCCUPATIONAL MEDICINE

10.2.1 MEDICAL EXAMINATIONS

Company places much importance to maintenance of able and healthy workforce. Contractor shall make all necessary arrangements and ensure that all the employees undergo

(A) Pre-Employment and

(B) Periodic Medical Examinations for all employees and the

(C) Confine Space entry fitness examination for those required to enter confined spaces as required by the PEC HSE policy. The major medical requirements is shown in Appendix M. Further details are mentioned in the above referenced documents.

All cost of the Medical Examinations, as depicted in Appendix-M, shall be borne by the Contractors.

The Medical Examinations shall be done at the PEC approved clinics and the Contractors shall be duly informed whenever list of approved clinics are revised. The examining physician shall record the findings in the Health Assessment Form provided by PEC and attach the copies of medical reports.

The final medical fitness for Confined Space Entry shall be approved only by PEC OH Physician. Contractor shall employ a nurse registered with MOH to maintain records of Pre-Employment, Periodical, CSE medical fitness examinations for the entire duration of the project / contract and ensure confidentiality.

The contractor shall submit the following documents to Company representative for audit, and whenever asked:

- List of employees with status and date of Pre-employment and Periodic Medical Examinations and CSE.

- List of employees eligible for medical surveillance examination for noise, ionizing radiation, and specified chemical and biological agents with status and date of the examination.

- Copies of medical examinations done, including forms duly filled and signed by the examining physician, and applicable tests results such as audiogram and Spirograph.

- Any documents required by PEC Medical division accordingly.

Contractor shall also comply with other occupational medical procedures like Medical requirements for food handlers, medical surveillance for specified chemicals, Ionizing Radiation, Hearing Conservation program etc. These are mentioned in respective HSE procedures.

10.2.2 FIRST AID KIT AND NURSES

The contractor shall provide first aid kits as per HSE procedure, at the rate of one for every 100 employees. The first aid kits shall contain antiseptics, bandages and

medicines with valid expiry date, at all times. The first aid kit shall be placed in a visible point at the work place, within the reach of workers. A trained nurse registered with the Ministry of Health Malaysia shall be in-charge of first aid kits. The first aid shall be administered by the nurse or trained first aider. The contractor / nurse must maintain date wise records of work related injuries and illnesses and cases to which first aid is given.

Nurse shall be approved by Ministry of Health and PEC Medical Division. Contractors first aid facilities shall be periodically audited by PEC.

First Aid room shall be cleaned and maintained in good hygienic condition.

10.2.3 MAINTAINING OF RECORDS

The contractor shall retain and preserve medical records of employees for duration of employee's employment with contractor plus 10 years after the employee has discontinued the job with the contractor, or as laid down by the law, whichever is maximum.

11.0 WELFARE OF CONTRACTOR EMPLOYEES

CONTRACTOR shall adhere to COMPANY guidelines and requirements for Contractor employees' welfare, as per (Workers Welfare Guidelines for PEC Contractors).

CONTRACTOR shall offer improved welfare (i.e. housing, food, transportation, and working & living conditions) for his workers to improve their capability to do their work. Also, the CONTRACTOR must obtain approval on the housing prepared for his labours from the Ministry of Health and DOE.

PEC Superintendent of the Contract shall organize a multi-discipline Team to inspect the CONTRACTOR's labours housing and other Contractor employees' welfare to ensure compliance to these requirements.

11.1 PERSONNEL TRANSPORTATION BUSES

Contractor shall provide an air-conditioned transportation buses for its employees from their company accommodation to worksite and vice versa. Transportation buses shall be provided with sun film / tint as protection against heat radiation.

Contractor's Personnel Transportation Buses shall not be more than five (5) years old.

12.0 COMPANY WORK PERMITS

As a general principle, no work in the COMPANY Controlled Areas can be carried out unless authorized by a cold or hot work permit, except those specified in the COMPANY Guidelines and Procedures for Work Permit System. The nature of work may also require additional authorization, such as Confined Space Entry Authorization, Excavation Authorization, Electrical Isolation, etc.

CONTRACTOR shall obtain appropriate written work permit (and additional authorization if required) through its COMPANY Representative before starting any work and an approved copy of the permit must be posted at the job site.

CONTRACTOR shall arrange with COMPANY representative on the approval requirements for 'Work Permit Authorization', and other essential authorization, where the training class and necessary test requirements are conducted at COMPANY HSE Training Center.

13.0 REGULATORY PERMITS

Except as otherwise provided herein CONTRACTOR shall, as CONTRACTOR's sole responsibility, and at CONTRACTOR's sole cost and expense, research, determine and obtain any required governmental permits, licenses, bonds, inspections, and notices required by laws, rules, or regulations to perform the work.

14.0 EMERGENCY RESPONSE AND INCIDENT REPORTING

14.1 EMERGENCY RESPONSE

CONTRACTOR must have own ERP that shall compliment the requirements of PEC ERP. CONTRACTOR shall ensure that Contractor and Sub-contractor employees clearly understand their responsibility for an appropriate emergency response as per the COMPANY ERP and Evacuation Plan through awareness / refresher training and Safety Talks. CONTRACTOR shall conduct periodic drills of its ERP in consultation with PEC ERP Drill Administrator.

In the event of a fire, CONTRACTOR shall move Contractor and Sub-Contractor's employees away from the vicinity of the fire and out of the way of firefighting activities in an orderly manner.

14.2 PERSONAL INJURIES

CONTRACTOR shall be responsible and pay for the cost of all necessary first aid, ambulance, and hospital services in case of accident or injury to CONTRACTOR's employees. All injuries sustained by the employees of CONTRACTOR while on COMPANY premises shall be reported immediately to the COMPANY representative and the work permit Issuing Authority.

14.3 INCIDENT INVESTIGATION AND REPORTING

CONTRACTOR should meet their responsibilities as per the COMPANY Incident Investigation and Reporting Procedure. Such incident shall include near miss, personnel injury, occupational illness, and release and spill of pollutants.

15.0 MINIMUM HSE REPORTS & RECORD REQUIREMENTS.

The CONTRACTOR shall prepare and submit the following monthly reports (through COMPANY representative) to COMPANY Team Leader Safety and COMPANY Team Leader Environment within the first two working days of the following month.

15.1 CONTRACTOR's monthly Safety and Occupational Health Statistics Report containing manhours, personal injuries, other incidents, training and audits. (Refer Appendix-A1)

15.2 CONTRACTOR's monthly Environmental Reports that should include the following: (also, refer to Appendix-B)

(a) Details of Waste Water Generation
(b) Details of Solid / Semi Solid Waste
(c) Environmental Incident
(d) Environmental Awareness Training to Employees

16.0 HSE PERFORMANCE, INCENTIVE REWARD AND PENALTIES

16.1 CONTRACTOR'S HSE PERFORMANCE EVALUATION

A periodic (quarterly) evaluation on Contractor's HSE Performance within the duration of their contract in the Company will be coordinated by the 'Superintendent of the Contract' by utilizing the evaluation form depicted in annexure C. This periodic HSE Evaluation Report will be used as reference in various purposes such as recommendation for incentive reward, Contractors' HSE Performance profiling, *Vendors & Contractors Evaluation Process*, amongst other things.

Project Manager/Contract Management Executive shall be held personally responsible for Contractor's HSE performance in case of consistent substandard performance. Company reserved the right to take action against him including his termination, *as per the criteria and guidelines from Vendors & Contractors Performance Evaluation Process document*. His future hiring for PEC contract shall be subject to acceptable past HSE performance.

16.2 INCENTIVE REWARD

CONTRACTORS who strictly adhere to COMPANY Regulations may be recognized and awarded through the COMPANY's 'Contractor HSE Reward and Deduction Scheme'. The recommendation for the Incentive Reward / Deduction shall be initiated by the COMPANY representative (Superintendent of the Contract), concurred by Team Leader-Safety, and shall be approved by concerned Department Manager and respective DCEO.

16.3 HSE INFRINGEMENT AND PENALTY SCHEME

All CONTRACTORS and CONTRACTOR employees working in COMPANY Controlled areas shall comply with the COMPANY HSE Procedures, Guidelines and Safe Work Practices. Violation of these COMPANY Procedures / Guidelines / Safe Work Practices shall be dealt according to penalty system for CONTRACTORS, as depicted in Appendix- E. COMPANY HSE representative shall decide whether an infringement is minor or major for violations which are not listed in the penalty system and shall be based on the Guidelines for Penalty System for HSE Violations.

COMPANY HSE Team Leader is authorized to issue infringement report to the COMPANY representative (Superintendent of the Contract*)* by using the 'Infringement Report Form' in Appendix - D. The Superintendent of the Contract shall take necessary action and provide feedback to COMPANY HSE Team Leader.

17.0 COMPANY MANAGEMENT SYSTEMS

17.1 SUPPORT RESOURCES

COMPANY HSE Department shall assist in the implementation of this document.

17.2 MANAGEMENT RECORDS

All records must be maintained in compliance with this document by the user.

17.3 AUDIT REQUIREMENTS

CONTRACTOR's compliance on the application of this document shall be reviewed periodically based on COMPANY Performance Standard for Inspection of Contractor's Compliance to Pre & Post-Mobilization HSE.

17.4 DEVIATION PROCESS

Deviations from this document must be authorized by concerned PEC Department Manager after consultation with Manager-HSE. Deviations must be documented, and documentation must include relevant facts supporting the deviation decision.

18.0 COVID-19 – Health, Safety and Environmental Risk Assessment

Currently the entire world is facing a pandemic situation due to covid-19 crises and it has major impact on the global economy. Such kind of situation generally faced by mankind in century, and it may change the complete lifestyle of each individual around the world. As this virus (covid-19) is highly contagious disease that can have severe effect on people, especially those who are vulnerable. This virus passes from person to person in communal areas and where it is not possible to maintain safe distancing. If a person is infected in a workplace, he can pass the virus to his families and those who are in close contact with him. The most vicious aspect of this virus is that a person can spread the virus without any symptoms and that make this virus more dangerous.

During the covid-19 pandemic it is essential that the workplace is protected to minimize the risk of the infection spreading.

Various guidelines, control measures, risk assessments at workplace and offering specific activities for essential services norms issued by Ministry of Health from each country. Currently all the countries are racing to develop covid-19 vaccines.

It is therefore, important for PEC to issue the policy and guidelines to deal with covid -19 situations and airborne transmission to prevent virus during the constructions and operations phase of the PEC project.

The following points are the examples of measures that should be considered when undertaking a risk assessment and guideline to be issued for site specific risk assessments procedures for shutdown.

1. **Emergency Planning and Response**
    - Plan for emergencies for unforeseen events such as pandemic disease (covid-19) situation can happen, so it is important to have a protocol in place that

clearly outlines contact points and specific steps that must be taken for prick action in the event of an emergency during site inactivity.

- Designate person for monitoring activities like severe weather condition, inspect critical sumps, gutters, storm water drainage to ensure good operation conditions.
- Ensure supply for essential services like water management, waste management and installing remote monitoring devices for effective management

2. Communications

- Inform the insurance company that company have unoccupied construction site and advise them of the precaution company is taking to reduce and mitigate the risk at site. Review insurance policy to make sure that site is properly covered. Review and update contact name and numbers to report a claim.
- Ensure insurance coverage for the first party claims such as workers compensation for such pandemic and covering the aspect of builder's risk related to procurement and supply chain disruptions are likely to causes delays to schedules and substantial or final completion of project.
- Notify local authorities and emergency responses organizations including police, fire department, local hospital that construction site is unoccupied. Provide them the contact information in case of emergency.
- Update post emergency contact numbers regularly and make sure the availability on the gate and along the perimeter fences.
- Providing updated information, guideline for all the people with various communication methods.

3. Site Security

- Identify potential safety hazards in terms of unknowing public, unknown vehicles and trespassing that may come in contact with the work site.
- Secured the entire site premises and install perimeter fences and repair if necessary.
- Install CCTV cameras with remote monitoring, where applicable, make sure the lighting protection system and ensure security alarm system / monitoring in place and working.

4. Site Supervision

- Conduct frequent regular site visits of the unoccupied property at different times of the day to note any changes.
- Checking of all site equipment's, non-essentials machinery, tools, ladders and scaffolding to be removed from the site.
- All sources if water for non-essential applications should be turned-off unless lack of water would cause damage to equipment or building systems. Water to essential services such as fire protection and life system should be maintained in full service.

5. Offices / Materials and Vehicles

- Maintain housekeeping in good order and removal of all the hazardous and chemical items from the site.
- All the office equipment, computer, copiers should be securely locked.
- Securely lock all the construction vehicles and key will be at the security gate. All the batteries to construction vehicles kept onsite should be disconnected.

Constructions or Operations Risk Assessment

If company need to slow down the operations for run the site operations, if that case scenario company need to do the risk assessment and control measures to deal with covid-19 situations

Hazard	Risk	Control measures	Persons at risk
Exposure from others due to: 1) Living with someone with a confirmed case of COVID-19. 2) Have come into close contact (within 1 metres for 15 minutes or more) with a confirmed case of COVID-19. 3) Being advised by a public health agency that contact with a diagnosed case has occurred.	High	● Continue following government action of self isolation and only to leave house on the following circumstances: for medical reasons; to shop for necessary food supplies; for exercise; and for work where you cannot do this at home ● Any existing individual risk assessments (disability, young persons or new / expectant mothers) to be reviewed ● Maintain contact with line management and Human Resources (HR) and to follow company policy / guidance. ● Travel is only required where you cannot work from home. Use private transportation, cycle or walk. As a last resort public transport to be used as a minimum and to implement social distancing where possible ● To continue following ongoing government guidance Stay at home and only attend hospital in an emergency. Do not attend GP surgery and phone National Care hotline (1800-202-6868) if further advice is required	Individual workers

		● Company to ensure extremely clinically vulnerable persons do not come to work and continue to shield themselves whilst following their specific medical advice issued to them ● Follow good MOH hygiene measures at all times ● Avoid all visitors to your home unless they are providing a medical requirement ● Do not approach delivery staff, allow packages to be left on the doorstep ● Do not take any antibiotics as they do not work against viruses.	
Suspected case whilst working on site	High	If a worker develops a high temperature or a persistent cough while at work, they should: 1) Return home immediately 2) Avoid touching anything 3) Cough or sneeze into a tissue and put it in a bin, or if they do not have tissues, cough and sneeze into the crook of their elbow. 4) They must then follow the guidance on self-isolation and not return to work until their period of self-isolation has been completed. 5) The work area should receive deep cleaning and social distancing maintained	Individual workers
General travel including foreign travel	High	● Do not travel unless you cannot work from home or deemed a key worker – implement teleconferencing for meetings ● Where an individual has recently travelled abroad, they must self isolate for 14 days ● Please continue to follow any further national government advice provided ● Where an occupational health (OH) service provider has been appointed, please seek additional advice or concerns through this service ● All persons to limit their use of public transport. Where travel is essential, please use private single occupancy where possible, cycle or walk	Individual workers
Access / egress to site	High	Where possible, please consider and implement the following practices: 1) Ensure all extremely clinically	Individual workers

		vulnerable persons do not attend site 2) Stop all non-essential visitors 3) Log all visitors to site 4) Introduce staggered start and finish times to reduce congestion and contact at all times 5) Monitor site access points to enable social distancing – you may need to change the number of access points, either increase to reduce congestion or decrease to enable monitoring 6) Remove or disable entry systems that require skin contact e.g. fingerprint scanners and look to increase cleaning or removal of common 'touch points' on site 7) Require all workers to wash or clean their hands before entering or leaving the site 8) Allow plenty of space (1 metres) between people waiting to enter site 9) Regularly clean common contact surfaces in reception, office, access control and delivery areas e.g. scanners, turnstiles, screens, telephone handsets, desks, particularly during peak flow times 10) Reduce the number of people in attendance at site inductions and consider holding them outdoors wherever possible 11) Drivers should remain in their vehicles if the load will allow it and must wash or clean their hands before unloading goods and materials. 12) Designate walking routes and one way systems with signage to help maintain social distancing 13) Additional parking and cycling facilities to be implemented to encourage those to avoid using public transport when travelling to work	
Inclement weather – cold temperature	Low	● All persons to dress appropriately for the weather ● Welfare facilities provided to shelter from the elements ● Maintain good hygiene measures at all times	Individual workers

		● PPE on individual issue basis and not to be shared	
Poor hygiene	High	● Wash your hands thoroughly and regularly. Use soap and water for at least 20 seconds. Use alcohol-based hand sanitiser if soap and water is not available and hand washing technique to be adopted as directed by MOH ● Avoid touching your face/eyes/nose/mouth with unwashed hands and cover your cough or sneeze with a tissue then throw it in the bin. ● Provide additional hand washing facilities to the usual welfare facilities if a large spread out site or significant numbers of personnel on site ● Regularly clean the hand washing facilities and check soap and sanitiser levels ● Provide suitable and sufficient rubbish bins for hand towels with regular removal and disposal. ● Sites will need extra supplies of soap, hand sanitiser and paper towels and these should be securely stored. ● Restrict the number of people using toilet facilities at any one time e.g. use a welfare attendant Wash hands before and after using the facilities Enhance the cleaning regimes for toilet facilities particularly door handles, locks and the toilet flush Portable toilets should be avoided wherever possible, but where in use these should be cleaned and emptied more frequently	Individual workers
Canteen - exposure from large numbers of persons	High	1) The workforce can stay on site once they have entered it and not use local shops to limit contact with others. 2) Dedicated eating areas should be identified on site to reduce food waste and contamination 3) Break times should be staggered to reduce congestion and contact at all times 4) Hand cleaning facilities or hand sanitiser should be available at the entrance of any room where people eat and should be used by	Individual workers

		workers when entering and leaving the area 5) The workforce should be asked to bring pre-prepared meals and refillable drinking bottles from home 6) Workers should sit 1 metres apart from each other whilst eating and avoid all contact 7) Where catering is provided on site, it should provide pre-prepared and wrapped food only - Payments should be taken by contactless card wherever possible and Crockery, eating utensils, cups etc. should not be used 8) Drinking water should be provided with enhanced cleaning measures of the tap mechanism introduced 9) Tables should be cleaned between each use 10) All rubbish should be put straight in the bin and not left for someone else to clear up 11) All areas used for eating must be thoroughly cleaned at the end of each break and shift, including chairs, door handles, vending machines and payment devices.	
Use of Changing facilities, showers and drying rooms	High	1) Introduce staggered start and finish times to reduce congestion and contact at all times 2) Introduce enhanced cleaning of all facilities throughout the day and at the end of each day 3) Consider increasing the number or size of facilities available on site if possible 4) Based on the size of each facility, determine how many people can use it at any one time to maintain a distance of one metres 5) Provide suitable and sufficient rubbish bins in these areas with regular removal and disposal.	Individual workers
Manual handling - dual lifting	High	1) Always consider if the task can be performed with one person using mechanical aid 2) Ensure the individual(s) are fit for work prior to commencing task 3) Break down the load where	Workers

		possible so that one person can comfortably carry 4) Assess your route so you can maintain 1m social distance whilst moving the load 5) Where dual lifts cannot be avoided, lift facing away from each each or side by side rather than face to face where possible 6) Where teams are used, try to keep to fixed teams / partnering to prevent cross over of workers 7) Where PPE is to be used, this is on an individual issue and items should not be shared	
Taking / accepting deliveries - contact with materials and persons (driver)	High	1) Review logistics plans to ensure safest routes have been identified including implementing one way systems 2) Maintain 1m social distancing when accepting materials 3) Materials to be placed outside of sites to reduce exposure to drivers 4) Review work programme to assess whether 'just in time' arrangements can be made to prevent additional or unnecessary deliveries 5) Hand washing and sanitizer measures available to maintain good hygiene	Individual workers
Working in local vicinity to construction workforce (maintaining 1m distancing)	High	1) Starting and finishing times are to be staggered and reviewed to ensure no build up of staff / teams in areas 2) Workers who are unwell with symptoms of Covid-19 should not attend the workplace 3) Work design to be reviewed regularly to identify any safer ways to move around site 4) Work programme to be reviewed to identify any work reordering that would limit exposure to others 5) Tasks are to be rearranged to enable them to be done by one person or as small number of persons without compromising safety measures. 6) Maintain social distancing measure of 1 metres from each	Individual workers, contractors, client

		other as much as possible with supervision in place to monitor compliance 7) Avoid skin to skin and face to face contact 8) Stairs should be used in preference to lifts or hoists and consider one ways systems around construction sites 9) Consider alternative or additional mechanical aids to reduce worker interface 10) Any additional COVID 19 measures specified by your Principal Contractor's site rules must be followed. Details of this shall be shared at site induction 11) Above hygiene measures and additional cleaning schedules to remain (regularly washing hands for at least 20 seconds with soap and warm water) 12) Any health concern to be raised immediately to line management / principal Contractor	
Working within 1metres of working team	High	1) Always consider if the task can be performed differently without having to breach the 1m social distancing rule 2) Workers are to limit face to face working and work facing away from each other when possible 3) Limit the frequency of working within 1m to an absolute minimum and ensure it is for strictly low intensity, sporadic work where exposure to this distance is less than 15 mins 4) Consider introducing an enhanced authorisation process (permit to work) for activities where less than 1m distance may be required 5) Provide additional supervision to monitor distancing and teams not to be rotated 6) Continue to conduct dynamic risk assessments whilst completing the work and speak up if there is a safer way of completing the task 7) All equipment to be thoroughly cleaned prior and after using it. 8) Increased ventilation will be	Individual workers

		provided within enclosed spaces 9) Sites can consider face covering however, it is advised to speak to your H&S competent person on these matters and supplies should be reserved for medical staff as it has been documented that the protective effect is minimal and supplies have been difficult to procure 10) Where respiratory protective equipment (RPE) needs to be worn, face fit testing (FFT) must be in place. This equipment is reserved to protect workers from other hazardous substances rather than COVID19 as there is limited evidence that the equipment will offer a high level of protection 11) Consideration given to disposable gloves and eyewear to prevent and reduce potential contamination 12) Reusable PPE should be thoroughly cleaned after use and not shared between workers. These should be stored in suitable places 13) Single use PPE should be disposed of so that it cannot be reused and to control potential contamination is controlled (waste removed by a responsible, approved contractor). 14) Workers deemed clinically vulnerable should never work within 2m of persons and preference should be given to whether any change in task can allow an individual to work from home where possible	
First aid - including mental health	High	1) First aid contents to be monitored to ensure adequate supplies remain 2) First aid and cover arrangements to be reviewed 3) First aider certificates to be checked for validity and understand amended practices in regards to attending a casualty during COVID (such as revised	Individual workers

		CPR methodology) 4) Emergency plans on site and communicated so all staff understand what action to take in the event of a suspected or confirmed case of COVID 19 5) Mental health first aiders to be considered 6) Communicate any occupational health service available to the workforce including any available employee assistance programme (EAP) or public support 7) Line management to regularly communicate to their team(s) 8) Effective reporting system established on site in order to rectify any raised issues or incidents in a timely manner	
Dormitories / Accommodation for Foreign Workers	High	1) Comply with the government norms and follow the rules and regulations 2) Controlling Movement of the workers outside dormitory 3) Provide Insolation facilities along with nursing staff and doctors 4) Monitoring and controlling in the premises	Individual workers

Training

Please ensure a manager's brief has been completed alerting to company specific process / procedures

Management

- Please ensure all staff are aware of reporting requirements and that all confirmed cases are escalated to your H&S competent person.
- Information notes are to be sent out and any updates communicated in a timely manner to the workforce.
- This must include letting staff know about symptoms and actions the medical professionals are advising people to take.
- A colleague who has been isolated for 14 days cannot return to work until the appropriate 'fit note' documentation is provided by their GP/healthcare provider to demonstrate they are now fit to return to work.
- Assessments to be reviewed every 6 months or where significant change has occurred
- Please remind staff that in order to minimise the risk of spread of infection, we rely on everyone in the industry taking responsibility for their actions and behaviours.
- Please encourage an open and collaborative approach between your teams on site where any issues can be openly discussed and addressed.

Annexures

Appendix – A1

Kuwait National Petroleum Company

CONTRACTOR'S MONTHLY HSE STATISTICS REPORT

Month & Year: _____

Contractor Name : _____

Contract / Project : _____

Contract Number : _____ Start Date: _____

Total Manpower : _____

Date of Last LWC	MAN-HOURS		
	This Month	Cumulative Total	Since Last LWC

Data Description	Code	This Month	Cumulative Total
Lost Workday Cases	LWC		
Lost Work-days	LWD		
Restricted Workday Cases	RWC		
Medical Treatment Cases	MTC		
Occupational Illness Cases			
First Aid Cases	FAC		
Other Incidents (Fire, Property Damage, Traffic)			
Near Miss Incidents	NM		
Infringement Notifications			
Toolbox Meeting			
HSE Training			
HSE Audits			
Periodic Medical Examination Conducted			

Details of Accident, Near Miss or Other Incidents* (Fire, Property Damage, Traffic)

Date & Location	Name, E/No. & Title	Brief Description	Action Recommended

Details of Toolbox Meeting / HSE Training *

Date	No. of Participants	Topics

Note: Provide monthly & YTD update for Training Intensity (TI= Training Manhours / Total No. of Employees)

Details of HSE Violations *

Date	Name, E/No. & Title	Brief Description of Violation	Action Taken

Details of HSE Audits *

Date	No. of Participants	Recommendation	Action Taken

* Attach Separate sheet for further details

Data Prepared By:

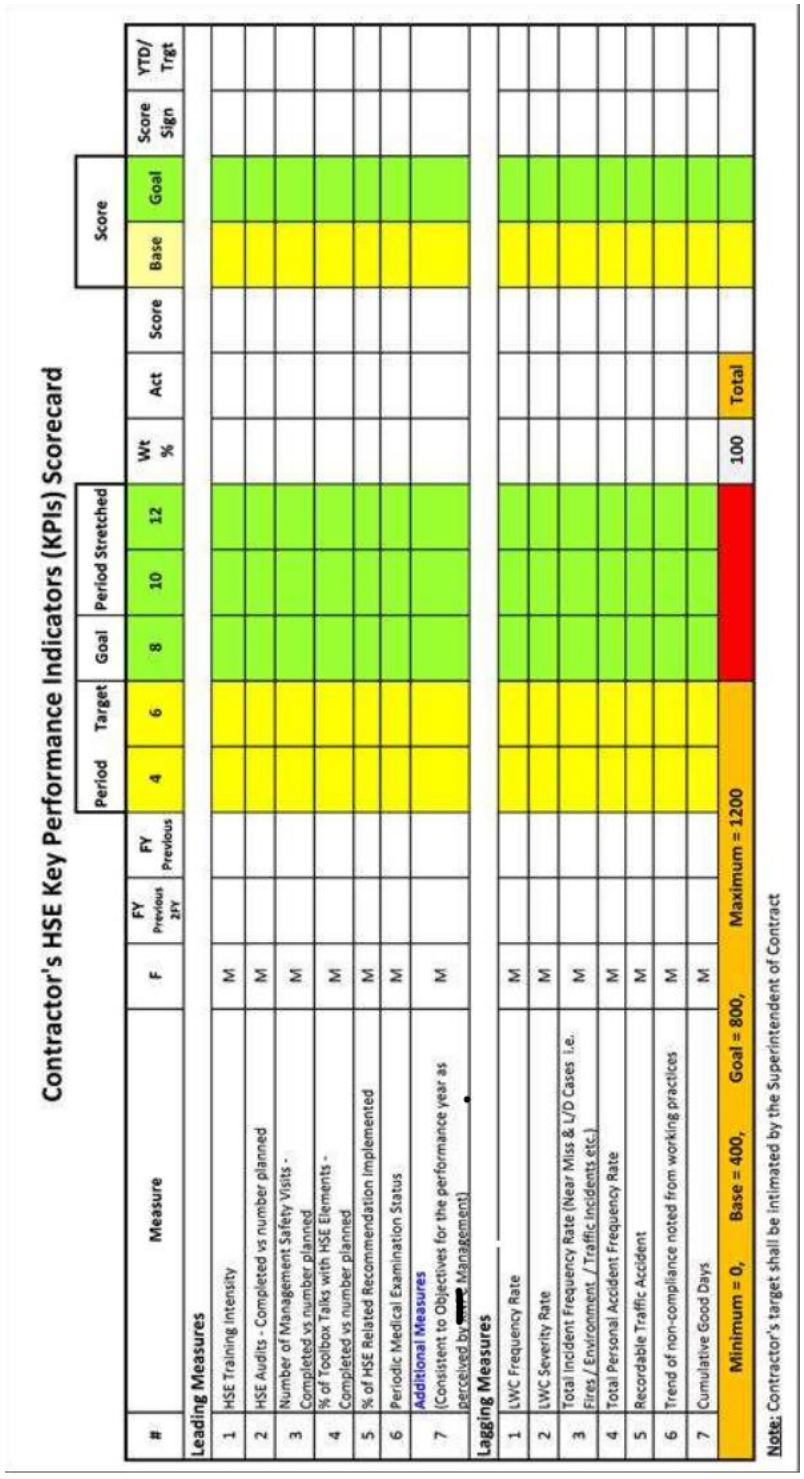
_____ _____

Print Name & Sign Contractor Manager / Representative

Tel. No.: _____ Tel. No.: _____

NOTE: A copy of this report shall be hand delivered to Sr. Safety Engr. within first two working days of following month

Appendix – A2



Contractor's HSE Key Performance Indicators (KPIs) Scorecard

#	Measure	F	FY Previous 2FY	FY Previous	Period	Target	Goal	Period Stretched		Wt %	Act	Score	Score		Score Sign	YTD/ Trgt
					4	6	8	10	12				Base	Goal		
Leading Measures																
1	HSE Training Intensity	M														
2	HSE Audits - Completed vs number planned	M														
3	Number of Management Safety Visits - Completed vs number planned	M														
4	% of Toolbox Talks with HSE Elements - Completed vs number planned	M														
5	% of HSE Related Recommendation Implemented	M														
6	Periodic Medical Examination Status	M														
7	**Additional Measures** (Consistent to Objectives for the performance year as perceived by [redacted] Management)	M														
Lagging Measures																
1	LWC Frequency Rate	M														
2	LWC Severity Rate	M														
3	Total Incident Frequency Rate (Near Miss & L/D Cases i.e. Fires / Environment / Traffic Incidents etc.)	M														
4	Total Personal Accident Frequency Rate	M														
5	Recordable Traffic Accident	M														
6	Trend of non-compliance noted from working practices	M														
7	Cumulative Good Days	M														
	Minimum = 0, Base = 400, Goal = 800, Maximum = 1200									100	Total					

Note: Contractor's target shall be intimated by the Superintendent of Contract

Appendix – B:

Contractor's Monthly Environmental Reports

Contract Details					
Contract / Project (Title)					
Contractor (Company Name)					
Contract No	Contract Period	Contract Start Date	Contract End Date	Total Employee at Site	Contract User (PEC Dep / Div)

A) Details of Waste Water Generation				
Type of Waste Water	Generated this month Total Quantity (KL)	Yr to Date Jan – Dec Cumulative Quantity (KL)	Discharged Location	WTM Filled
Industrial Waste Water			◊ Effluent Treatment Facility ◊ Other location	◊ Yes ◊ No
Sanitary Sewage			◊ DOE Authorized Sewage Treatment Facility ◊ MPW Sewage Network ◊ Other Location	◊ Yes ◊ No
Remarks if Any				

B) Details of Solid / Semi Solid Waste Generation					
Type of Waste Water		Generated this month Total Quantity (KL)	Yr to Date Jan – Dec Cumulative Quantity (KL)	Discharged Location	WTM Filled
Hazardous Waste				◊ Waste Reception & Treatment Station	◊ Yes ◊ No
Non Hazardous Waste Industrial				◊ Waste Reception & Treatment Station	◊ Yes ◊ No
Recycle Waste	Paper			◊ Recycle Company	◊ Yes ◊ No
	Plastic				
	Metal				
	Other				
Non Hazardous Waste					◊ Yes ◊ No
Remarks if Any					

C) Environmental Incident						
Incident Report No.	Date	Incident Details	Incident Type	Quantity	Year to Date Jan to Dec	
					Total no of Incident	Cumulative Quantity
			◊ Air ◊ Water ◊ Land			
Location Area		Details of Recommendations	Action Taken			
Remarks if Any						

D) Environmental Awareness Training		
Training Course title of the course		
Total No of Employee Trained (This month)		Attendance Sheet Attached ◊ Yes ◊ No
Total No of Employees Trained this year		
Remaining Employees to be trained this year		
Remarks if Any		

E) Other Details (if any)

Note: A copy of this report shall be submitted to environment division

Contractor Manager / Representative

Appendix – D : Infringement Report Form

Date:.....

From : Team Leader, Safety ( )

To : Team Leader, ... ( )

INFRINGEMENT REPORT

Name :	Employee No.:
Occupation:	Company:
Location:	Vehicle No.:
Date of Infringement:	Time of Infringement:
Supervisor Name:	Telephone No.:
Details of Infringement:	
Previous Violation:	

This Violation is: ☐ Minor : ( ) First ( ) Second ( ) Third

☐ Major : ( ) First ( ) Second ( ) Third

Action Recommended : ☐ Written Warning ☐ Penalty KD .....

☐ Suspension ☐ Dismissal

☐ Other.....

Please advise action taken as per the penalties for safety Violations on or before .....

Team Leader, Safety

cc: DCEO
Department Manager
File

Appendix – E

PENALTY SYSTEM FOR CONTRACTORS

1. INFRINGEMENT REPORT

All contractors and their employees working in COMPANY Controlled areas shall comply with the COMPANY HSE Regulations. Violation of the regulations will be dealt according to penalty system for contractors. Infringement report is issued by the COMPANY HSE Divisions when a violation is cited or reported.

2. MINOR AND MAJOR VIOLATION

The penalty system is divided into two categories, Minor and Major. (PEC Guidelines on Penalty System for HSE Violations, shall be utilized as reference for violations which are not listed below).

1. **(a) Minor Violation**

   - Not wearing personal protective equipment (PPE) at work site.
   - Minor traffic violation (wrong parking, overspeeding)
   - Blocking of emergency equipment or exits.
   - Using unapproved scaffolding.
   - Not keeping proper housekeeping
   - Not keeping noise level as per EPA limits
   - Not discharging/handling/storing/transporting effluents/wastes as per the guidelines
   - Transporting and disposing the effluents or waste/s without waste transport manifest.

2. **(b) Major Violation**

   - Smoking in the non-smoking areas, carrying matches or lighter.
   - Working without valid work permit.
   - Not wearing proper breathing apparatus if instructed.
   - Not providing shoring for the excavations.
   - Not providing fire extinguisher for hot work.
   - Repeating minor violations more than twice.
   - Major traffic violation.
   - Found guilty negligent driving resulting in a vehicle accident.
   - Entering closed area or classified area without permit.
   - Not complying with written instruction on the work permit.
   - No proper packing/sealing of materials applied while transportation/shifting of wastes, which results in public complaints
   - Usage of truck/vehicle without good condition for shifting hazardous materials
   - Not meeting EPA and Company requirements as indicated in the guidelines.
   - Non-adherence to PEC HSE procedure, guidelines or safe work practices are proven (by incident investigation) to be direct cause of high potential incidents

3. PENALTY STAGES

VIOLATION	PENALTY		
	FIRST	**SECOND**	**THIRD**
MINOR	MYR 2,000	MYR 5,000	MYR 10,000
MAJOR	MYR 10,000	1 % of contract value or MYR 50,000 whichever is lower	2% of contract value or MYR 100,000 whichever is lower

* In the event of Contractor's violation as per above stipulations, the company reserve the right to exercise the following remedies, individually or collectively, in addition to any other rights and remedies provided under the Contract at its sole discretion:

a) Suspension of employee(s) involved in violation(s)

b) Immediate termination of employee(s) involved in violations and such employees will not be hired in other PEC contracts also

c) Termination of the contract

d) Blacklisting of the Contractor from PEC

HSE Requirements' Applicability Guideline

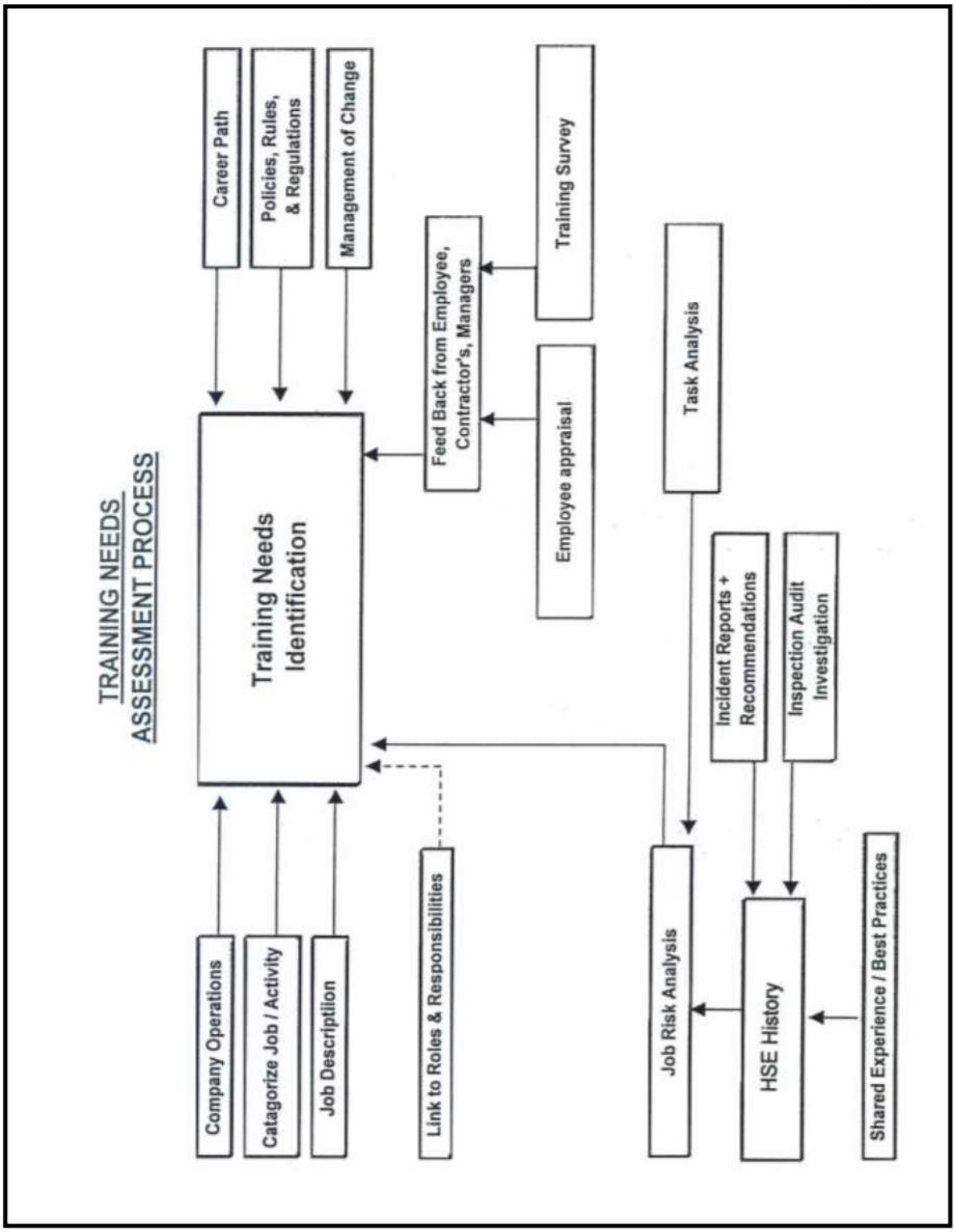
Note: The following guideline shall be used by the CONTRACTOR in the preparation of their written HSE Plans & Programs that shall be submitted to the COMPANY for approval at the initiation of the contract.

S.No.	TYPES OF WORKS	Applicable HSE Requirements
1	Civil Works (all sections) • Soil and Earth Works • Construction Works	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)
2	Tanks for Petroleum products (all sections) • Tank Construction and Repair • Cleaning Services for Tanks and Pipe Trenches • Special Services on Tanks / Vessels	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)
3	Piping, Valves and Associated Works (all sections) • Field and Site Pipe Welding and Erection Works • Valves overhauling and reconditioning • Special Services • Hot Tapping & Stoppling	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)
4	Road and Dyke Works (all sections) • Road and dykes construction and maintenance	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)
5	Plant Installation & Maintenance (all sections) • Plant installations and integrated project execution including civil, mechanical, electrical & instrument work • Plant maintenance including mechanical, electrical & instrument work	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)
6	Heat, Ventilation Air Conditioning & Refrigeration (all sections) • Supply, installation and maintenance of HVAC	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)
7	Electrical (all sections) • Switch Gears installation & Maintenance • Services	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)
8	Instrumentation (all sections)	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)
9	Industrial Coating and Plating Garnet & Grit / Shot Blasting and Painting	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)
10	Heavy Equipment (All sections)	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)

S.No.	TYPES OF WORKS	Applicable HSE Requirements
11	Industrial Cleaning Operations and Services • Chemical Cleaning • Hydrojetting (Hydro Blast) • Industrial Sewage Network Cleaning and Clearing • Retention basins sludge removal, washing & cleaning services	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)
12	Catering Services • Catering services at company facilities (including inside and outside areas) • Kitchen equipment maintenance	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)
13	Administration A1 - Janitorial and Building Cleaning A2 - Clerical and Mail Handling A3 - Horticulture, gardening and grass & shrub removal A4 - Hire of vehicle (self drive/with driver) for personnel transportation A5 - Garbage collection and removal A6 - Material handling A7 - Production of publications and photographic services A8 - Manpower Supply Services A9 - Facility Management A10- Supply and maint. of photocopier machines on rental basis A11- Courier services (local & international)	All 'Compliance Terms and Conditions' mentioned in S.No. 25 below shall be applied.
14	Refinery Plant Maintenance and Services (all sections)	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)
15	Information Technology (Telecommunications) (1) Installation and Maintenance (all sections)	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)
16	Industrial Insulation & Refractory Works (all sections)	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)
17	Marine Services A1 - Marine Construction and Repair A2 – Marine Vessels rental A3 - Under water Inspection	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)
18	Fire, Security and safety A1 – Fire suppression agent and systems instn. and maint. A2 – Fire detection / alarm system installation and maint. A3 – Fire water network and foam systems construction A4 – Installation and maintenance of security systems	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)
19	Conditioning, monitoring & troubleshooting of rotary equipment	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)
20	Catalyst handling service (2) Sculping, dumping, loading and screening	All HSE Requirements and conditions

S.No.	TYPES OF WORKS	Applicable HSE Requirements
21	Elevators A1 - Maintenance of industrial elevators A2 - Maintenance of Domestic elevators A3 - Industrial elevators inspection, surveying and certification services A4 - Supply and installation of domestic and industrial elevators	All 'Compliance Terms and Conditions' mentioned in S.No. 25 below shall be applied.
22	Information Technology (3) Installation and maintenance (all sections)	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)
23	Inspection Services (all sections)	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)
24	Petrol Stations (all sections)	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)
25	Consultancy Services A1 - Building design, foundation design, structural and architectural engineering A2 - Tank Design A3 - Project management A4 - Cathodic Protection System, design, survey & assessment A5 - Marine Consultancy A6 - Information technology (strategy planning, mgt., etc.) A7 - Hazop Assessment A8 - Environmental Services A9 - Fire alarm & fire fighting system, design survey and assessment A10- Electrical distribution, design and assessment A11- Design, survey & assessment of heat tracing system A12- Environment impact assessment study A13- Multidisciplinary engineering for new units / revamp of existing units A15- Business process international standard (ISO Certification) A16- Enterprise integration & communication systems (EICS) A17- Benchmarking of IT services A18- IT business continuity (risk mgt. & disaster recovery) A19- IT auditing A20- Feasibility studies & process consulting A21- Front-End Engineering and Design (FEED) A22- Material Management A23- Turnaround Services A24- Quantitative Risk Assessment (QRA) studies A25- HR studies and Management A26- Design of Petrol Filling Stations A27- Industrial Hygiene A28- Safety & Fire A29- Security Services A30- Medical Consultation Services	**Compliance Terms and Conditions:** (1) In general, all Consultancy Services Contract shall comply with the requirements to prepare HSE Plans & Programs and submit the same for COMPANY'S approval at the initiation of the contract. (2) If the scope of the Consultancy Services does not include engagement or visits to activities in operation areas, maintenance worksites, construction sites, and other office or building activities involving manual handling may be exempted to comply with the following HSE requirements: (a) Conduct of Contractor's HSE Meetings & Trainings (clause 6.3) (b) Conduct of HSE inspection/ audit by Contractor's key personnel (clause 6.5) (c) Preparation of Contractor HSE handbook/manual (clause 6.7) (3) The Contractor shall comply with all applicable sections of the document (HSE Guidelines for Contractors) excluding clause nos. 6.3, 6.5 & 6.7, as quoted above.
26	EPC-Engineering, Procurements & Const. Work (all sections)	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)
27	PC- Procurements and Construction Work (all sections)	All HSE Requirements and conditions on the document (HSE Guidelines for Contractors)

Appendix - J


TRAINING NEEDS
ASSESSMENT PROCESS
Training Needs Identification
Career Path
Policies, Rules, & Regulations
Management of Change
Feed Back from Employee, Contractor's, Managers
Training Survey
Employee appraisal
Task Analysis
Incident Reports + Recommendations
Inspection Audit Investigation
Company Operations
Catagorize Job / Activity
Job Description
Link to Roles & Responsibilities
Job Risk Analysis
HSE History
Shared Experience / Best Practices

GENERIC HSE PLAN CHECKLIST

Item	Check Item	Required? Y/N	Existing? Y/N	If not available when needed?
Section 1 – Leadership and Commitment				
1.1 – Commitment to HSSE aspects through Leadership				
1.1.1	Senior managers foster commitment to HSE issues through their personal style of leadership and management.			
1.1.2	Visible expressions of commitment by senior people.			
1.1.3	HSE matters are placed high on personal and collective agendas.			
1.1.4	All senior managers set a personal example to others. They are, and are seen to be actively involved in HSE matters, e.g. attendance at HSE meetings, personal investigation of HSE audits and reviews, etc.			
1.1.5	A feedback system is established to encourage and facilitate employee and contractor feedback on HSE matters.			
1.1.6	A positive culture is promoted at all levels.			
1.1.7	Policies and standards are endorsed and implemented at the local level.			
Section 2 – Policy and Strategic Objectives				
2.1 HSE Policy Documents				
2.1.1	Contractor has a policy that makes reference to the importance of HSE. It is formalised by the chief executive's or the manager's signature.			
2.1.2	A written HSE policy is dated and signed by chief executive.			
2.1.3	Policy statements specific to individual aspects of the contract (location; sites; plant), are issued.			
2.1.4	Policy statements are issued to cover specialised aspects (e.g. substance abuse)			
2.1.5	Policy statements are consistent with subsidiary guidelines.			
2.1.6	Policy statements are clear, concise and motivating.			
	Content			
2.1.7	The importance of HSE set as a contract objective.			
2.1.8	Incidents are unacceptable and preventable.			
2.1.9	HSE is established as a line management responsibility.			
2.1.10	Everyone is responsible for their own and their colleagues' HSE at work.			
	Distribution and availability			
2.1.11	HSE policies are handed to each employee by their line manager when they are issued.			
2.1.12	All new employees are handed a copy by their line manager.			
2.1.13	HSE policies are displayed on notice boards at each work site.			
2.1.14	Copies of HSE policies are provided to each company involved in the contract.			
2.1.15	HSE policies are available to all contract personnel in their own language.			
	Discussion			
2.1.16	HSE policies are discussed by line managers with each employee at time of issue.			
2.2 – HSE Contract Strategic Objectives				
2.2.1	Contract objectives are defined to meet HSSE, including security and social responsibility as well as time, cost and quality.			
2.2.2	Accountability for HSSE success and any failure are clearly stated.			
2.2.3	Designated team leaders are to produce HSSE objectives, tasks and KPIs for the contract.			

Item	Check Item	Required? Y/N	Existing? Y/N	If not available when needed?
2.2.4	Procedures for distribution, reporting and reviewing HSSE issues are established.			
3.1 – Organisational structure for HSSE management				
3.1.1	An identified focal point exists within the team structure ensuring that all HSSE matters have been identified, assessed and managed.			
3.1.2	Personnel responsible for the implementation of HSSE objectives are clearly identified in the organisation chart.			
3.1.3	Responsibilities are adequately defined during all phases of the contract.			
3.1.4	Job descriptions in place show each team members' HSSE competencies, responsibilities and function.			
3.1.5	The organisation chart to clearly show positions of HSSE professionals.			
3.1.6	Workforce strategy is defined.			
3.1.7	The level of personnel resources does not compromise HSSE performance			
3.1.8	Staff personnel are competent, and with sufficient appreciation of HSSE as necessary, and with specific training where required.			
3.1.9	Access of contractor's line management to their corporate HSSE management structure is defined.			
3.1.10	The level at which contractor's corporate management (middle, senior or board level) will be involved in handling contract HSSE issues is clearly defined.			
3.1.11	In the contractor's corporate organisation, individuals at middle, senior or board level charged with HSSE responsibilities is clearly identified.			
3.1.12	Specialised HSSE advice is available to line management if required e.g. employment of HSSE specialist.			
3.1.13	Managers are involved in HSSE activities, objectives setting and monitoring.			
3.1.14	Managers take action and provide resources to support their stated policies and objectives.			
3.1.15	HSSE management is an intrinsic part of operational management.			
3.1.16	HSSE professionals may be engaged, and a process for doing so is in place.			
3.1.17	Contractor documents the roles of HSSE professionals/advisors.			
3.1.18	The reporting requirements of HSSE advisors to line management are documented.			
3.1.19	HSSE advisors have direct access to contractor's operations and senior contract managers.			
3.1.20	Line management to follow up on advice given by HSSE Advisors.			
	HSSE communication			
3.1.21	Effective means to communicate HSSE issues to subsidiary, contractor and subcontractors personnel are defined and in place.			
3.1.22	Subsidiary expectations on HSSE management are communicated in depth.			
3.1.23	Appropriate communication techniques, in the appropriate language, are used to ensure all personnel are fully informed of HSSE matters. Specify whether this is done via personal contact; interactive video; notice boards; newsletters; bulletins; intranet facilities.			
3.1.24	HSSE performance notice boards are maintained in free access locations.			
	HSSE meetings			
3.1.25	Subsidiary and contractor have a schedule of regular meetings to discuss HSSE interface matters.			

Item	Check Item	Required? Y/N	Existing? Y/N	If not available when needed?
3.1.26	A regular schedule is set up for w orksite HSSE meetings.			
3.1.27	Contractor's managers that have responsibility for scheduling HSSE meetings are clearly identified.			
3.1.28	Procedures to record attendance at HSSE meetings and to review these records are in place.			
3.1.29	Agendas are published prior to HSSE meetings being held and indicate the structure of the meeting and w ho should attend.			
3.1.30	HSSE meeting agendas should include health, safety, environment, security and social responsibility aspect of the contract.			
3.1.31	HSSE meeting agendas are consistent w ith the objectives of the HSSE plan.			
3.1.32	A system is in place to assure the effectiveness of HSSE meetings.			
3.1.33	HSSE meetings are open to all personnel involved in the contract, and all personnel are encouraged to participate w ith a view to continual improvement.			
3.1.34	Action items are assigned to identified personnel and a system in place to close out items in timely fashion.			
3.1.35	HSSE meetings are the main instrument for ensuring that all HSSE activities are communicated to all personnel.			
3.1.36	All HSSE meetings are recorded and provide data for future review s.			
3.2 – HSSE training of managers, supervisors and HSSE critical position holders				
3.2.1	All senior line managers have received and w ill continue to receive training to develop management and communication skills.			
3.2.2	Supervisors to have on the job orientation training.			
3.2.3	HSSE specialists are verified to be competent in their allocated roles and their skills, know ledge and understanding of their assigned responsibilities; they are re-assessed from time to time.			
3.2.4	Training includes incident investigation and reporting as appropriate.			
3.2.5	Audit training is given to managers w ho may be required to conduct audits during the contract.			
3.2.6	HSSE critical teams (fire, first aid, Medevac) are given specific training for the likely situations they may encounter during the Contract.			
3.3 – General HSSE training				
3.3.1	HSSE training is planned and conducted efficiently and in timely manner.			
3.3.2	HSSE training includes: safety; emergency arrangements; road transport; first aid; w ork procedures PTW, JSA; hazard aw areness; safety intervention STOP; occupational health; security; basic HSSE rules; legislative requirements; environmental management.			
3.3.3	Training includes the correct use of PPE and other protective equipment.			
3.3.4	Line managers provide support to ensure time and resources are available for HSSE training.			
3.3.5	New employees are adequately trained and confident of their ow n abilities before they start w ork.			
3.3.6	All employees coached to improve their individual HSSE competence			
3.3.7	An orientation programme is in place for all personnel, especially for new recruits and visitors to the w ork site.			
3.3.8	Records of employees are maintained of all training and orientation provided.			
3.3.9	Employees are aw are that their HSSE performance is part of the contractor's appraisal and rew ard system			
3.3.10	Training to include any contracted personnel.			

Item	Check Item	Required? Y/N	Existing? Y/N	If not available when needed?
3.3.11	HSSE training is included in other courses; orientation; job specific; line management; auditing techniques			
3.3.12	HSSE training is continuously assessed for effectiveness, employee feedback is used.			
3.4 – Competence Assurance				
3.4.1	Contractor has issued a statement that competence and training of the workforce meets contract requirements appropriate for the work to be conducted.			
3.5 – Contractors Management Process				
3.5.1	The HSSE plan identifies and shows that subcontractors are well integrated into the contract.			
3.5.2	Subcontractors HSSE-MS are assessed.			
3.5.3	Subcontractors HSSE plans, if required, are suitable, and interface correctly with contractor's and subsidiary's requirements			
3.5.4	Contractor communicates to subcontractors that the same rigorous HSSE standards apply to them			
3.5.5	All subcontractors are clearly identified and their respective roles and responsibilities are documented.			
3.5.6	Contractor maintains a record of previous Subcontractors performance, as these are to be used to select current subcontractors.			
3.5.7	Contractor maintains an approved Subcontractor list where HSSE performance has been considered			
3.6 – HSSE standards				
3.6.1	The HSSE plan is the prime reference for all applicable standards relating to the contract.			
3.6.2	The HSSE plan indicates minimum objectives for health, safety, environment, security and social responsibility.			
3.6.3	Contractor has an HSSE manual/set of standards.			
3.6.4	HSSE standards identify minimum criteria for achievement of contract objectives.			
3.6.5	HSSE standards are available in writing to all relevant personnel in a consistent and clear form.			
3.6.6	End users are involved in developing HSSE standards.			
3.6.7	HSSE standards comply, where relevant, with subsidiary requirements			
3.6.8	Procedures for obtaining deviations from the standards are in place.			
3.6.9	A responsible person for authorising deviations is clearly identified.			
3.6.10	A system of recording approved deviations exists.			
3.6.11	Relevant national and international standards are identified.			
3.6.12	Subsidiary rules, standards, procedures relevant to the contract are adequately covered.			
4.1 – Risk Assessment and Treatment				
4.1.1	Contractor maintains an up to date hazard inventory and assessment with measures to be implemented with respect to each risk.			
4.1.2	The hazard assessment by the subsidiary is included in the contractor's hazard inventory and assessment.			
4.1.3	There is a methodology prescribed describing how hazard and risk assessments are undertaken and who has the necessary expertise to carry these out.			
4.2 – Health Hazards				
4.2.1	Health facilities are defined as part of the contract.			

Item	Check Item	Required? Y/N	Existing? Y/N	If not available when needed?
4.2.2	An occupational health programme, identifies: health hazards; assesses the health risks; provides for the control of health hazards; identifies PPE; prophylactic requirements, provides emergency cover; applies to all w ork sites.			
4.2.3	A w elfare programme, if in place, meets the needs of isolated w ork sites.			
4.2.4	Local medical facilities are assessed for their appropriateness to provide for contract needs as and w hen required.			
4.2.5	Health facilities are assessed for contract day to day needs.			
4.2.6	The provision of medical supplies is managed to ensure the contract requirements are not compromised.			
4.2.7	Personnel are checked for medical fitness to w ork by a recognized and approved medical facility.			
4.2.8	Pre-existing health conditions are identified and recorded.			
4.2.9	An ongoing system of health surveillance based on job specific health risks is in place.			
4.2.10	Where medical staff are provided they are competent to carry out their assigned roles and responsibilities.			
4.2.11	Medical staff to have access to external medical facilities w hen required.			
4.2.12	Accommodation and catering facilities are to acceptable standards of hygiene and fit for purpose.			
4.2.13	Food storage, handling and preparation are to acceptable industry standards			
4.3 – Safety Hazards and PPE				
4.3.1	Guidelines/methodologies are available for undertaking job hazard analyses and identifying the controls necessary to manage the risks.			
4.3.2	PPE – a system is in place for the management of PPE and includes: • the identification of statutory PPE requirements associated w ith assessed risks. • the assessment of the need for PPE and its suitability. • procedures to record the issue of PPE and a follow up system of inspection and replacement/recertification. • procedures to check that PPE is issued and used correctly. • procedures to check that PPE is issued and used correctly. • a schedule w ith defined criteria for PPE renew al/replacement. • a procedure for re-certification of PPE as appropriate and necessary.			
4.3.3	All protective and rescue equipment that is provided is fit for purpose.			
4.4 – Logistics Hazards				
4.4.1	The competence, physical ability, psychological capability, character and experience of drivers are assessed at recruitment.			
4.4.2	Drivers' documentation is checked and a record maintained.			
4.4.3	Drivers to be tested in the type of vehicle they w ill be in control of, and over the type of terrain encountered in the contract.			
4.4.4	Drivers' records of employment and performance to be maintained.			
4.4.5	Vehicles should be operated w ithin manufacturers specifications.			
4.4.6	Vehicle use should be clearly identified against job requirements.			
4.4.7	Vehicles required to carry passengers must be equipped to contract specifications.			
4.4.8	Cargo carrying vehicles should be equipped to segregate loads as specified in the contract.			
4.4.9	A vehicle maintenance programme is in place and adhered to.			
4.4.10	A journey management system is in place, w hich includes the authorization of different types of journeys, the roles and responsibilities of individuals, and covers the recovery in the event of a problem.			

Item	Check Item	Required? Y/N	Existing? Y/N	If not available when needed?
4.4.11	All journeys are recorded including relevant details.			
4.4.12	Contracted-in transportation is capability assessed, and complies with contract specifications which are subject to reviews. Such contracted-in situations are authorized by a recognized contractor manager.			
4.5 – Environmental Hazards				
4.5.1	All personnel involved are aware of the environmental objectives of the contract.			
4.5.2	Procedures are in place to protect the environment from contract operations, including imported materials and substances.			
4.5.3	Contractor has an identified focal point for environmental matters, who has the necessary expertise.			
4.5.4	Environmental matters are a line management function responsibility.			
4.5.5	Environmental impact reports are developed and reviewed throughout the duration of the contract.			
4.5.6	A procedure is in place to recover from environmental incidents.			
4.5.7	A competent contractor person is responsible for conducting environmental audits as and when necessary.			
4.6 – Security Hazards				
4.6.1	Contractor has a policy which recognizes the importance of managing security aspects within the context of the contract operations.			
4.6.2	A procedure is in place to enable compliance with the Voluntary Principles on Security and Human Rights (VPSHR).			
4.6.3	A security threat assessment has been undertaken in order to identify the security risks (airborne; terrestrial; marine) which exist in the region in which the contract operations will occur.			
4.6.4	A memorandum of understanding on security co-operation has been agreed with the host authorities in order to describe the arrangements and responsibilities for managing security.			
4.6.5	Resourcing and organizational support of security personnel is appropriate to the threat level and operational context.			
4.6.6	Contractor has an identified focal point for security matters who has the necessary background and expertise.			
4.6.7	Contractor has made provision for the training and capability building of local security forces with whom they will co-operate, particularly in locations where indigenous capability is not of the required standard.			
4.6.8	Contractor has evacuation arrangements which are commensurate with the in-country risk and which recognize the logistical difficulties of the locus of operation, particularly where this might be a remote location in a difficult country.			
4.6.9	An effective method of capturing security incidents is in place with the ability to learn and improve performance.			
4.6.10	Contractor has an effective methodology for auditing security aspects of the contract with appropriate management of remedial actions.			
4.7 – Social Responsibility Hazards				
4.7.1	Contractor has a policy which recognises the importance of managing social aspects and community relations within the context of the contract operations.			
4.7.2	Contractor has a policy which recognises the importance of managing cultural heritage aspects and inter-cultural sensitivities within the context of the contract operations.			
4.7.3	Where the contract might have an impact upon; social aspects, people's livelihoods, access to resources or land, then a social impact assessment has been carried out to identify threats to livelihood and appropriate corrective measures have been put in place.			

Item	Check Item	Required? Y/N	Existing? Y/N	If not available when needed?
4.7.4	Resourcing and organisational support of sustainable development and community relations personnel is appropriate to the social and operational context.			
4.7.5	Contractor has an identified focal point for sustainable development and community relations matters who has the necessary background and expertise.			
4.7.6	Contractor has made provision for the training and capability building of local communities with whom they will co-operate, particularly in locations where indigenous capability is not of the required standard.			
4.7.7	Where resettlement of indigenous people, or loss of livelihood, have been identified as potential issues, appropriate measures have been put in place to manage these in a manner which is in line with stakeholder and community expectations.			
4.7.8	An effective method of capturing community related incidents is in place with the ability to learn and improve performance.			
4.7.9	An effective process is in place for consulting with, and providing information to, affected communities, recognizing the limitations within the host country (language, culture, educational levels, poverty levels, gender restrictions)			
4.7.10	Contractor has an effective methodology for auditing sustainable development and community relations aspects of the contract with appropriate management of remedial actions.			
5.1 – HSSE Operations Manuals				
5.1.1	Written HSSE procedures are available for all hazardous operations, and include HSSE precautions to be taken.			
5.1.2	Procedures are consistent with subsidiary requirements.			
5.1.3	HSSE procedures are controlled documents.			
5.1.4	Procedures address the appropriate level of control.			
5.1.5	Procedures cover; health; safety; environment; security; social responsibility			
5.1.6	Written procedures are; available to all employees including subcontractors; available in employee's own language; and include job specific descriptions.			
5.1.7	Procedures cover possible deviations, and identify the person responsible to authorize deviations.			
5.1.8	A record is maintained of all deviations authorized			
5.1.9	A system is in place to identify any gaps in issuing procedures for hazardous operations			
5.1.10	A Permit to Work (PTW) system is available			
Basic HSSE rules				
5.1.11	Contractor has issued a set of HSSE rules			
5.1.12	HSSE rules include coverage of: health and environment as well as safety; specific contract HSSE issues; hazards that may be encountered; basic housekeeping and hygiene			
5.1.13	A system is in place to update rules and disseminate appropriately.			
5.1.14	Personnel responsible for updating and issuing the rules are identified.			
5.1.15	End users are involved in the update process.			
5.2 – Infrastructure and Equipment Integrity				
5.2.1	All HSSE equipment assigned to the Contract is identified in a register.			
5.2.2	Each individual piece of equipment is uniquely identified, and referenced to the appropriate standard.			
5.2.3	Where required the classification, licensing authority, test certificates are clearly identified.			

Item	Check Item	Required? Y/N	Existing? Y/N	If not available when needed?
5.2.4	HSSE critical equipment is subject to regular inspection and maintenance, and a responsible person is identified to carry out a review that these programmes are carried out.			
5.2.5	Where tradesmen provide their own equipment as part of a contracted-in situation, then such equipment is included in assessment and inspection, to assure they comply with contract specifications.			
5.3 – Management of Change				
5.3.1	A documented Management of Change (MoC) process is in place to ensure that any significant changes to any aspect of the operation are controlled and do not introduce unmanaged hazards.			
5.3.2	The MoC is referenced to PTW and LOTO requirements during maintenance work and periods of temporary change.			
5.3.3	The contractor's PTW system is consistent with Industry norms and subsidiary guidelines.			
5.3.4	For operations that take place in variable weather and environmental conditions, a table of acceptable conditions is established (also known as a Manual of Permitted Operations – MoPO), outside of which operations may not take place.			
5.3.5	A procedure is in place to describe how the introduction of any new equipment (hardware and software) is controlled.			
5.3.6	A procedure is in place to record document updates and control.			
5.4 – Emergency Planning and Response				
5.4.1	Emergency response procedures are in place for all identified emergency situations and the responsibilities of contractor's management are clearly identified.			
5.4.2	Clear identification of subsidiary role in emergencies.			
5.4.3	An appropriately manned response centre is set up to co-ordinate emergency responses.			
5.4.4	All personnel are made aware of emergency procedures and their individual roles and responsibilities.			
5.4.5	Of particular importance in emergency situations is that instructions are available and understood in the language of the individuals.			
5.4.6	Emergency plans are covered in employee orientation.			
5.4.7	Lines of communication are clearly identified and tested with; third party emergency services; local hospitals; helicopter services; Medevac facilities;			
5.4.8	Third party emergency services are aware of their roles in procedures they will be asked to respond to.			
5.4.9	Emergency procedures are tested and practiced regularly			
5.4.10	Test of emergency procedures, may be conducted without warning.			
5.4.11	Recovery procedures are in place that can be activated after an emergency.			
5.4.12	Recovery procedures are tested to demonstrate preparedness.			
5.4.13	Procedures are in place that identify the roles and responsibilities of subsidiary and contractor personnel to notify government and other authorities of emergency situations and outcomes.			
6.1 – HSSE-MS implementation and Active Performance Monitoring of Work Activities				
6.1.1	The HSSE Plan includes identified performance indicators to measure HSSE performance during the contract.			
6.1.2	Progress against identified objectives is measured on a regular basis.			
6.1.3	HSSE initiatives/incentive schemes are defined and in place.			
6.1.4	Achievement are measured against identified milestones			

Item	Check Item	Required? Y/N	Existing? Y/N	If not available when needed?
6.1.5	Numbers and types of training courses completed, numbers of attendees are monitored			
6.1.6	Numbers and types of audits completed are monitored			
6.1.7	Action items identified are recorded, monitored and closed out is acknowledged.			
6.1.8	A system of analysis and feedback to personnel is in place to review HSSE performance measurements.			
6.1.9	Feedback is included in discussion at HSSE meetings, on HSSE notice boards, and by managers' presentations.			
6.1.10	Contract HSSE performance is compared with other similar contracts, and subsidiary personnel are involved.			
6.2 – Safety Performance Indicators				
6.2.1	Measurements for lost time injury frequency and total recordable incident rate are in place.			
6.2.2	First aid cases are recorded.			
6.2.3	Near miss incidents and anomalies are recorded			
6.2.4	Material losses are recorded and performance indicators are in place			
6.3 – HSSE Performance Monitoring				
6.3.1	Occupational illness cases are recorded and indicators are in place.			
6.3.2	Sickness absenteeism is monitored			
6.3.3	Environmental incidents (incidental emissions of pollutants and actual impacts), their type and seriousness are recorded, and reported to authorities as per regulations in place.			
6.3.4	Security incidents are recorded and performance indicators are in place			
6.3.5	Logistics incidents, particularly road transportation incidents are recorded and performance indicators are in place			

MEDICAL INVESTIGATION REQUIREMENT		
(A) Pre-Employment	**(B) Periodical**	**(C) Confined Space Entry**
At the time of Recruitment	Below 50 years of age - every 2 years Above 50 years of age - every 1 year	Annually
Health Questionnaire Physician Examination Vitals - height, weight, blood pressure, pulse, BMI		
LABORATORY INVESTIGATIONS		
Pre-Employment	**Periodical**	**Confined Space Entry**
CBC	CBC	CBC
Blood Group / Rh factor	Fasting Blood Glucose	Blood Sugar- Random
Fasting Blood Glucose	Total Cholesterol	Urine Routine
Kidney Profile (Urea & creatinine)	Triglycerides	
Liver Profile (ALT, SGOT)	ALT	
Serum Albumin	Serum Creatinine	
Lipid Profile (Total Cholesterol & Triglycerides)	Serum Uric Acid	
VDRL	Serum Albumin	
Urine Routine.	Urine Routine	
X ray - Chest, Lumbosacral Spine KUB (Kidney & urinary bladder area)	Stool For Occult Blood (Above 50 years) **Lipid Profile If:** **-** BMI is >35 years, - Smokers - Employees with Diabetes, hypertension, heart disease & increased Cholesterol.	**Respiratory Fit test (RFT)**
SPECIAL TEST		
Pulmonary Function Test - Spirometry / Audiometry / Vision / ECG (40 years & above)		
Note: **The physicians if necessary, for the approval, will advise repeat medical tests or special medical examination / tests.**		

Appendix - N

GENERIC HSEMS PREPARATION GUIDELINES

SN	HSEMS ELEMENTS AND EXPECTATIONS	Meet Requirement?		
		Yes	No	NA
1	**Leadership and Commitment**. This is the principal element in the process. It establishes the priority management places on safety and occupational health. Additionally, it sets the direction for the organization and dictates the involvement and commitment to the effort. Systems and programs that support this element include a clearly defined policy, active and visible management support, and participation in safety activities, rewards, and recognition.			
2	**Safety & Occupational Health Planning**. Short and long long-term S&OH plans shall be developed that are clearly identifiable and are integrated into the business plan. Systems and programs that support this element include strategy development processes, goal setting and alignment, and actual build-down of plans for effective implementation.			
3	**Occupational Health**. The occupational Health element provides for the identification, evaluation, and control of potential health hazards, thus protecting the present and future health of employees. Systems and programs that support this element include chemical, physical, biological, and ergonomic exposure assessments, control plans, medical surveillance programs, and occupational health procedures and programs.			
4	**Employee Ownership and Participation**. The goal is to achieve employee ownership and commitment to the safety improvement process. Acitivities that support this element include employee involvement and participation on safety teams, hazard recognition systems, off-the-job safety programs, and employee participation in safety activities such as meetings, training, incident investigations, audits, etc.			
5	**Behavioral Accident Prevention**. Behavioral accident prevention encourages continuous improvement through the recognition and reduction of at-risk behaviors. Systems and programs that support this element include employee training, observation of work practices, positive feedback, and behavioral metrics.			
6	**Roles and Responsibilities**. Roles and responsibilities shall be documented, maintained, and clearly communicated. Employees understand their specific areas of responsibility, have the authority to accomplish their tasks safely, and be held accountable for fulfilling their roles in the safety process. Systems and programs that support this element include documented roles and responsibilities for all employees, S&OH team charters, and job charters.			
7	**Training**. Employees shall receive training to provide the necessary skills for accomplishing their assigned roles and responsibilities. Training systems shall provide for initial, periodic, and ongoing training. Systems and programs that support this element include employee selection, identification of employee training and development needs, employee orientation, regularly required training, operator/mechanical skill training and qualification, development and maintaining of training resources, and demonstration of proficiency.			
8	**Contractors.** Effective implementation of contractor safety systems protects Client and contractor employees and assets. Systems and programs that support this include contractor selection, training and education, auditing, incident reporting/investigations, and performance monitoring.			
9	**Standards and Procedures**. Development, maintenance, and communication of standards and procedures ensure that risks are either eliminated or controlled and provide guidance to achieve regulatory compliance. Systems and programs that support this include regulatory/legislative issues management process, engineering standards development and maintenance, and S&OH programs/procedures development and maintenance.			
10	**Metrics**. Metrics are necessary to implement and continuously improve the safety process. Systems and programs that support this include the use of leading indicators, such as degree of management system implementation, as well as trailing indicators, such as injury/incident data.			
11	**Audits**. A systematic approach to auditing evaluates performance against a given set of criteria, documents successes, and identifies opportunities for improvement. Systems and programs that support this include work practice audits, system audits, compliance audits, and recommendation closure process.			
12	**Incident Reporting and Investigations**. Incident investigation sytems identify, evaluate, eliminate, and communicate potential hazards. Management is expected to create an environment for open reporting of all incidents. Systems and programs that support this include incident investigation procedures, communication of lessons learned, computerized incident reporting and tracking system, incident reporting requirements, and recommendation closure.			
13	**Emergency Preparedness**. Effective emergency preparedness systems provide identification, assessment, and management of potential adverse situations. Effective evaluation of incidents and sharing of lessons learned provide valuable information for preventing similar incidents. Systems and programs that support this include establishment of an emergency management organization, emergency response planning, training, community involvement activities, and drills.			
14	**Mechanical and Operating Integrity**. A comprehensive mechanical and operating integrity program maximizes equipment reliability and operating discipline, thus providing a means to eliminate unplanned events. Systems and programs that support this include documentation of process technology information, process hazard analysis, operating and mechanical procedures, management of change and prestart-up reviews, inspection and tests, QA/QC, design criteria documentation, risk assessment, and mitigation systems.			

Appendix - O

HSE Manpower Strength & Requirements Guidelines

A. PROJECTS DEPARTMENT

Employee Strength See note (b) below	**Minimum Strength of HSE Staff**
No. of employees: < 30 **(Part Time Basis)**	- One discipline (Engr./ Supvr.) with safety experience that will handle Safety Responsibilities - One discipline (Engr./ Supvr.) with environment experience that will handle Environment Responsibilities ** (See note below)
No. of employees : 30 - 100	- One Safety Supervisor, dedicated / approved and on full time responsibility - One discipline (Engr./ Supvr.) with environment experience that will handle Environment Responsibilities, on part time basis
No. of employees : 101 - 250	- One Safety Engineer + One Safety Supervisor, dedicated / approved and on full time responsibility + - One discipline (Engr./ Supvr.) with environment experience that will handle Environment Responsibilities, on part time basis
No. of employees : 251 – 500	- One Safety Engineer + - One Safety Supervisor (for each 250 employees) + - One Environment Supervisor All above staff shall be dedicated, approved and on full time responsibility
No. of employees : > 500 - 1000	- One Safety Engineer (for each 500 employees) + - One Safety Supervisor (for each 250 employees) + - One Environment Engineer + One Environment Supervisor All above staff shall be dedicated, approved and on full time responsibility
No. of employees : > 1000	- HSE Manager - One Safety Engineer (for each 500 employees) + - One Safety Supervisor (for each 250 employees) + - One Environment Engineer + One Environment Supervisor + - HSE Trainer + - One Nurse + - *One Industrial Hygiene Technician* All above staff shall be dedicated, approved and on full time responsibility

** For Projects Department (above table), any contract with physical activities at site shall have a dedicated / approved full time Safety Supervisor

PEC TECHNICAL STANDARDS

HEALTH, SAFETY AND ENVIRONMENT

HEALTH, SAFETY, SECURITY, ENVIRONMENTAL REQUIREMENTS

(Doc.No.:- PEC-03C2)

PREFACE

PEC Technical Standards (PTS) are based on the experience acquired during the involvement with the design, construction, operation and maintenance of processing units and facilities of Aromatic Complex Project in Singapore. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good technical practice to be applied by PEC' OPUs in oil and gas production facilities, refineries, gas processing plants, chemical plants, marketing facilities or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to users for their consideration and decision to implement. This is of particular importance where PTS may not cover every requirement or diversity of condition at each locality. The system of PTS is expected to be sufficiently flexible to allow individual operating units to adapt the information set forth in PTS to their own environment and requirements.

When Contractors or Manufacturers / Suppliers use PTS they shall be solely responsible for the quality of work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, it is expected of them to follow those design and engineering practices which will achieve the same level of integrity as reflected in the PTS. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the owner.

The right to use PTS rests with three categories of users:

1. PEC and its affiliates.
2. Other parties who are authorized to use PTS subject to appropriate contractual arrangements.
3. Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) and 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

Subject to any particular terms and conditions as may be set forth in specific agreements with users, PEC disclaims any liability of whatsoever nature for any damage (including injury or death) suffered by any company or person whomsoever as a result of or in connection with the use, application or implementation of any PTS, combination of PTS or any part thereof. The benefit of this disclaimer shall inure in all respects to PEC and/or any company affiliated to PEC that may issue PTS or require the use of PTS.

Without prejudice to any specific terms in respect of confidentiality under relevant contractual arrangements, PTS shall not, without the prior written consent of PEC, be disclosed by users to any company or person whomsoever and the PTS shall be used exclusively for the purpose they have been provided to the user. They shall be returned after use, including any copies which shall only be made by users with the express prior written consent of PEC.

The copyright of PTS vests in PEC. Users shall arrange for PTS to be held in safe custody and PEC may at any time require information satisfactory to PEC in order to ascertain how users implement this requirement.

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10.0 HEALTH, SAFETY, SECURITY, ENVIRONMENTAL REQUIREMENTS - HSSE

10.1 PURPOSE

The purpose of this Chapter is to outline, describe and define the requirements for CONTRACTOR, as per OWNER's Health, Safety, Security and Environmental (HSSE) management program and OWNER'S HSE & security policies during the PROJECT.

10.2 GENERAL INTRODUCTION

This Chapter outlines the health, safety, security and environmental ("HSSE") requirements that CONTRACTOR shall meet throughout the execution of the PROJECT.

The purpose of these safety and health requirements is to ensure compliance to regulatory requirements and to prevent incidents or events that could result in fatality, injury or illness to personnel and/or damage to environment or property.

CONTRACTOR shall comply with all the applicable Health, Safety and Environment ("HSE") LAWS and PERMITS pertaining to safety, health, environmental protection and fire protection, which are applicable to the location, where the WORKS are being carried out.

CONTRACTOR shall also comply at all times with the requirements, as set forth by the OWNER in its Health, Safety and Environment Management System ("HSE MS"), policies, operating standards, WORKSITE HSE requirements, OWNER's Zero Tolerance Rules ("ZeTo") and any special instructions and all requirements stipulated in this CONTRACT.

These requirements are intended to supplement any safety and health requirements imposed by LAW with which the CONTRACTOR is obliged to comply. CONTRACTOR shall also adhere to any safety and health procedures as may be imposed by OWNER.

CONTRACTOR shall be held responsible for ensuring that its SUB-CONTRACTORS fulfill all the Health, Safety, Security and Environmental (HSSE) requirements outlined herein for the whole duration of their activities for the PROJECT.

10.3 REQUIREMENTS OF OWNER'S HSSE MANAGEMENT SYSTEM

10.3.1 HSSE LEADERSHIP AND COMMITMENT

OWNER is committed to the protection of the Environment, the Health, the Safety and the Security of personnel working on this PROJECT as well as others, who may be affected by WORK and CONTRACTOR's activities.

It is required that CONTRACTOR also fulfills this commitment and in so doing, provides anything is necessary for the protection of people, property and the environment. CONTRACTOR will, in advance, endeavor to eliminate any foreseeable hazards, which could result in accidental loss, including personnel injury, fire, security, loss and property damage during the carrying out of the WORK.

In addition, the management of CONTRACTOR shall ensure that it achieves and maintains a well-informed and motivated work force (including amongst its SUB-CONTRACTORS and their respective workforces) that will effectively contribute to the overall success of the HSSE program implemented by OWNER.

Pursuant to above, the HSSE objectives are:

- To ensure that HSSE goals are the prime consideration in the execution of the WORK.
- To achieve a target of zero fatalities and zero injuries.
- To minimise any unplanned impact on the natural environment.
- To apply management with clear health, safety, security and environmental objectives during all CONTRACTOR's activities carried out on the WORKSITE.
- To continue to review the management of HSSE throughout the performance of the WORK in order to continuously improve performance.
- To communicate all the foregoing to the labor force participating in the WORK.

CONTRACTOR shall strive for a 'ZERO' injury and incident workplace and will set a safety and health goal throughout the performance of the WORK.

The OWNER's HSSE philosophy is summarized in the following statement: ***'No harm to people, No accident, No damage to the environment & No loss of project's property'***

All personnel shall take full responsibility for all HSSE related issues for the duration of the CONTRACTOR's activities on the WORKSITE.

10.3.2 RIGHT TO STOP WORK ON HSE GROUND

The OWNER shall have the right to prohibit commencement of the WORKS or to stop any WORKS in progress on HSE ground (without limitation) if MATERIALS, CONTRACTOR'S EQUIPMENT the CONTRACTOR's personnel (whether procured by the CONTRACTOR from third parties or supplied by the CONTRACTOR) or work conditions are considered to be unsafe or not in compliance with OWNER's HSSE rules and/or requirements.

In such event, the CONTRACTOR shall, without reservation, remove the unsafe MATERIAL, CONTRACTOR'S EQUIPMENT, the CONTRACTOR's personnel or work conditions prior to seeking the OWNER's permission to resume or commence the WORKS. Any relative costs resulting of any delays or actions taken or required, which arise in any way in connection with this Article and/or the WORKS stoppage on HSE ground, shall be at the CONTRACTOR's sole expense and shall be deemed to be included in the CONTRACT PRICE..and shall not entitle CONTRACTOR to any EXTENSION OF TIME.

10.3.3 CONSEQUENCE MANAGEMENT FOR HSE NON-CONFORMANCES

In case of HSE non-compliance committed by the CONTRACTOR's or its SUB-CONTRACTOR's / VENDOR's personnel, which has been verified by the OWNER, consequence management shall be applied to the CONTRACTOR's or its SUB-CONTRACTOR's / VENDOR's personnel in accordance with the requirements of "HSE Consequence Management for HSE Non-Conformances".

For HSE non-compliances of a major category, as given inside the *"Project Procedure - Project HSE & Security Requirements for EPCC CONTRACTORs*" are fully applicable.

If HSE non-compliances of a major category, as prescribed, were repeatedly committed by CONTRACTOR / VENDOR personnel, OWNER shall have the right to terminate the CONTRACT in accordance with the provisions claim for any loss, damages suffered by the OWNER as a result thereof.

If an incident of HSE non-compliance by the CONTRACTOR / VENDOR personnel occurs and results in fatality during execution of the WORK, OWNER shall have the right to terminate the CONTRACT in accordance with the provisions and the OWNER shall also have the right to call on the bank guarantee pursuant to recover any loss, claims or damages suffered by the OWNER as a result thereof.

The above are without prejudice to any other rights and remedies of OWNER arising hereunder or by LAW or otherwise.

10.3.4 PROTECTION OF WORKERS, PUBLIC, ASSETS AND ENVIRONMENT

CONTRACTOR shall protect the safety and health of workers and people living or working near the activity from potential hazards and risks carried out by that activity. CONTRACTOR, without cost to OWNER, shall take all necessary precautions and mitigation measures to protect the workers and the public and minimise disturbance and inconvenience to the public resulting from performance of the WORKS.

Throughout performance of WORKS, CONTRACTOR shall execute the WORKS and conduct all operations in such a way as to minimise any impact upon the natural environment, including compliance with all LAWS, PERMITS, and rules applicable to the WORKSITE, e.g. ENVIRONMENTAL MANAGEMENT PLAN, Detailed Environmental Impact Assessment (DEIA), DEIA approval conditions, etc.

CONTRACTOR shall agree to indemnify OWNER and consultants of OWNER for all claims, damage costs and penalties relating to any environmental damage or loss or non-compliance with any LAWS or PERMITS arising out of CONTRACTOR and/or SUB-CONTRACTOR performance of WORKS.

10.3.5 HSSE POLICIES

CONTRACTOR shall prepare, implement and maintain a written statement of the Health, Safety, Security and Environment policy for the PROJECT which complies with the Occupational Safety and Health Act 1994.

The policy shall describe the CONTRACTOR's HSSE philosophies and objectives for the PROJECT and shall contain the following as minimum:

- Commitment to HSSE;
- Establishment of HSSE as a line management function and responsibility;
- Recognition that all incidents and injuries are preventable;

• Emergency preparedness;

• Providing necessary resources with adequate competency to safeguard HSSE;

• Compliance with LAW and regulatory requirements;

• Ensure security of personnel, equipment & property.

CONTRACTOR's HSSE policy statement for the PROJECT shall be dated and signed by the CONTRACTOR management and shall be submitted to OWNER and approved within thirty – (30) days of EFFECTIVE DATE.

CONTRACTOR shall communicate the intents and requirements of the HSSE policy to its personnel and SUB-CONTRACTORS involved in the PROJECT.

CONTRACTOR shall ensure that SUB-CONTRACTORS' HSSE policies and standards are aligned with CONTRACTOR's HSSE policy.

CONTRACTOR shall draw to the attention of OWNER any conflicting requirements within the various HSSE instructions and procedures with which CONTRACTOR is obliged to comply, prior to commencement of the affected part of the PROJECT.

10.3.6 DRUGS AND ALCOHOL POLICY

OWNER's policy with regard to drugs and alcohol is very clear:

'No personnel is allowed at the WORKSITE to work under the influence of alcohol, drugs or other intoxicating substances, other than medically prescribed medication given by a Medical Doctor.'

OWNER reserves the right to randomly require CONTRACTOR's and SUB-CONTRACTOR's employees to undertake a drugs & alcohol test and to terminate the employment of personnel, if they are found to be under the influence of alcohol, drugs or other intoxicating substances. These same rules also apply to drivers of buses, lorries or other vehicles operating within the PEC SITE and operators of the CONTRACTOR's EQUIPMENT and other equipment during their presence on the PEC SITE.

10.3.7 HSE MANDATORY CONTROL FRAMEWORK

OWNER's HSE Mandatory Control Framework ("MCF") contains the mandatory requirements to be implemented by the CONTRACTOR and is included in MANDATORY CONTROL FRAMEWORK. The main objective of MCF is to strengthen the governance of Health, Safety and Environment (HSE) through:

- Clear HSE requirements for effective implementation;
- Consistent implementation of the HSE management system;
- Expediting the implementation of process & fabrication safety;
- Effective implementation of HSE assurance.

The MCF supports the OWNER's policy for HSE and provides the high level framework for the management of HSE. The scope and application of the individual control requirements are stated in the respective PTS references for each element in the MCF.

In all cases, CONTRACTOR is reminded that relevant to the HSE / environmental management system requirements of CONTRACTOR's activities on WORKSITE, CONTRACTOR shall refer at all times to the HSE MCF and the original PTSs given inside– MANDATORY CONTROL FRAMEWORK.

The CONTRACTOR's HSE management system shall be aligned with OWNER's HSE MCF, where all the 10 key elements are implemented. Consistent application of the CONTRACTOR's HSE management system will ensure compliance with the requirements of the MCF and referenced PTSs and, consequently, will support the delivery of an improved and sustainable HSE performance and culture throughout the PROJECT.

10.3.8 PROJECT HSE PLAN & PROJECT SECURITY PLAN

The first step in the planning for HSE program and activities is the preparation by CONTRACTOR of a PROJECT HSE PLAN, which has to be submitted to OWNER for approval within forty-five – (45) days after COMMENCEMENT DATE and in any case prior to the commencement of any CONTRACTOR's activities on the WORKSITE. This document will be an 'umbrella' document which will need to be supported by other HSE procedures.

CONTRACTOR shall implement and maintain its own HSE procedures, work instructions and guidelines during the construction aspects of the WORKS.

The PROJECT HSE PLAN shall be agreed with OWNER prior to its implementation and shall be subject to periodic audit by OWNER. It needs to refer, as a minimum, but not limited, to the following elements of HSE management:

- Leadership and commitment;
- Policy and strategic objective;
- Organisation, responsibilities, resources, standards and documents;
- Health management;
- Environment management;
- Safety & transportation management;
- HSE risk management / HSE risk reviews;
- HSE training and familiarisation;
- Prevailing LAWS and regulations;
- Planning and procedure;
- HSE management of SUB-CONTRACTORS;

- Process safety, safe operations, asset integrity;
- Management of change;
- Competence assurance;
- Incident management and emergency response;
- Implementation and monitoring;
- Management review.

CONTRACTOR shall develop its own PROJECT SECURITY PLAN, which has to be submitted to OWNER for approval within ninety - (90) days after COMMENCEMENT DATE and in any case prior to the commencement of any CONTRACTOR's activities on the WORKSITE.

The PROJECT SECURITY PLAN needs to refer, as a minimum, but not limited, to the following elements of security management:

- Leadership and commitment;
- Policy and strategic objective;
- Organisation, responsibilities, resources & standards;
- Security management;
- Security threat assessment;
- Security awareness and training;
- Communication, incident reporting and investigation;
- Emergency response and evacuation;
- Protection of information and information systems;
- Management review, evaluation, inspection and auditing;

CONTRACTOR will need to develop a number of security & emergency response procedures, work instructions and guidelines in order to ensure the security and crisis management of the WORKSITE.

10.3.9 WORKSITE HSE & SECURITY PROCEDURES

CONTRACTOR shall develop, implement and maintain HSSE procedures, work instruction, guidelines & checklists for the WORKSITE that fully reflect the requirements identified in the PROJECT HSE PLAN and the PROJECT SECURITY PLAN.

The HSSE procedures for the WORKSITE shall contain detailed requirements and arrangement for managing the HSSE performance and reporting of all WORKSITE activities throughout the different phases of the PROJECT.

CONTRACTOR's HSSE procedures, work instructions, guidelines & checklists shall also refer to the HSSE aspects related to all specific CONTRACTOR's activities during the PROJECT.

The HSSE procedures for the WORKSITE shall also address those HSSE issues with regard to any visitors or other personnel, who may be exposed to potential hazards whilst present on the WORKSITE.

All of the HSSE procedures and work instructions shall be principally be prepared in two languages, English and Bahasa Malaysia, in addition to any other language required to suit the composition of the CONTRACTOR's and SUB-CONTRACTOR's personnel.

Whilst the use of dual-language is permissible for certain work instructions, the instructions and wordings in English shall be present and take precedence where there is conflict within the translation. OWNER shall have the right to request a copy of such documents from CONTRACTOR at any time.

CONTRACTOR shall submit the HSSE procedures to OWNER for review within sixty – (60) days after COMMENCEMENT DATE and/or prior to any commencement of any CONTRACTOR's activities on the WORKSITE.

10.3.10 CONTRACTOR'S HSE & SECURITY ORGANISATION

CONTRACTOR shall establish an internal management structure for the PROJECT and shall identify the positions within this structure and the specific roles and responsibilities of its personnel with regard to management of HSE & Security ('HSSE") for the PROJECT.

The CONTRACTOR's KEY PERSONNEL approved by OWNER shall have overall responsibility of HSSE at the WORKSITE.

CONTRACTOR shall also appoint an HSE Manager who shall be responsible for ensuring that all activities on the WORKSITE are conducted in a safe and secure manner. The HSE Manager shall report directly to the CONTRACTOR's Construction Manager.

The minimum qualification required for the HSE Manager(s) is the Department of Occupational Safety and Health ("DOSH") Safety & Health Officer ("SHO") certification and registration, as required under the Occupational Safety and Health (Safety and Health Officer) Regulation of 1997 (or equivalent / higher, local or international HSE certification approved by OWNER) with minimum 10 years of HSE experience in major Onshore / Oil & Gas Projects.

CONTRACTOR shall appoint adequate number of HSE Supervisors and HSE Officers, who are responsible for enforcement of the HSE requirements at WORKSITE. The HSE Supervisors will report to the HSE Manager and the HSE Officers will report to the HSE Supervisors respectively.

The minimum qualification required for the HSE Supervisor(s) is the Department of Occupational Safety and Health ("DOSH") Safety & Health Officer ("SHO") certification and registration, as required under the Occupational Safety and Health (Safety and Health Officer) Regulation of 1997 or an international HSE certification approved by OWNER with a minimum of 3-5 years of HSE experience in major Onshore / Oil & Gas Projects.

The minimum qualification required for of the HSE Officer(s) is National Institute of Occupational Safety and Health ("NIOSH") Certificate Program for Safety & Health Officer or international HSE certification approved by OWNER, with a minimum of 1-2 years of HSE experience in major Onshore Oil & Gas Projects.

OWNER reserves the right to interview and approve the HSE Manager(s), HSE Supervisor(s) and HSE Officer(s) allocated for carrying out the specific activities or request allocation of more HSE Manager(s), HSE Supervisor(s) and/or HSE Officers, if indeed, required.

A minimum of one, full – time, HSE Officer is typically required per 50 – 100 employees on the WORKSITE, depending on the activities and associated risks, with the above mentioned qualifications.

CONTRACTOR shall ensure that HSE Manager(s) and HSE Supervisors shall be certified and shall have the requisite level(s) of qualification, experience and expertise. CONTRACTOR shall submit to OWNER for approval, the Curriculum Vitae of the proposed personnel carrying out the HSE functions.

The CONTRACTOR shall also appoint Security Manager(s) and a team of Security Officers responsible for the organisation and management of security at the WORKSITE.

CONTRACTOR shall ensure that Security Manager(s) and Security Officer(s) shall have the required experience and caliber and CONTRACTOR shall submit to OWNER for approval, the Curriculum Vitae of the proposed personnel carrying out the Security functions.

All HSE & Security personnel shall be clearly identified on the WORKSITE, by wearing a red helmet or a distinctive vest, which shall be approved by OWNER.

10.3.11 COMPLIANCE WITH LEGISLATIVE AND OWNER REQUIREMENTS

10.3.11.1 COMPLIANCE WITH OWNER'S HSE REQUIREMENTS

CONTRACTOR shall comply with all applicable Health, Safety and Environmental (HSE) LAWS and PERMITS including fire and security, which are applicable to the location where the WORKS are being carried out.

CONTRACTOR shall indemnify OWNER against all legal costs, fines and compounds imposed and claims and damages incurred as a result of breach or non-compliance with any relevant LAWS and PERMITS.

CONTRACTOR shall be fully responsible to search and identify all requirements of the relevant authorities having jurisdiction and to strictly adhere to them. CONTRACTOR shall not seek additional compensation from OWNER through a CHANGE NOTICE or by any other means while complying with the requirements of the regulatory authorities having jurisdiction. All of the requirements of the regulatory authorities shall be deemed to form part of the CONTRACTOR's SCOPE OF WORK and shall not be construed as a CHANGE or addition to the scope of the CONTRACT.

CONTRACTOR shall comply at all times with the requirements as set forth by OWNER in its Health, Safety and Environment Management System (HSEMS), policies, operating standards, WORKSITE HSE requirements, PEC Zero Tolerance rules ("ZeTo" rules), any special instructions, and all requirements stipulated in this CONTRACT. These requirements are intended to supplement any known or ought to be known LAWS and PERMITS applicable at the location where the WORKS are being carried out.

CONTRACTOR shall take all necessary HSE control and recovery measures related to or arising out of the performance of the CONTRACT in order to protect the WORK, the personnel and property of the OWNER, CONTRACTOR, SUB-CONTRACTOR, all third parties and public from the hazards and risks associated with the planning and execution of WORK.

CONTRACTOR shall be held responsible for ensuring that SUB-CONTRACTORS and third parties fulfill HSE requirements outlined herein.

Notwithstanding the above, the CONTRACTOR shall perform all obligations related to the HSE requirements listed in Section C – Part II- HSSE MANAGEMENT REQUIREMENTS and Section C - Part II - ENVIRONMENTAL MANAGEMENT.

10.3.11.2 COMPLIANCE WITH LEGISLATIVE REQUIREMENTS

The CONTRACTOR is fully responsible during execution of the WORK for compliance with the LAW, including (without limitations):

- Relevant national, Malaysian LAW;
- Relevant Johor's State Enactment;
- Applicable international laws and regulations;
- National and international Standards or Codes of practices;
- The OWNER's HSE & Security procedures and guidelines;

- Traffic management technical instructions by Malaysian Public Works Department.

The CONTRACTOR shall undertake its HSSE functions, roles and responsibility, described in this Part II - Chapter 10.0 in accordance with:

- Occupational Safety and Health Act 1994;
- Occupational Safety and Health (Safety and Health Committee) Regulations 1996;
- Environmental Quality Act 1974;
- Factories and Machinery Act 1967;
- Factories and Machinery (Safety, Health and Welfare) Regulation 1970;
- PEC HSSE Management System (HSSE-MS);
- PEC Technical Standards (PTSs);
- PEC Mandatory Compliance Framework (MCF);
- Detailed Environmental Impact Assessment (DEIA) requirements and approval conditions, as issued by DOE;
- Additional regulatory requirements from the DOE, Atomic Energy Licensing Board (AELB) and BOMBA in Malaysia.

In addition to that, CONTRACTOR shall ensure that an HSE legal register will be developed with the licenses & LAW required as well as the requirements that CONTRACTOR needs to comply with.

CONTRACTOR must keep the HSE legal register “live” throughout the PROJECT and ensure compliance.

CONTRACTOR shall ensure that all aspects of the PROJECT HSE PLAN, PROJECT SECURITY PLAN and HSE procedures for the WORKSITE are fully implemented throughout the PROJECT.

CONTRACTOR shall be fully responsible for the supervision of its personnel and its SUB-CONTRACTORS and their personnel to ensure that they strictly adhere to all applicable HSSE requirements.

OWNER will monitor CONTRACTOR’s implementation of the PROJECT HSE PLAN, PROJECT SECURITY PLAN and its HSSE procedures, work instructions, guidelines & checklists.

The CONTRACTOR shall co-ordinate all SUB-CONTRACTORS throughout the PROJECT to meet the HSSE objectives of the PROJECT. CONTRACTOR shall confirm that it will achieve this by addressing each of the following:

- Implementations of the agreed CONTRACTOR’s PROJECT HSE PLAN & PROJECT SECURITY PLAN;

- Selection of competent SUB-CONTRACTORS for all activities (excavation, working at height, transportation of materials, rock blasting, etc);
- Obtaining the participation, commitment and co-operation of all SUB-CONTRACTORS;
- Detailed planning of the WORKSITE activities to co-ordinate, minimise and control interfaces and identify potential hazards (such as performance of Pneumatic testing, Hydrostatic testing, Radiography testing, etc);
- Preparation of method statements and Job Hazard Analysis (JHA) or equivalent and review by OWNER prior to start of any activity;
- Introduction of regular Tool Box Talks and daily meetings;
- Regular discussion of HSSE matters with CONTRACTOR and SUB-CONTRACTORS;
- Communicating all relevant HSSE information to SUB-CONTRACTORS;
- Regular review of the safe system of work and updating of the PROJECT HSE PLAN to facilitate continual improvement of the system.

10.3.12 HSSE RESPONSIBILITY

CONTRACTOR shall specify the HSSE responsibilities of the KEY PERSONNEL for the PROJECT in the PROJECT HSE PLAN with the minimum requirements as set out below.

10.3.12.1 CONTRACTOR'S PROJECT MANAGER

The CONTRACTOR's Project Manager shall be accountable for ensuring that the CONTRACTOR's team working on WORKSITE complies with the requirements of this document, and has statutory and moral obligations for ensuring that employees and SUB-CONTRACTOR are provided with a safe, secure and environmentally sound working environment. CONTRACTOR personnel, and in particular, line management, shall do their outmost to promote HSSE matters in accordance with the above mentioned PROJECT's HSSE objectives.

HSSE roles and responsibilities, including interface between the OWNER and/or CONTRACTOR's management, will be clearly defined in PROJECT

DOCUMENTATION. All CONTRACTOR personnel share a responsibility to work in a manner which does not expose themselves or others to hazards while performing operations defined in their scope of work.

'All employees have the RIGHT and obligation TO STOP ANY WORK that they believe is unsafe'.

The CONTRACTOR's Project Manager shall ensure that adequate resources are provided for the PROJECT in terms of personnel, support from the

CONTRACTOR's Office in its local jurisdiction, advice and planning, and any other identified aspects of the PROJECT that may impact the overall HSSE program.

The CONTRACTOR's Project Manager shall ensure that HSSE documentation is comprehensively prepared and delivered to OWNER at appropriate time as specified by OWNER.

HSSE documentation shall include relevant information which is required to allow the OWNER to operate and maintain the FACILITY safe during the operational phase.

CONTRACTOR's Project Manager shall chair CONTRACTOR's monthly Safety, Health & Environmental committee meetings.

CONTRACTOR's Project Manager shall participate in the HSSE audits and inspection programs and ensure that relevant personnel participate in HSE audit and inspection program at the WORKSITE.

CONTRACTOR's Project Manager shall support a "ZERO" incident and injury culture and ensure personnel's participation in HSSE awareness training programme(s) and activities that include promoting safety at WORKSITE.

CONTRACTOR's Project Manager shall be accountable for ongoing development and implementation of CONTRACTOR's activities at WORKSITE, review work planning requirements for inclusion in procedures / guidelines / inspection lists, and shall ensure all of the following people working on WORKSITE: supervisors / workers / crane operators / lorry drivers, vehicle operators and any other operators of CONTRACTOR'S EQUIPMENT or other machinery understand their roles regarding HSSE and promote HSSE activities on the WORKSITE.

CONTRACTOR's Project Manager shall participate in inductions for the PROJECT, tool box talks & safety meetings and ensure its SUB-CONTRACTORS attend inductions and are properly briefed.

10.3.12.2 CONTRACTOR'S CONSTRUCTION MANAGER

The CONTRACTOR's Construction Manager, shall report to the CONTRACTOR's Project Manager and shall be responsible to ensure the implementation of the PROJECT HSE PLAN and PROJECT SECURITY PLAN for the PROJECT.

CONTRACTOR's Construction Manager has the following responsibilities:

- Implement the PROJECT HSE PLAN and the HSE procedures for the WORKSITE;
- Implement the PROJECT SECURITY PLAN and Project Emergency Response Plan and security procedures for the WORKSITE;
- Ensure that SUB-CONTRACTORS' personnel are fully qualified, experienced and competent;

- Develop detailed planning of CONTRACTOR's activities at the WORKSITE to ensure proper coordination of interfaces with OTHER CONTRACTORS in order to minimise and control potential issues and hazards;
- Ensure that all risks associated with the construction aspects of the WORK (including COMMISSIONING) are identified and those which are known to the OWNER, or have been identified during design, are communicated to relevant SUB-CONTRACTORS. Transmittal records on this communication shall be kept;
- Obtain from SUB-CONTRACTORS their risk assessments, work method statements and HSE plans and ensure that they are reviewed, approved and all mitigation measures are in place prior to commencement of the WORK;
- Ensure that SUB-CONTRACTORS have been made aware of their roles and responsibilities with regard to safe working procedures and that both SUBC-ONTRACTORS and their workers comply with the rules for the WORKSITE which have been set out in the PROJECT HSE PLAN for the PROJECT and HSE procedures for the WORKSITE;
- Ensure that all workers attending and working at the WORKSITE are properly informed and consulted on HSE matters. Ensure that field staff attending and working at the WORKSITE are suitably competent and understand their HSSE responsibilities;
- Participate in HSSE audit and inspection programs at WORKSITE;
- Coordinate with the CONTRACTOR’s environmental specialist or environmental officer on any matters related to environment. Similarly is also responsible on the health related matters;
- Ensure that the WORKSITE is properly secured and all emergency response and security issues are properly managed.

10.3.12.3 CONTRACTOR’S HSSE MANAGER

The CONTRACTOR's HSSE Manager shall have the following minimum responsibilities:

- Manage a team of CONTRACTOR’s HSE & Security professionals on the WORKSITE;
- Report to OWNER’s HSSE Manager and OWNER’s Construction Manager any issue related to HSSE on the WORKSITE;
- Develop and implement HSE / environmental / security induction program for all personnel working on the WORKSITE;
- Arrange and participate in HSSE training activities;
- Administer and participate in periodic HSSE audit and inspection of the WORKSITE. The HSSE inspection schedule shall ensure that all parts of the WORKSITE are inspected every week;
- Audit and monitor CONTRACTOR’s HSSE programs including enforcement of the drugs and alcohol policy referred to above;

- Advise the CONTRACTOR’s discipline supervisors, field superintendents and SUB-CONTRACTORS’ construction managers of any HSSE shortfalls and provide specialist advice;
- Ensure that emergency response and security requirements are properly managed and coordinated;
- Carry out daily inspections of all work areas to ensure SUB-CONTRACTORS' compliance with regard to safe work practices and ensure that SUB-CONTRACTORS’ HSSE performance is monitored by SUB-CONTRACTOR’s supervisors;
- Support a zero incident and injury culture. Ensure compliance with the HSSE implementation plan for the PROJECT, and promote the goal of "ZERO – No Harm to people";
- Attend weekly PROJECT progress meeting and the monthly safety and health committee meeting;
- Communicate incident reports and lessons learned to SUB-CONTRACTORS & OWNER in the event of any HSSE incident at WORKSITE, immediately report verbally to OWNER’s HSSE Manager and OWNER’s Construction Manager, followed by written report;
- Produce and submit to OWNER monthly HSE statistics and reports for the PROJECT;
- Promote HSE awareness program for the PROJECT;
- Take the lead role in HSE communications pertaining to the PROJECT with government bodies and local authorities;
- Ensure that all security & emergency response issues and incidents are properly reported.

10.3.12.4 CONTRACTOR’S FIELD SUPERINTENDENTS

CONTRACTOR'S field superintendents shall have the following minimum responsibilities:

- Co-ordinate with all SUB-CONTRACTORS under their respective control and supervision;
- Carry out regular HSSE inspections of all areas of the WORKSITE in coordination with the HSSE Manager;
- Review work method statements and job hazard analysis ("JHA") produced by SUB-CONTRACTORS to ensure they are in line with CONTRACTOR’s HSE procedures for the WORKSITE;
- Ensure rigging studies are produced and in line with lift classifications and lifting plans are submitted to OWNER for review;
- Attend weekly progress meetings and safety and health committee meetings to discuss and resolve HSSE issues and concerns;
- Ensure that all works carried out by SUB-CONTRACTORS are in line with approved work methods;

- Ensure that staff under CONTRACTOR's control is competent, qualified and experienced to perform the aspects of the WORK subcontracted to them and understand their HSSE responsibilities;
- Ensure that security and emergency response issues are properly coordinated, managed and reported by allocated personnel at WORKSITE.

10.3.12.5 CONTRACTOR'S DISCIPLINE SUPERVISOR

CONTRACTOR's discipline supervisors shall have the following minimum responsibilities:

- Ensure that the works performed by SUB-CONTRACTORS under their control are undertaken in a way that addresses and eliminates hazards at the WORKSITE, and ensure that the work method statements and JHA, where required, are in place.
- Comply with statutory HSE & environmental requirements.
- Carry out daily HSE inspections at the WORKSITE, and follow up on any deficiencies noted with SUB-CONTRACTORS' field management.
- Obtain and carry out a daily audit of Permits to Work and ensure compliance.
- Report any incident at the WORKSITE, participate in the investigation and implement the recommendations as appropriate.
- Ensure that all persons carrying out their work and duties at the WORKSITE are fully aware of the risks and follow the agreed work method.
- Monitor daily team talks and weekly toolbox talks.
- Support a ZERO incident and injury culture.
- Participate in and fully support the objectives of HSSE training and activities.
- Inspect any equipment to be used on the WORKSITE, including all CONTRACTOR'S EQUIPMENT both prior to and during usage (e.g. lorries, excavators, cutting machines etc).
- Equipment including all CONTRACTOR'S EQUIPMENT to be used needs to be properly inspected and maintained prior to use by CONTRACTOR.
- Ensure that all personnel appointed by CONTRACTOR and SUB-CONTRACTORS are following the basic rules of housekeeping.

10.3.12.6 CONTRACTOR'S WORKSITE PERSONNEL

CONTRACTOR's personnel working on the WORKSITE (including SUB-CONTRACTORS' personnel) have the following responsibilities:

- Participate in and adhere to all HSSE instructions, safety / security precautions, procedures and activities;
- Conduct inspections of CONTRACTOR'S EQUIPMENT prior to use;

- Participate in JHA, toolbox talks etc. Participate in emergency exercises and safety initiatives;
- Present a comprehensive approach to work safely in accordance with GOOD ENGINEERING PRACTICE;
- Follow the safety & security rules for the WORKSITE and participate in promoting safety;
- Support a zero incident and injury culture;
- Participate in and fully support the HSSE programs, rules and activities for the WORKSITE;

- Comply with requirements for personal protective equipment ("PPE");
- Wear appropriate PPE in accordance with OWNER's HSE policies and LAW;
- Report any unsafe condition or activity;
- Report to CONTRACTOR's discipline supervisor and inform other employees in immediate area of hazard, marking or barricading hazards were possible, until effective removal or repair can be completed;
- Understand their 'right to stop work' where a situation or part of an operation is deemed unsafe;
- Stop the work if a situation or part of an operation is deemed unsafe and report to the CONTRACTOR'S discipline supervisor;
- Attend the daily and weekly toolbox talks;
- Practice daily housekeeping;
- Attend HSSE training, when instructed by the CONTRACTOR's discipline supervisor.

10.3.13 FATIGUE MANAGEMENT

CONTRACTOR shall ensure that all WORKS at WORKSITE are carried out during normal permitted working hours, as agreed with OWNER. CONTRACTOR shall ensure that any works carried out outside the normal permitted working hours shall be authorised by OWNER, prior to commencement.

CONTRACTOR shall ensure that all hazards associated with working outside normal permitted working hours, including night shifts and weekends operations, are identified and mitigated and CONTRACTOR shall perform a specific risk assessment and issue a Permit to Work ("PTW"), as required by OWNER.

System or arrangement for control of WORK outside normal permitted working hours shall be addressed in the Construction Plan, PRE-COMMISSIONNING and COMMISSIONNING Execution Plan, PROJECT HSE PLAN and the HSE procedures for the WORKSITE with particular attention given on the following:

- Nature and level of supervision;

- Task observation and monitoring of the workforce;
- Lighting conditions at the WORKSITE and access to the WORKSITE;
- Activities that are identified as being potentially hazardous e.g. lifting operations, hydrotesting activities, NDT etc;
- Emergency and medical response arrangements.

CONTRACTOR shall monitor and record working hours of personnel and ensure an adequate resting time is provided to prevent working with prolonged hours and avoid fatigue.

CONTRACTOR's and SUB-CONTRACTOR's personnel fatigue management shall be according to the requirements of the OWNER's instructions and guidelines, given inside the - *Fatigue Management*.

10.3.14 PERMIT TO WORK SYSTEM (PTW)

The Permit to Work ("PTW") System constitutes a formal method of ensuring safe work practices for a specific activity with identified hazards. The work permit granted through the PTW System stipulates the safety and precautionary or risk control measures to be applied with reference to the specific procedure.

CONTRACTOR shall comply with the PTW System, which will be prepared by OWNER and issued to the CONTRACTOR and all OTHER CONTRACTORS and shall cover all activities on the PEC SITE. The typical activities, where the PTW System will apply, as a minimum, are:

- Work at height;
- Confined space entry;
- Rock blasting;
- Electrical isolation & re-activation;
- Welding / cutting / machining;
- Painting and surface blasting;
- Excavation;
- Piling;
- Heavy lifting;
- Scaffolding erection;
- Radiography work;
- Critical lifting as follows:
    - Lifting over live process facilities or equipment;
    - Personnel transfer using lifting equipment;
- Coordinated lift whereby the weight of load exceeds the maximum lifting capacity of one of the lifting appliances e.g. using of multiple cranes;

- Lifting of special load structure e.g. boiler, compressor, pressure vessels or reactor;
    - Lifting load of weight of more than 80% of rated capacity of the lifting equipment at the specified working radius and boom angle in accordance with the crane load chart;
    - Lifting more than 10 tons in close proximity of live process equipment.
- Hot work (during COMMISSIONING and at locations near flammable materials).

CONTRACTOR will need to comply with the OWNER's PTW System, as given to them by OWNER. The PTW System will be developed appropriately to be in line with the PTS and fully applicable for each phase (e.g. CONSTRUCTION, COMMISSIONING etc).

10.3.15 WORKING IN CONFINED SPACE

Confined space entry shall be authorised through OWNER's Permit To Work (PTW) approval process. CONTRACTOR shall take adequate precautions and mitigation measures which include, but not limited to gas/oxygen tests, PPE requirements, respiratory protection equipment (RPE), isolation of connections to confined space, provision of ventilation equipment and preparation of confined space for safe entry, standby person, availability of rescue equipment and emergency response team (ERT).

The relevant Safety Officer or Entry Supervisor shall ensure that all necessary precautions and mitigation measures are implemented.

CONTRACTOR's entrants shall be certified medically fit by the Approved Medical Examiner (AME) before they are allowed to work in a confined space.

10.3.16 CONSTRUCTION HSE REQUIREMENTS

10.3.16.1 TOOLS AND EQUIPMENT

CONTRACTOR shall ensure that all CONTRACTOR'S EQUIPMENTS (machinery, tools and equipment, facilities, and other items associated with the WORK) whether purchased or rented are maintained in a safe condition and to be operated by competent operators. Tools shall only be used for the job they were designed to perform. All guards shall be fitted and shall be in good condition at all times. All grinding discs shall be checked for correct size and speed prior to fitting. Electrically powered tools shall meet the hazardous zones requirements where applicable. All electric cables shall be industrial type. Use of domestic electric cables is prohibited. CONTRACTOR shall repair or replace defective tools and equipment at CONTRACTOR's costs. Appropriate personal protective equipment shall be worn at all times, when using any tool or equipment.

10.3.16.2 COMPRESSED GAS CYLINDERS

CONTRACTOR shall ensure that:

- Compressed gas cylinders stored, or transported or used shall be in an upright position and secured to some substantial object or structure by a chain or other suitable means capable of supporting the weight of the cylinder. This applies to all cylinders, whether empty or full**.**
- Cylinder valves shall be closed and hoses depressurised when cylinders are not in use.
- Cylinders shall have protective valve caps in place while they are being transported / stored.
- Cylinders shall be returned promptly to a suitable storage area after use. They shall not be left at any work site. Cylinder storage areas should be kept away from general traffic paths and shall not be adjacent to vehicle paths.
- Flammable gases and oxygen cylinders shall not be stored in close proximity unless separated by a non-combustible wall.
- Cylinders shall only be hoisted when enclosed in an approved box or cradle within which they are securely fastened.
- Cylinders shall be identified by a colour code in accordance with Malaysian standards.
- Gas welding cylinders shall have hose check valve (non-return valves).
- Flashback arrestors shall be installed to quench flashback flames and cut off the gas flow automatically, in both oxygen and fuel gas outlet lines.

10.3.16.3 WELDING AND CUTTING

CONTRACTOR shall ensure only competent and authorised workers are allowed to use welding and cutting equipment. CONTRACTOR shall ensure suitable precautions and mitigation measures against exposure of welding hazards such as excessive ultraviolet radiation, fire, welding fumes, and dusts are put in place.

Welding, and/or flame cutting in the vicinity of flammable or combustible substances/materials shall only be done under the control of a PTW.

CONTRACTOR shall provide adequate number of suitable fire extinguishers at the sites where hot work are taking place. Welders shall be trained and competent in the use of fire extinguishers.

10.3.16.4 ABBRASIVE WHEELS

CONTRACTOR shall ensure that safety protection in the form of goggles and /or shields and hearing protection devices (“HPD”) are provided and utilised by the personnel working with grinding machines and abrasive wheels. When changing

discs on a portable grinder it is imperative that a suitable replacement disc is fitted and installed in the correct manner. CONTRACTOR shall ensure only trained and competent personnel are permitted to carry out this task.

10.3.16.5 GRIT BLASTING

CONTRACTOR shall confirm with OWNER the need for hot work permit prior to grit blasting. CONTRACTOR shall provide the blaster with an approved air face mask and oil free air supply. Associated workers and any other personnel within the blasting area shall wear approved respiratory protection. The blasting gun shall have a 'dead man' safety device operated by the blaster. Under no circumstances the device shall be tied back or defeated.

CONTRACTOR shall made efforts to minimise the exposure of the blasting grit to the surrounding environment. Protective shield shall be erected and notice board shall be posted in order to prevent exposure of the blasting grit to other workers in the vicinity.

10.3.16.6 USE OF CHEMICALS AT WORKSITE

CONTRACTOR shall declare any hazardous chemicals used for the WORK to OWNER. CONTRACTOR shall ensure all requirements for use, storage, handling and transportation of chemicals including personal protection outlined in the Material Safety Data Sheet are strictly followed. The Material Safety Data Sheets for all chemicals shall be made available in the languages stipulated under the LAW. When in doubt concerning these requirements, consult OWNER's HSE personnel.

Flammable chemicals such as solvents and cleaning agents shall not be stored or used in un-ventilated areas or in close proximity to any sources of ignition. These chemicals shall be stored in a proper storage facility outside the work area whenever they are not being used. Proper labeling and re-labeling of the chemical containers shall be done accordingly. Source of ignition such as smoking is strictly prohibited in the vicinity of any such chemicals.

10.3.16.7 USE / HANDLING OF ASBESTOS OR ASBESTOS CONTAINING MATERIALS

The use of any asbestos or asbestos-containing materials is strictly prohibited for WORK related to the CONTRACT. For work that requires handling / removal of asbestos or asbestos-containing materials at WORKSITE, CONTRACTOR shall take the necessary precautions to ensure protection of their workers and others from the risks of exposure to asbestos fibres. CONTRACTOR shall make reference to OWNER's Asbestos Inventory to determine if the WORK to be undertaken may involve handling of asbestos or asbestos-containing materials.

10.3.16.8 ELECTRICAL SAFETY / POWER SOURCE

No part of any lifting device or any equipment operated near power lines shall be closer than the following minimum 'voltage safe distances':

• For 150-750 V, the safe distance shall be 2.0 m;

• For 750- 50k V, the safe distance shall be 3.0m;

• For 50k-250k V, the safe distance shall be 4.5m;

• For 250k V, the safe distance shall be 6.0m.

The above clearance applies in all directions. All overhead lines shall be identified with a highly visible sign placed 7m from both sides of the lines, 1.8m above ground. A restriction guard pole connected with ropes shall be installed to restrict clearance close to power lines.

10.3.16.9 EXCAVATION

CONTRACTOR shall ensure that all excavation work shall meet the following requirements as a minimum:

- Excavations work shall be subjected to the control of PTW and excavation certificate.
- Prior to embarking excavation work, proper excavation design and plan shall be drawn up taking into consideration of the soil type, the weather conditions and proximity to facilities.
- Walkways between trenches should be kept clear of obstruction.
- A competent person shall inspect all excavations, shafts, tunnels and earthwork.
- A standby person shall be made available at all times equipped with all necessary safety equipment.
- All excavation exceeding 1.5 meters shall be shored and a PTW complete with confined space certificate shall be secured.
- No mechanical excavation within 1 meter of the existing service shall be allowed. All underground services shall be hand exposed and identified.

10.3.16.10 BARRICADE, PLATFORMS AND GUARDRAILS

CONTRACTOR shall provide adequate barricades, covers, guardrails, signal flag persons or other appropriate warning devices to protect personnel near any hazardous operations or overhead works. Temporary covers for floor openings shall be firmly fastened and clearly identified by warning signs. All elevated work areas, walkways, platforms etc. whether permanent or temporary, shall be

protected by an approved guardrail and shall provide a sturdy working space. CONTRACTOR shall provide all the necessary signs, barriers, signal flag persons, etc. to protect the general public from exposure to injury due to the excavation work.

All legislated and OWNER requirements for warning signs and/or barriers adjacent to public roads shall be strictly adhered to.

10.3.16.11 SCAFFOLD & LADDERS DESIGN

A safe means of access shall be provided for any work to be carried out at a height greater than 2 meters above ground (or less than 2 meters, if assessed that it is needed).

If a suitable permanent access is not available, a well-designed, erected, inspected and maintained scaffold will provide a safe means of access and safe working areas. Additionally safe access to scaffold work platforms by ladder shall be provided. All scaffoldings shall be constructed in accordance with BS 5973 Code of Practice for Access and Working Scaffolds and Special Scaffold Structures in Steel or its equivalent.

All scaffolding materials and components shall be as follows:

a. Scaffold tubes

All tubes shall be galvanised steel 48.3mm OD and wall thickness 4mm comply to BS 1139 Part 1, 1982 and free from cracks, splits or excessive corrosion and straight. Black steel or aluminum scaffold shall not be allowed to be used at SITE.

b. Coupling and fittings

They shall be of sound construction, comply with BS 1139, Part 2. Tubular and fittings of different standards shall not be mixed.

c. Board or decking meet the recommended BS 2842:1981 or regulation 87 of Factory and Machinery Act 1967.

All timber scaffold boards shall follow the Factories and Machineries (Building Operations and works of Engineering Construction), Safety regulations, 1986.

d. Ladders

Ladders shall meet the requirements of BS 1129:1982.

e. Frame or tubular scaffold

Proprietary steel frame or tubular scaffold of sound design and construction shall be approved by OWNER before use.

f. Inspection

A scaffold inspector shall inspect all scaffold materials. Any scaffold above 40 meters shall be designed and endorsed by a professional structural engineer and copy of design forward to DOSH.

g. Erection

Scaffolds shall only be erected, altered or dismantled by competent scaffolder under supervision of a scaffolder supervisor. All inspection of scaffolds shall be done by a competent scaffold inspector.

10.3.16.12 STORAGE AND WAREHOUSE

CONTRACTOR shall provide appropriate storage facilities for the storing of material, chemical and fuel on WORKSITE. The requirements for storing of materials shall also include the following:

- Construction material shall be stored at the designated locations on WORKSITE;
- Written procedures on transportation, handling and disposal for all material shall be made available;
- Good housekeeping shall be practiced at all storage facilities;
- Storage areas shall be located away from heavy vehicle traffic areas;
- Storage floors and bins shall be labeled and constructed to safely support the loads with maximum safe load limits posted;
- Storage buildings and warehouses shall be provided with an approved lightings and fittings in compliance with hazardous area classification, well ventilated and constructed with chemical resistant flooring, spill containment, waste collection and treatment where appropriate for the chemicals or fuel stored;
- All hot work including welding, cutting or any other operations that create sparks shall be controlled via PTW system inside a warehouse or near the flammable/combustible material storage yards;
- Adequate number of fire extinguishers of appropriate type shall be made available at strategic locations at all storage areas and warehouses;
- All personnel shall wear approved PPE whilst working in storage areas and warehouses;
- Flammable and combustible liquids shall be stored separately in different storage buildings;
- Storage rooms shall be constructed to meet the specified fire resistant rating suitable for their use;
- Approved safety cans / cabinets / containers shall be used to store and transfer flammable and combustible liquids, with the name of the material clearly stamped;

- "No Smoking" signs shall be posted at strategic locations in storage areas and warehouses storing flammable and combustible liquids.

10.3.16.13 EXPLOSIVES

CONTRACTOR shall obtain all relevant permits and comply with the regulatory requirements for the use of explosives.

CONTRACTOR shall ensure that every reasonable precaution and mitigation measures will be taken to ensure that CONTRACTOR personnel handling the explosives comply with established industry standards and best practices in the safe transportation, storage, handling and usage of explosives.

10.3.16.14 LIFTING

All cranes supplied by CONTRACTOR shall have valid certificate of fitness issued by authority e.g. PMA certificate issued by DOSH Malaysia. All cranes shall be inspected, tested and witnessed by OWNER competent person before putting them into service. All associated lifting equipment shall be inspected.

CONTRACTOR shall inspect and maintain all cranes to ensure they are in safe working conditions. All defective cranes shall be taken out of service, repair or replace if necessary. Whenever there is any doubt on the integrity of the crane, load test shall be performed at CONTRACTOR's cost.

A colour coding shall be used to identify inspected lifting appliance. CONTRACTOR shall seek approval from OWNER on any heavy lifting of 15 tons and above. CONTRACTOR is responsible for ensuring that a competent and authorised operator operates any lifting device and that a signal man is designated to signal the operator as necessary to properly place and control the loads.

Prior to performing any lift, the operator shall determine the weight of the object being lifted and ensure that cables, lifting device, slings, wire ropes, chains etc. used are of a sufficient strength to support the weight of the load.

No worker shall be allowed under the load. Tag lines shall be used to guide and control the load where excessive movement is possible.

A competent worker shall inspect all wire rope, chains, and slings prior to performing any lift. Record of inspection shall be kept for OWNER's review. During winch or tow, all personnel shall be clear of the 'whip area' of cable/rope under tension

10.3.16.15 HEAVY MACHINERY

All CONTRACTOR vehicles on the WORKSITE shall have proper insurance and be maintained in safe operating conditions.

All heavy machinery shall be operated by competent and certified operators. They shall be operated in a safe manner and at a speed suited to the terrain and weather conditions.

All cranes, stringing trucks, heavy tracked equipment and machinery, welding rigs and all vehicles shall be fitted with reverse alarms.

Any vehicle with restricted vision shall not operate in the vicinity of workers, except under the direction of a designated worker who is ensuring that the path way is clear and safe.

10.3.16.16 WORKING AT HEIGHT

When working at height more than 7.5 meters, CONTRACTOR shall provide suitable safety nets, which extends 2.5 meters beyond the edge of work level. The nets shall be sufficiently anchored using steel hooks or shackle. The net shall be inspected daily.

If safety nets cannot be used, CONTRACTOR shall provide fall protection devices such as full harness with double lanyards etc. to the workers. Fall protection is required when working above two (2) meters (or less, if assessed that it is needed). Personnel using fall protection shall be trained on its use.

10.3.16.17 AIR HOSE

Air hose should not be used to clean any part of the body or clothing or use to blow off dirt on the floor.

10.3.16.18 RADIOGRAPHY

CONTRACTOR shall obtain a PTW c/w radiation certificate for radiography work. Extra precaution shall be taken to keep away all non-relevant personnel from the area. The area shall be isolated by visible barricades, signs, warning lights, adequate supervision by competent personnel, etc. The radioactive source shall be handled, transported and stored according to approved procedure. CONTRACTOR shall employ only qualified radiography operators as per Malaysian Atomic Energy Licensing Board (AELB) for the job. Properly calibrated radiation survey meters shall be made available.

10.3.17 HAZARDS IDENTIFICATION AND CONTROL

10.3.17.1 RISK MANAGEMENT

CONTRACTOR shall implement all risk management actions which are applicable throughout the PROJECT as may be identified in the detailed Environmental Impact Assessment ("EIA"), Quantitative Risk Assessment ("QRA"), Health Risk assessment ("HRA"), Hazard and Operability Study ("HAZOP"), Hazard Identification Risk Analysis ("HAZID"), Environmental Impact Identification ("ENVID") or any other risk assessment studies performed for the PROJECT.

A risk assessment for each activity task forming part of the WORK shall be undertaken in the form of a JHA or equivalent and shall be carried out by CONTRACTOR or SUB-CONTRACTORS prior to commencement of each specific activity.

10.3.18 HAZID OF CONTRUCTIONS CRITICAL ACTIVITIES

CONTRACTOR shall perform a HAZID prior to the commencement of the WORK in order to identify the critical fabrication activities where appropriate levels of management will be required to comply with HSSE requirements. Typical examples of critical activities, which may require special HSSE requirements at the WORKSITE include:

- Transportation of heavy equipment;
- Loading, unloading of heavy equipment;
- Lifting and installation of heavy equipment;
- Other equipment requiring lifting and transportation;
- Traffic management;
- Work at height during simultaneous operations ("SIMOPS");
- Management of CONTRACTOR’s specific WORKSITE;
- Coordination with OTHER CONTRACTORS in accordance with the requirements of the SITE MANAGEMENT RULES;
- Fabrication activities and fabrication risks;
- Drainage systems;
- Crossings / bridges / roads / paths;
- Precautions and measures in place for flood conditions;
- All other issues raised as part of the HAZID.

If one HAZID session is insufficient for the CONTRACTOR’s activities, then additional HAZID sessions shall be performed by CONTRACTOR and CONTRACTOR is obliged to invite OWNER to attend any HAZID session.

CONTRACTOR's HSE Manager(s) and HSE Officers shall ensure that all issues raised during all HAZID sessions as well as other critical fabrication matters raised throughout the performance of the WORK are followed-up and addressed.

10.3.18.1 SPECIFIC WORKSITE'S JOB HAZARD ANALYSIS

CONTRACTOR shall ensure that all of its line supervisors fully understand the potential hazards involved in those aspects of the WORK under their supervision and that safe practices, safety precautions or actions to be followed in respect of the same and CONTRACTOR shall ensure that its line supervisors communicate these issues to all personnel involved in each activity forming part of the WORK prior to commencement of each activity forming part of the WORK.

CONTRACTOR shall ensure that all JHAs carried out during performance of the WORK will be reviewed and approved by CONTRACTOR's HSE Officer and OWNER's designated HSE Manager.

CONTRACTOR shall pay special attention to the critical activities of transportation, fabrication, construction, and COMMISSIONING, in addition to interface with the OTHER CONTRACTORS.

Before assigning personnel to any activity forming part of the WORK, CONTRACTOR shall carry out a JHA for such activity.

The JHA plays a significant role for the risk assessment of the various activities being carried out by CONTRACTOR at the WORKSITE and CONTRACTOR shall ensure that its results, together with outcomes and conclusions are communicated to all personnel working on the WORKSITE by the appropriate means, which shall include presentations, meetings and tool box talks.

In addition to that, specific JHAs will be required to be developed and communicated for critical activities, as identified on the WORKSITE.

10.3.19 CHEMICALS HAZARDOUS TO HEALTH

Chemicals hazardous to health shall not be used by CONTRACTOR, where other practicable and safer alternative exists. All chemicals purchased and brought to WORKSITE whether by OWNER, CONTRACTOR, SUB-CONTRACTORS or suppliers and their respective representatives shall be furnished with Material Safety Data Sheet (MSDS) in both Bahasa Melayu and English languages (and any other language required having regard to the nationalities of the personnel). CONTRACTOR shall ensure that the MSDS/CSDS arrive at the WORKSITE accompanying the MATERIALS to which they relate.

A complete and up to date register of all chemicals used in the PROJECT and the Material Safety Data Sheet (MSDS) for each chemical shall be kept by the CONTRACTOR's HSSE Manager and shall be readily available for inspection by OWNER. All chemicals used shall be labeled in accordance with LAW and any other requirements of OWNER.

CONTRACTOR shall propose and implement a safe system of work and provide all required PPE to ensure that risks associated with the use, handling and disposal of chemicals hazardous to health are minimised. An assessment of health hazards arising from the use of chemicals hazardous to health shall be conducted by a competent person, appointed by CONTRACTOR and approved by the Department of Safety & Health (DOSH).

Special attention shall be paid to the storage area of the chemicals and disposal, when required.

The storage area shall be designed as per instructions given inside the MSDS/CSDS and inspected regularly by CONTRACTOR's HSE Manager and HSE Officer(s). The storage area shall have appropriate ventilation and shall ensure appropriate environmental conditions inside for all chemicals under different external conditions.

The disposal of chemicals shall be through a certified, approved, third party, which will take the remaining chemicals, give a disposal note and ensure further processing as per local waste management and chemicals management regulations.

OWNER highlights that the use of halon, asbestos or other banned chemical substances is forbidden on PEC SITE.

OWNER has the right at any time to audit the chemical's storage area and request a record of the disposal notes.

10.3.20 HSSE COMMUNICATIONS

Effective communications are vital to the successful implementation of the Project HSE Plan, Project Security Plan and Project Emergency Response Plan for the PROJECT. Communications will take many forms but their common objective is to improve understanding of HSE matters. CONTRACTOR shall propose its overall strategy for communications of all matters relevant to HSSE both for those involved in the PROJECT and at WORKSITE as required, in the Project HSE PLAN.

Mechanisms for communication and feedback shall include, as a minimum:

- Suggestion boxes;
- System or procedures for the recording of:
    - Concerns / recommendations raised during toolbox or team talks;

- Concerns / recommendations raised with CONTRACTOR'S supervisors at the WORKSITE.

- Public complaints.

Any advice on HSSE issues at SITE generated by CONTRACTOR's personnel shall be tabled at the monthly HSE Committee meeting. The conclusion of these discussions shall be communicated back to the CONTRACTOR who shall in turn advise its SUBCONTRACTORS and all personnel working at the SITE.

10.3.21 HSSE KICK – OFF MEETING

CONTRACTOR shall carry out an HSSE kick off meeting all with SUB-CONTRACTORS for the PROJECT, which has to be attended by OWNER.

Agenda or discussion items for the meeting shall include as a minimum:

- Scope of the WORK;
- Type and nature of WORK;
- Working hours;
- HSSE organisation and roles and responsibilities;
- PROJECT HSE PLAN;
- PROJECT SECURITY PLAN;
- Project Emergency Response Plan;
- HSSE rules and regulations for the WORKSITE;
- HSE / environmental / security induction requirements;
- HSSE training;
- Personnel protective equipment;
- Standards and requirements for CONTRACTOR'S EQUIPMENT;
- Interfaces with OWNER and SUB-CONTRACTORS;
- HSSE audit and inspection;
- Hazards identification and risk assessment;
- Hazardous materials handling, storage and use;
- Incident reporting and investigation;
- Permit-to-Work System;
- Environmental protection measures including noise restrictions;
- Use of vehicles;
- Security, fencing and access control;
- Communications systems at the WORKSITE e.g. radio system;
- Emergency response and crisis management;
- Medical facilities at the WORKSITE;

- Welfare facilities at the WORKSITE;
- Any other specific anticipated hazards related to the PROJECT or the PEC PROJECT.

10.3.22 HSSE MEETINGS

10.3.22.1 HSSE COMMITTEE

CONTRACTOR shall form a HSSE Committee for the PROJECT complying with the requirements specified under Occupational Safety and Health (Safety and Health Committee) Regulations 1997. The HSSE Committee meeting shall be held monthly, however the frequency may be increased if deemed necessary.

The composition of the HSSE Committee shall be in accordance with LAW and, as minimum, shall include the CONTRACTOR's Project Manager as the chairman and CONTRACTOR's DOSH Registered Safety and Health Officer, as the secretary.

The agenda for the meeting shall include the following items as a minimum:

- Review of previous minutes of meeting;
- Safety and health key performance indicators;
- Incidents and near misses;
- Lessons learned and action items arising from incident investigation;
- Safety and health audit and inspections findings;
- Safety and health promotion and initiatives;
- Review of current and future construction activities;
- Safety and health concerns and issues;
- Interface issues between CONTRACTOR and SUB-CONTRACTORS;
- Feedback from personnel working at the WORKSITE.

10.3.22.2 SPECIAL HSSE MEETINGS

CONTRACTOR shall arrange additional meetings to address special circumstances that may arise such as:

- Activities forming part of the WORK which require special instructions and precautions that have not been implemented at WORKSITE;
- Visits by government bodies or authorities due to non-compliance with LAW;
- Poor performance of specific SUB-CONTRACTORS;
- Major non-conformance with HSSE requirements;
- Major incidents such as fatality, major fire or explosion;
- Security and emergency response incidents;

- Major impacts on HSSE resulting from design changes during the construction phase of the WORK or potential hazards which were unknown prior to the LETTER OF AWARD.

Thorough HSSE assessments shall be made by CONTRACTOR's supervisors at SITE supported by CONTRACTOR's HSSE personnel.

Meetings shall be held between these personnel to discuss those hazards identified and to propose solutions to such hazards and any unsafe acts/conditions.

All HSSE meetings shall be documented and the minutes of meeting submitted to OWNER within three (3) calendar days of such meeting, excluding in relation to those special or emergency HSSE meetings (as described in the relevant minutes of meeting) which shall be submitted to OWNER immediately following the meeting.

10.3.23 TOOLBOX TALKS

a. Daily Toolbox Talks

CONTRACTOR shall ensure that a daily "toolbox talks" are conducted at start of each shift by SUB-CONTRACTORS' line supervisors, in a language or languages understood by the relevant workforce. The talk shall address the application of HSSE rules and procedures related to the activities forming part of the WORK which are to be carried out during the relevant shift.

Duration of the toolbox talk should typically be 5 - 15 minutes, but for hazardous activities e.g. confined space entry, the duration may be extended, as appropriate.

b. Weekly Mass Toolbox Talk

CONTRACTOR shall ensure that SUBCONTRACTORS conduct a weekly mass "toolbox talk" of 15-20 minutes duration at the start of each shift in a language understood by the relevant workforce. Toolbox talks may be conducted by SUBCONTRACTORS' safety representatives, line supervisor or management. Topics for the toolbox talk shall be agreed between CONTRACTOR and SUB-CONTRACTORS.

Typical the topics may include, but not limited to:

- Care and use of respiratory protection;
- Manual handling and lifting;
- Noise and noise induced hearing loss;
- Lock out tag out;

- Labelling;
- Topical issues relevant to the PROJECT;
- Fire prevention;
- Control of substances hazardous to health;
- Scaffolding;
- Vector control;
- Housekeeping;
- Working at height;
- Pollution prevention;
- Hot works / welding;
- Radiography / radioactive source handling;
- High pressure testing;
- Use of personal protective equipment;
- Permit to Work;
- Crane operations;
- Action items or lessons learned from incidents.

The weekly “toolbox talk” shall be recorded and the records shall be issued to the HSSE Committee.

10.3.24 MONTHLY HSSE REPORT

CONTRACTOR has an obligation to develop a monthly HSSE report, as per following:

- CONTRACTOR monthly HSSE report shall cover the HSSE activities and performance of the previous month. CONTRACTOR shall submit such report to OWNER within five (5) working days from the last Friday of each month, after the ‘cut off’ date of the month. The HSSE report shall include, as a minimum, the following:
- A table of all incidents and their immediate and underlying causes;
- A table of all HSSE observations at WORKSITE and description of corrective action taken to rectify the shortfall;
- HSSE lagging and leading indicators;
- A summary of HSE activities, government visits, management visits and HSE audits describing problem areas and corrective actions, if any;
- A summary of HSE training provided at the WORKSITE;
- Breakdown of numbers of CONTRACTOR personnel at WORKSITE;
- Breakdown of numbers of SUB-CONTRACTOR personnel at WORKSITE;
- Breakdown of the total man-hours worked on a monthly and cumulative basis;

- Photos of main / critical activities at the WORKSITE.

Graphs and statistics showing fatal accident rate ("FAR"), lost time injury Frequency ("LTIF") and total reportable case frequency ("TRCF") shall be prepared on a cumulative basis from the beginning of the construction phase of the WORK with detailed number of HSSE lagging and leading indicators.

The following table gives a minimum, but not limited, typical list of Key Performance Indicators (KPIs) that can be used:

Lagging	Leading Indicators
• Fatality • Fatal accident rate (FAR) • Lost time injury case (LTI) • Lost time injury frequency (LTIF) • No of day lost • Medical treatment case (MTC) • Restricted workday case (RWC) • Total reportable case frequency (TRCF) • First aid incident • Fire incident case • Property damage • Security breach • Environmental spill • Near miss	• HSE training/induction • HSE inspection • HSE management audit & walkabout • HSE meeting • Toolbox talk / meeting • Job hazard analysis for critical activities inclusive abnormal activities • UA/UC report • Hazard observations

10.3.25 LANGUAGE

CONTRACTOR shall develop procedures and instructions to ensure effective communications are in place to deal with any multi-lingual personnel employed at WORKSITE who do not understand and/or cannot communicate in either Bahasa Melayu or English languages.

CONTRACTOR shall identify to OWNER its strategy for meeting these multi-lingual needs sufficiently in advance of commencement of the WORKS at the WORKSITE.

10.3.26 TRAINING AND HSE COMPETENCY ASSURANCE

10.3.26.1 HSSE INDUCTION

All personnel working at WORKSITE shall be required to attend an HSE / environmental / security induction, conducted by CONTRACTOR's HSSE

personnel in a language clearly understood by each employee, before commencing work.

CONTRACTOR shall establish appropriate system or mechanism for identification of personnel who have completed the required HSE inductions and in order for such personnel to be allowed access into WORKSITE.

CONTRACTOR's HSSE induction shall cover the following subjects:

- Issue and use of worker identification cards.
- Overview of the WORKS and hazards.
- Minimum HSE requirements and legal requirements for the WORKSITE.
- Traffic regulations for the WORKSITE and the PEC SITE.
- Personal protective equipment.
- Medical and first aid facilities.
- Emergency management.
- Fire prevention and suppression.
- Housekeeping.
- Noise at work.
- Radiography.
- Permit to Work Systems.
- Toolbox talks.
- Scaffolding and tagging.
- Manual handling.
- Hot work and control of ignition sources e.g. electrical equipment.
- Working at heights, safety harnesses, lifelines.
- Handling of chemicals hazardous to health.
- Heavy lifting.
- Confined spaces.

- Misconducts:
    - Drug and alcohol policy.
    - Gambling.
    - Fighting.
    - Theft.
    - Sexual harassment.
- Security rules for the WORKSITE and the PEC SITE.
- Prohibited items.
- Environmental issues.

- Waste management issues.
- Environmental spill response.
- Communications.
- Reporting of injuries and incidents.
- Stop work policy.
- HSE incentives schemes.
- Consequence management, including option of dismissal, for noncompliance to HSE and security rules and regulations.

CONTRACTOR's HSE personnel shall be evaluated by OWNER to check their competency to ensure they are able to discharge their duties effectively.

CONTRACTOR shall ensure that all personnel involved in construction activities forming part of the WORK have a CIDB Green Card prior to entering the PEC SITE.

In addition to the basic HSSE induction, all supervisors shall attend a further training or induction covering the following subjects:

- Incident reporting and investigations.
- HSE inspection techniques.
- Permit to Work.
- Implementation of the PROJECT HSE PLAN.
- Hazard identification and control e.g. Job Hazard Analysis.
- Project Emergency Response Plan.

CONTRACTOR shall ensure that all visitors to WORKSITE, including mechanics, temporary crane drivers and corporate management, are given an outline briefing of the HSSE rules and regulations for the WORKSITE as contained in the formal HSE/ environmental / security induction prior to entering WORKSITE.

Visitors shall be required to use appropriate PPE e.g. helmet, boots, hearing protection, an one-piece coverall and safety spectacles and shall be accompanied at all times while on WORKSITE, by personnel who have fully completed the HSE/ environmental / security induction.

CONTRACTOR shall maintain a fully up to date training register of all personnel, who have been inducted and received other additional training. This register shall include any training carried out at the WORKSITE by CONTRACTOR and its SUB-CONTRACTORS.

10.3.26.2 SPECIFIC TRAINING

Training is necessary to help personnel acquire the skills, knowledge and attitudes to assist them in providing maximum contribution to the HSSE aspects of their work – whatever their position in the organisation.

CONTRACTOR shall establish a checklist/ questionnaire to be used as a basis for delivering critical technical and/or HSSE training:

Specific types of training required for personnel involved in the PROJECT shall include:

- Formal off-the-job training, such as training in specific skills.
- Formal on-the-job training and assessment, such as:
    - training in specific skills which may have been previously learnt or provided by CONTRACTOR and
    - on-the-job coaching and counseling / supervisor-led training and instruction to individuals.
- A period of supervised experience to enable personnel practice and develop new skills.
- Various subjects of specific HSE training, e.g. PTW, lifting operations, scaffolding, work at height etc, as listed for HSSE induction, but more detailed and technically oriented.

- CONTRACTOR shall comply with LAW and ensure that all workers attend the Construction Industrial Development Board (CIDB) green card (HSE familiarisation course) prior to entering the PEC SITE.

10.3.26.3 COMPETENCY

CONTRACTORs shall ensure that all personnel and SUB-CONTRACTORS are competent to perform their designated activities forming part of the WORK at the WORKSITE and have been properly inducted to enable them to do the same. OWNER reserve the right to interview and/or assess any employee or SUB-CONTRACTOR and/or its employees to assess competence.

If such interview and/or assessment is considered by OWNER to demonstrate a failure of competence, OWNER may instruct CONTRACTOR to remove such employee or SUB-CONTRACTOR and/or its employee(s) (as applicable) from the WORKSITE.

CONTRACTOR shall maintain a fully applicable Competence Assurance Scheme, which identifies HSE critical and HSE related positions (i.e. crane drivers, forklift drivers, radiographers and scaffolders, confined space entrants and supervisor and first-aiders).

CONTRACTOR shall keep up to date and comprehensive records of the training, qualifications, licenses of its personnel and SUB-CONTRACTORS' personnel which can be audited by OWNER at any time during the execution of the WORK.

In addition to that, it needs to be highlighted to CONTRACTOR that prior to the introduction of hydrocarbon / START-UP phase, all personnel involved in START-UP activities shall need to go through Oil and Gas Safety Passport (“OGSP”) training.

10.3.26.4 HSSE AUDITS

CONTRACTOR shall assess the adequacy and effectiveness of the various components of the HSE plans and security plans for the PROJECT through audits. CONTRACTOR shall develop an internal audit program with details of areas and activities to be audited and the proposed schedule. The HSSE audit program shall be agreed in advance by OWNER.

The key elements to be audited, as a minimum, are as follows:

- HSSE policies.
- HSSE organisation.
- PROJECT HSE PLAN and PROJECT SECURITY PLAN and their implementation.
- Performance measurement and monitoring.
- HSSE management system improvement.
- HSSE walks and inspections.

The HSSE audit shall be conducted by competent personnel who are independent and do not have conflicting interests. The team shall include members of the CONTRACTOR's management team and OWNER's management team on the WORKSITE.

OWNER may review the frequency or schedule of audits if there is any evidence of systemic failure within its management system and request for additional audits.

10.3.26.5 TIME OUT FOR SAFETY

"Time Out for Safety" is a policy which is intended to empower individuals, CONTRACTOR's supervisors and managers who perceive that there is a potential hazard associated with a task, to stop the work and take "Time Out for Safety" without the fear of negative consequences.

"Time Out for Safety" can be combined with other safety tools, such as JHA, for a Pre-Activity Safety Review ("PASR").

10.3.26.6 MANAGEMENT LEADERSHIP VISITS

CONTRACTOR shall ensure visibility of senior management on the WORKSITE in order to demonstrate leadership and HSSE commitment to the workforce. Such visibility also provides an ideal opportunity to interact and engage the workforce on HSSE issues in a manner which demonstrates the overall importance of HSSE issues and time spent by senior management specifically on those HSSE issues.

10.3.27 NON CONFORMANCE AND CORRECTIVE ACTIONS

CONTRACTOR shall ensure that all non-conformance and corrective actions identified in HSE inspections, audits or incident investigations are promptly rectified. CONTRACTOR shall establish and implement a structured system to facilitate the recording, following-up and monitoring of the status of such non-conformance and corrective actions.

10.3.28 HSSE PERFORMANCE REVIEW

CONTRACTOR shall prepare, maintain and submit to OWNER records and reports on the following:

- Incident notification report (immediately).
- Log of all incidents (monthly).
- Summary of incident investigation findings and remedial actions taken (monthly).
- Summary report of all incident statistics (monthly).
- Log of HSE incentives adopted and results achieved (monthly).
- Log of non-conformance and status of corrective actions (monthly).
- Attendance log for all HSSE inductions (weekly).
- Report on compliance audit relating to the PROJECT HSE PLAN, PROJECT SECURITY PLAN and the HSSE procedures for the WORKSITE (monthly).
- Records of emergency / security drills (monthly).
- Minutes of Safety, Health and Environmental committee meeting (monthly).

10.3.29 HSE INCENTIVE SCHEME

CONTRACTOR is responsible to develop and promote an HSE incentive scheme philosophy throughout the whole PROJECT, as per OWNER's instructions and OTHER CONTRACTORS HSE incentive schemes.

CONTRACTOR shall be fully responsible to sponsor and drive the HSE incentive scheme on WORKSITE throughout the duration of the PROJECT for CONTRACTOR'S activities and workforce and ensure appropriate follow up.

The HSE incentive scheme shall be based on an objective assessment of workforce HSE performance, as per HSE key performance indicators ("KPIs"), reported on monthly basis and may have the form of an HSE competition or awards' program.

CONTRACTOR shall evaluate HSE performance by comparing the leading KPIs (e.g. HSE training hours, HSE inspections, UA/UC, Hazard Observations), the

lagging KPIs (e.g. LTIF, TRCF etc) and the manhours of its team within CONTRACTOR's workforce. A budget shall be allocated on a monthly basis and shall be for HSE awards to be given to the best performing team(s) and individual(s).

CONTRACTOR shall describe the incentive scheme program and calculation scheme of awards, depending on KPIs, inside CONTRACTOR's incentive scheme plan. OWNER will need to review and approve the CONTRACTOR's HSE incentive scheme in order to ensure that it is aligned with the OTHER CONTRACTORS incentive schemes.

OWNER will not allow the awards to be given in cash or any other form of money to individuals, however, OWNER is encouraging the purchase of small gifts to be given directly to the best HSE performers or the whole workforce upon completion of a specific activity safely.

CONTRACTOR is encouraged to combine any kind of monthly or weekly HSE competition with a dedicated HSE campaign (e.g. Dropped Objects, Lifting Operations etc), as part of CONTRACTOR's HSE management system on WORKSITE.

10.3.30 HSSE AWARENESS PROGRAM

CONTRACTOR shall propose and implement a HSSE awareness program for the PROJECT which may include, amongst other things:

- HSSE posters, notices and bulletins.
- HSSE briefing and talks.
- HSSE video presentation.
- HSSE banners.
- HSSE incident flashes.

CONTRACTOR shall provide a prominent HSSE performance scoreboard at the entrance to the WORKSITE displaying, amongst other things, the number of man-hours worked since the last reportable incident and name of SUB-CONTRACTOR with the best HSSE record.

In line with OWNER's objective to promote safety awareness and safe working practices amongst all employees and CONTRACTOR's personnel, the CONTRACTOR shall install an HSE Performance Scoreboard to highlight achievement(s) / milestone(s) of safe working hours of employees.

The CONTRACTOR shall install the above at each site office. The HSE Performance Scoreboard shall be of acceptable material and shall contain the following information as a minimum (in English and Bahasa Malaysia):

Name of CONTRACTOR _____

Date (Start of Work) _____

HSE Targets for This Project _____

Best Achievement (Manhours, Year) _____

Current Manhours Achieved (Manhours, Year) _____

Date of Last Loss Time Incident _____

Total Number of Loss Time Incidents to-date _____

All lettering in the HSE Performance Scoreboard shall be of suitable sizes and shall be visible from at least 10 meters distance.

In addition to that, CONTRACTOR shall assembly HSSE bulletin boards located at strategic locations at WORKSITE to disseminate HSSE information to the personnel working on the PEC SITE.

10.3.31 PERSONAL PROTECTIVE EQUIPMENT

CONTRACTOR and its SUB-CONTRACTORS shall provide the following, as a minimum, to all personnel working on the WORKSITE:

- Safety Helmet.
- Safety Footwear.
- Eye Protection (safety spectacles with side shields as a minimum).
- Gloves.
- Hearing Protection.
- One piece coverall for construction activities (made of non-fire retardant material).

CONTRACTOR and its SUB-CONTRACTORS shall provide the mandatory safety equipment at no cost to ALL of their respective employees, either as original supply or as replacement for lost or damaged safety equipment. Failure to use mandatory safety equipment shall result in immediate dismissal from the SITE.

CONTRACTOR shall also make provision for the supply of additional PPE, as circumstances may demand having regard to the activity being performed or the circumstances, such as:

- Goggles.
- Face shields for grinding.
- Rubber boots with toe protectors and reinforced soles.
- Wet weather clothing.
- Respiratory equipment.

- One piece coverall (in a colour which differs from the overalls used by OWNER).
- One piece coverall made of fire retardant material (for personnel who work in high fire-risk areas and/or activities during COMMISSIONING and START-UP phases).

CONTRACTOR shall use ultrasonic, gas leak detectors, wherever required during the introduction of hydrocarbons or inspections of confined spaces inside PEC AREA.

CONTRACTOR shall ensure that SUB-CONTRACTOR personnel working on the WORKSITE shall wear PPE according to CONTRACTOR's requirements.

10.3.32 HOUSEKEEPING

CONTRACTOR shall ensure that good housekeeping is maintained continuously throughout the duration of the WORK. Due regard shall be paid to proper disposal of all types of wastes especially hazardous / scheduled wastes, tidiness, and clear access ways and emergency exits.

Access and egress of all exits, fire and safety equipment, and work areas shall be kept clear of obstructions at all times. Special attention shall be given to maintaining clear walkways, removal of slippery and tripping hazards, securing or removing of loose materials at height, and proper storage of materials. Scheduled wastes such as oily or chemical soaked rags shall be disposed of in accordance to regulatory requirements. All housekeeping costs shall be borne by CONTRACTOR.

10.3.33 LIGHTNING ARRESTORS FOR EPCC ACTIVITIES

In recognition of the fact that Johor has recorded the most occurrences of lightning in Malaysia, CONTRACTOR shall install lightning arrestors at suitable locations on the WORKSITE in order to provide a safe zone for CONTRACTOR'S activities.

CONTRACTOR shall ensure that the specifications for the lightning arrestors fulfill the requirements of OWNER and national / state authorities.

10.3.34 ZETO RULES & GUIDELINES

"ZeTo" means Zero Tolerance and is intended by OWNER to be a principle to ensure all activities are carried out in a safe manner and any non-compliance shall not be tolerated.

OWNER'S ZeTo Rules shall apply to all employees, CONTRACTOR, SUB-CONTRACTORS, OTHER CONTRACTORS and OWNER's personnel working at the WORKSITE and the PEC SITE.

CONTRACTOR, OTHER CONTRACTORS and SUB-CONTRACTORS shall adopt the ZeTo Rules, together with an HSE policy and HSE management system ("HSE MS") which is in accordance with OWNER's HSSE policies in order to reduce the HSSE risks associated with the WORK to a level that is as low as reasonably practicable.

The following ZeTo Rules are applicable at WORKSITE:

- Valid PTW must be held by CONTRACTOR and / or its SUB-CONTRACTORS where applicable.
- Verify energy isolation before commencement of each activity.
- Obtain authorisation before overriding or disabling safety critical equipment.
- Protect yourself against a fall when working at height.
- Use the correct personal protective equipment (PPE).
- Obtain authorisation before excavation or entering a trench.
- Do not position yourself under a suspended load.
- Do not smoke outside designated areas.
- Do not use your mobile phone/walkie-talkie while driving, follow the speed limit and use your seat belt.

10.3.35 CONTRACTOR'S SUPPLIED EQUIPMENT

All CONTRACTOR'S EQUIPMENT, including generator sets, welding sets, portable electrical equipment, mobile cranes, air powered tools, pumps, generators and compressors shall be inspected and approved by CONTRACTOR's discipline supervisors prior to their entry onto the WORKSITE and shall be checked fortnightly thereafter.

CONTRACTOR shall ensure that all CONTRACTOR'S EQUIPMENT in any way associated with or utilised in the WORK, are fit for use and maintained in a safe and good working condition. Operational Fitness Certificates, Electrical Test Certificates, Calibration Certificates etc. where applicable shall be provided.

Cranes, trucks, vehicles and any other relevant equipment shall also be inspected and approved by the relevant local authority (e.g. Energy Commission, Director General, Department of Road Transportation) prior to their entry onto the WORKSITE.

For cranes, trucks, vehicles a registration is required by the Department of Road Transportation, according to the category of the vehicle, driver's licenses as per category of the vehicle and annual or six (6) monthly inspections from the Department of Road Transportation.

Diesel engines / generators are also required to have the relevant specification licenses issued by national authorities (e.g. Director General).

Diesel engine / generator with capacity of more than 5 kilowatt shall be registered with the Energy Commission in accordance with the Energy Commission Act 2001 and Electricity Supply Act 1990, prior to use by CONTRACTOR and its SUBCONTRACTORS.

Diesel engine / generator with a consumption of liquid (diesel) burning capacity of more than 15 Kg / hr, shall have a written approval from the Director General, prior to use by CONTRACTOR and its SUB-CONTRACTORS.

For the diesel engines, the operator / driver of the engine need to registered with the DOSH as per Factory and Machinery Act, 1970.

Temporary generator sets on WORKSITE have to be registered with the Energy Commission and inspected by competent electricians as well.

Records of inspection shall be kept in the forms of checklist and stickers displayed on the CONTRACTOR'S EQUIPMENT and shall be readily available for audit by OWNER.

The OWNER's Zero Tolerance (ZETO) rules are attached for compliance by all personnel of CONTRACTOR and SUB-CONTRACTORS.

In addition to that, all CONTRACTOR's supplied equipment shall comply with the requirements of the OWNER's Mandatory Control Framework ("MCF"), as given in MANDATORY CONTROL FRAMEWORK.

10.3.36 SCAFFOLDING

CONTRACTOR shall use only tubular-type scaffolding for the PROJECT at WORKSITE.

Scaffolding practices shall comply with the requirements under Factory and Machinery Act 1967 (Building Operation and Work of Engineering Construction (Safety) Regulation, BOWEC; 1986) and based on the following standards:

- BS 5973: 1993 - Code for Practice for Access and Working Scaffolds and Special Scaffold Structures in Steel.
- BS 5974: 1982 - Code of Practice for Temporarily Installed Suspended Scaffolds and Access Equipment.
- BS 1129: 1982 - Specification for Portable Timber Ladders, steps, Trestles and Lightweight Staging, for the Building and Civil Engineering Industries.
- BS 1139:1991 (Part 1 - 5) Metal Scaffolding.
- BS 2037: 1964 - Specification for Aluminum Ladders, Steps and Trestles for the Building and Civil Engineering Industries.
- BS 2482: 1981 - Specification for Timber Scaffold Boards.

• BS 2830: 1973 - Specification for Suspended Safety Chairs and Cradles for Use in the Construction Industry.

CONTRACTOR shall comply with OWNER's standards and procedures in relation to scaffolding in accordance with international & standards, as described above and local safety guidelines as well as the requirements of Paragraph 10.3.16.11.

Before the use of any scaffolding in connection with the WORK, all scaffolding shall be inspected and approved by a certified Scaffolding Inspector appointed by CONTRACTOR. Such scaffolding shall be inspected upon complete installation, after modification and after been exposed to adverse weather conditions e.g. heavy rains and storms.

All tubular scaffolds exceeding 40 meters in height shall be constructed based on the approved structural calculation and drawing of a professional engineer appointed by CONTRACTOR. A copy of the approved drawing of the scaffold design shall be made available at the WORKSITE for inspection by OWNER and shall be in line with the requirements of Paragraph 10.3.16.11.

Personnel involved in the erection, dismantling and inspection of scaffolding shall observe and comply with safety requirements for working at height. These include the need to use full body harness with double lanyards.

The CONTRACTOR'S HSE Manager(s) and HSE Officers working on the WORKSITE shall monitor compliance with safety requirements of all scaffolding.

10.3.37 FIRE PREVENTION

CONTRACTOR shall ensure that the CONTRACTOR'S ACTVITIES carried out on the WORKSITE are conducted in a manner that minimises the risk of a fire. This will be achieved by:

- Proper storage system for flammable materials and chemicals in a systematic and controlled manner.
- Training on basic fire prevention and suppression to be included in the safety programs.
- Adequate fire protection equipment to be located in areas of possible fire.
- Regular inspections of any potential sources of flammable ignition of flammable on the WORKSITE by CONTRACTOR.
- Strict compliance with the "No Smoking" policy.
- Regular inspection by CONTRACTOR of all CONTRACTOR'S EQUIPMENT or other equipment and storage areas containing flammable material and chemicals.

10.3.38 VEHICLES AND MOBILE ENGINE

All vehicles entering the PEC SITE and the WORKSITE shall respect traffic rules and regulations inside the PEC SITE and WORKSITE. The speed limit will be at 25 km/hour and drivers are expected to drive extremely carefully due to the numbers of personnel working both on the WORKSITE and the PEC SITE.

All vehicles and drivers travelling to the WORKSITE shall have the appropriate licenses which will be inspected regularly by CONTRACTOR's HSE Manager(s) and HSE Officers working on the WORKSITE.

During START-UP, where hydrocarbon could have been introduced into the UNITS and/or Systems, entry of vehicles and engine driven equipment into the affected process area and their general usage shall be controlled using the PTW System. The vehicles and equipment shall also have spark arrestor installed on the exhaust system.

10.3.39 SMOKING

CONTRACTOR shall establish and implement a strict "No Smoking" policy at WORKSITE as follows:

a. Prior to START-UP, smoking shall only be permitted in the designated areas of the WORKSITE, which will be carefully selected and regularly inspected by CONTRACTOR's HSE Manager(s) and HSE Officers working on the WORKSITE.

b. During and after START-UP, smoking shall be prohibited on the WORKSITE, inside the warehouse and in or on any other specified areas, and such ban shall include banning of lighters and matches in or on the WORKSITE and such other areas.

CONTRACTOR shall communicate the requirements of the "No Smoking" policy to all personnel working at WORKSITE. Violation of the "No Smoking" policy shall result in immediate and permanent removal of the employee from the WORKSITE.

10.3.40 EMERGENCY PREPAREDNESS

a. Emergency Response Plan

CONTRACTOR shall prepare an emergency response plan for the WORKSITE and submit the same to OWNER for approval within ninety - (90) days after COMMENCEMENT DATE and in any case prior to the commencement of any CONTRACTOR's activities on the WORKSITE.

The Emergency Response Plan for the WORKSITE shall include, as a minimum:

- a list of the emergency response organisations and their roles and responsibilities;
- communication procedures; and
- emergency and medical evacuation plan and
- specific response procedures for major incidents e.g. oil spills, chemicals spills, crane failure, fire, structure or scaffold collapse.

The Emergency Response Plan for the WORKSITE shall comply with any requirements of the Detailed Environmental Impact Assessment (DEIA) and conditions provided by Department of Environment in Malaysia (DOE).

CONTRACTOR's Project Manager shall be responsible for preparing, issuing and ensuring that all personnel understand the Emergency Response Plan and procedure.

Key information on emergency evacuation such as the types of alarm, communication flow, emergency response team, emergency contact numbers, spill absorption material, evacuation routes and assembly area shall be displayed on notice boards which are strategically located at WORKSITE.

b. Emergency responses training, exercises and drills

All personnel working on the WORKSITE shall be advised of the actions to be followed in the event of fire or any other emergency situation. Such advice shall be given during HSE inductions and HSE training sessions.

CONTRACTOR shall conduct emergency evacuation exercises and/or fire drills on a quarterly basis using a probable incident scenario agreed by OWNER in advance. OWNER shall be invited to observe the drill and provide input for improvement.

c. Emergency assembly area

CONTRACTOR shall identify and assign designated emergency assembly area(s) at WORKSITE and the areas shall be clearly identified with signage (e.g. assembly point).

Adequate signage shall be provided throughout the WORKSITE to direct or guide personnel to the emergency assembly areas in an emergency situation.

Non-compliance of personnel with signage, procedures and rules for emergency response is a reason for immediate dismissal from the WORKSITE.

10.3.41 OCCUPATIONAL HEALTH

a. Pre-employment medical screening

CONTRACTOR shall ensure that all its employees and SUB-CONTRACTOR's employees engaged in the WORK are declared medically fit for the job and healthy by an Occupational Health Doctor. Any medical diseases or disabilities which may adversely influence the employee's ability to perform his role in the WORK shall be reported to OWNER prior to the commencement of the WORK.

Any person having the following illnesses are not permitted working at WORKSITE:

- A history of fits, blackouts and fainting attacks;
- A history of heart disease or heart disorder;
- Asthma, bronchitis, or a shortness of breath on exertion;
- Nervous or mental disorder;
- Serious defects in eyesight;
- Any other disease or condition that may affect or endanger the person's safety and health.

Pre-employment screening shall be performed as per instructions and guidelines of "*PTS– Health Assessment for Fitness to Work"*.

b. Medical Welfare of Personnel

CONTRACTOR shall at no cost to OWNER be responsible for the medical benefits of its own and SUB-CONTRACTOR's employees. CONTRACTOR shall make necessary arrangements for medical consultation, treatment or hospitalisation if and when necessary and will arrange suitable insurance coverage for such contingencies.

CONTRACTOR shall ensure that all local personnel are covered by Social Security Organization ("SOCSO") and that all foreign personnel are covered by Workman Compensation in accordance with the Employee's Social Security Act 1969 and Workmen's Compensation Act 1952 respectively.

c. CONTRACTOR's simple first aid / medical room, medical facility and first aid station

CONTRACTOR is responsible to provide first aid / medical room located at an appropriate location at the PEC SITE within its own camp area. The facility should be manned throughout the working hours and comply with requirement of First Aid / Medical Room

CONTRACTOR is responsible to build and operate a first aid station ("FAS") within its own construction area manned with medical personnel on a 24 hours a day / 7 days a week basis.

CONTRACTOR is responsible to provide first aid boxes within its own camp area and construction area. The first aid boxes shall comply to the and any other requirement of OWNER's medical management and health inspections system.

CONTRACTOR is fully responsible at all times for its own personnel and SUB-CONTRACTOR's personnel and shall ensure that medical facilities operating within its area of responsibility are sufficient to accommodate the needs of the workforce and comply with the regulations.

CONTRACTOR is also responsible for the repatriation of its own personnel back to their home, if required by their medical condition, and is fully responsible for the insurances of its own personnel.

CONTRACTOR is also fully responsible to ensure that its own SUB-CONTRACTORS comply with PROJECT's expectation with regard to medical facilities and insurances of the workforce.

CONTRACTOR is also responsible to ensure that SUB-CONTRACTOR's personnel receive appropriate medical care during the entire PROJECT.

d. Communicable diseases and Food / Water Safety

CONTRACTOR shall comply at all times with OWNER's requirements with regard to communicable diseases management and Food / Water Safety management, as per respective Communicable Diseases and Food Safety.

10.3.42 INCIDENT NOTIFICATION, REPORTING AND INVESTIGATION

CONTRACTOR shall notify any occurrence of incident(s) at WORKSITE to OWNER without any delay and definitely within the first 24 hours.

All incidents involving death shall be reported to the Police immediately. All accidents, dangerous occurrences, poisoning and occupational diseases prescribed under the Occupational Safety and Health (Notification of Accident, Dangerous Occurrence, Poisoning and Occupational Diseases (NADOPOD)) Regulations 2004 shall be reported to the Department of Occupational Safety and Health (DOSH) within the specified time frame.

All incidents involving a death shall be immediately reported to OWNER and to the Police Administration, as per process requested by OWNER, in order to comply with National and State regulations.

CONTRACTOR shall not interfere with incident area and shall keep or preserve evidence(s), except it needed to interfere for ensuring safety of personnel.

CONTRACTOR shall, promptly following such incident(s), investigate all incidents resulting in injury or death to personnel, or damage to equipment, or having the potential to have resulted in injury or death to personnel or damage to equipment and shall take immediate measures to avoid any recurrences.

Results of the CONTRACTOR's investigation, including recommendations for preventive action, shall be issued to the OWNER within seven (7) days after the date of the incident.

CONTRACTOR shall keep records of all work injuries and illness at WORKSITE. These records shall include:

• Employee's name and pass number.

• Date of injury.

• Nature of injury or illness.

• Treatment and further care for injury party.

• Any restrictions resulting from injury and treatments.

OWNER will provide CONTRACTOR, the definitions of incidents and different incident levels (Levels 1, 2 & 3). CONTRACTOR's incident reporting and Emergency Response Plan shall be aligned with the OWNER's definitions and specific expectations. CONTRACTOR shall report in a consistent manner and using the same system as the OTHER CONTRACTORS, and as agreed and approved by OWNER to ensure a homogeneous approach.

10.3.43 SECURITY ACCESS CONTROL

10.3.43.1 ACCESS CONTROL

All personnel shall attend a security induction / briefing, before entering the WORKSITE.

CONTRACTOR shall establish an effective system for controlling access to the WORKSITE and monitoring workers movements to and from WORKSITE through any of the following methods:

• Access Control System / Entry passes for workers.

• Entrance recording data for workers.

• Other mechanisms such as computerised access control system.

CONTRACTOR shall ensure proper implementation of the PROJECT SECURITY PLAN for the WORKSITE and proper organisation and management of the CONTRACTOR’s security team on the WORKSITE.

10.3.43.2 SECURITY MEASURES FOR THE WORKSITE, PERSONNEL AND EQUIPMENT

CONTRACTOR is responsible exclusively for the security of its own personnel and SUB-CONTRACTORS' personnel and CONTRACTOR'S EQUIPMENT, EQUIPMENT, MATERIALS and/or supplies on the WORKSITE and its Offices, laydown or other designated areas.

CONTRACTOR shall develop a PROJECT SECURITY PLAN for the WORKSITE and deploy a team of security professional / security guards who will be responsible for the management of security on a 24 hours a day / 7 days a week basis.

CONTRACTOR will comply and ensure compliance with the security plan for the PEC SITE developed by OWNER and any instructions given by OWNER’s security manager.

CONTRACTOR will need to ensure that its security personnel are employed by the pre-selected, third party security providers advised by OWNER. The security personnel shall be checked regularly and any security incidents shall be reported immediately to the OWNER’s security manager.

CONTRACTOR shall be responsible for fencing and guarding all CONTRACTOR'S EQUIPMENT, EQUIPMENT, MATERIALS and/or SUPPLIES on the WORKSITE and its Offices, laydown or other designated areas.

CONTRACTOR shall incorporate a security management system, security precautions and measures within the PROJECT SECURITY PLAN for the WORKSITE and such plan shall be in line with the Project Emergency Response Plan and deal with the proposed scenarios.

CONTRACTOR shall comply at all times with any security instructions given by OWNER relevant to the security on the PEC SITE and the WORKSITE.

10.3.44 DRIVING SAFETY AND SITE TRAFFIC CONTROL

CONTRACTOR shall establish system for control of vehicles into WORKSITE. This shall include:

- Introduction of speed limits.
- Installation of road traffic signs at strategic locations along the roads.
- Control movement of vehicles or mobile equipment.

• Installation of speed bumps to slow down speed.

• Provision of pedestrian crossing at appropriate locations.

• Provision of flag man to be stationed at hazardous locations.

• Heavy vehicle crossing.

CONTRACTOR shall ensure that all road transport safety regulations is in accordance with local requirement LAW and shall be adhered to while driving on WORKSITE and/or PEC SITE.

10.3.45 POTENTIAL FINDINGS OF UNEXPLODED ORDNANCES (UXO)

OWNER has engaged a third party expert to provide recommendations with respect to the disposition of any potential findings of Unexploded Ordinances ("UxO") on the PEC SITE.

Upon a discovery of an Unexploded Ordinance at the WORKSITE during the course of WORK, it is imperative all personnel is already trained on the action to be taken and follow all safety and security instructions given to them by OWNER.

The following instructions must be included as part of the daily HSE toolbox talk referred to above. The following instructions are related to the discovery of a finding of an UxO during the performance of the WORK:

• Immediately stop all work in the vicinity of the find. It is the duty of the Security / HSE Officer for the WORKSITE to stop all work in a 100m minimum radius before arrival of the Police.

• Mark the location of the UxO by using a ground marker, e.g. using a red flag.

Restrict / barricade the area of the find up to 100 meters from the location of the UxO and request personnel to stop working around a periphery of 500 meters until further a assessment is carried out by the OWNER’s UxO experts. Safety tape / a line should be used as a barricade. All access routes to the location must be marked with dual language special signage e.g. DANGER / BAHAYA and NO ENTRY / DILARANG MASUK.

• No workers, including management, are allowed into the restricted / barricaded area.

• Report a finding of an UxO to the CONTRACTOR's manager for the WORKSITE and OWNER’s manager immediately.

• CONTRACTOR's manager for the WORKSITE in liaison with OWNER’s manager shall immediately report the find to the Police.

• The area shall remain cordoned and off limits to all workers until the UxO has been cleared by the Police and certified as safe & secure.

CONTRACTOR personnel shall be instructed NOT to do the following:

- Do not move the UxO, or if already moved during the WORK, do not move further following discovery.
- Do not touch, drop, heat treat or tamper the UxO in any way.
- Do not attempt to remove the detonator or attempt to make it detonate, e.g. by hammering it, dropping it from height on to hard surface or squeezing it with any means. In summary personnel should 'LEAVE IT ALONE'.
- Do not apply any heat source or pressure to the UxO or surrounding environment.
- Do not enter the restricted / barricaded area.
- Be aware the UxO could also detonate by effects of lightning.

CONTRACTOR shall strictly follow all instructions given by OWNER, OWNER's third party UxO experts and Police until successful disposition or removal of the UxO.

10.3.46 HSSE WARNINGS AND SIGNAGES

CONTRACTOR shall provide sufficient and prominent HSE & security warning signs at strategic locations on the WORKSITE to warn personnel of the possible risks or hazards at WORKSITE, such as high noise, falling objects, electrical voltage, hazardous chemicals, radiography activity and security risks.

CONTRACTOR shall provide ample number and competent HSE personnel to monitor and supervise any hazardous activities (such as radiography testing and heavy lifting) at WORKSITE.

Other warnings and signage on the PPE requirements and prohibition of smoking, restricted items to be brought into the WORKSITE and others as appropriate shall also be installed at strategic locations on the WORKSITE.

10.3.47 PROJECT HSSE ASSURANCE, REVIEW AND CLOSE OUT

A close out meeting for the PROJECT will be held following PROVISIONAL ACCEPTANCE of the whole of the WORK to evaluate the HSSE performance, including but not necessarily limited to:

- Performance against HSSE objectives and targets.
- HSSE statistics.
- Lagging and leading indicators / total man-hours.
- HSSE non-conformance trends.
- Identifying continual improvement measures.
- A list of all the incidents reported on the WORKSITE during execution of the PROJECT.
- A summary of the main HSE / environmental incidents.

• A summary of the main security incidents.

• Main HSE / environmental / security issues.

• HSSE performance of each SUB-CONTRACTOR.

• HSSE audits schedule by internal and/or external, findings and action plans;

• HSSE lessons learnt.

This report will be used for the overall performance evaluation of the CONTRACTOR and their SUB-CONTRACTORS.

10.3.48 DOCUMENTATION TO BE GIVEN TO CONTRACTOR UPON AWARD OF THE CONTRACT

Upon award or during execution of the CONTRACT, CONTRACTOR may be given by OWNER, additional HSE documentation / guidelines / requirements, as applicable to CONTRACTOR's activities on the WORKSITE, for compliance and implementation.

10.3.49 HSSE DELIVERABLES TO BE DEVELOPED BY CONTRACTORS UPON AWARD OF THE CONTRACT

The CONTRACTOR shall ensure that the following HSE / Security / Environmental deliverables (as described in detail above) are produced, as a minimum, to fulfill the requirements of proper HSE & Security control on the WORKSITE:

• PROJECT HSE PLAN for the WORKSITE.

• Project Emergency Response Plan for the WORKSITE

• PROJECT SECURITY PLAN for the WORKSITE.

• Project Health Plan for the WORKSITE.

• Incident notification, classification, investigation and reporting / HSSE communication procedure.

• Security threat assessment for the WORKSITE.

• Construction HAZID report.

• Management of Change procedure

• Personnel competence and compliance with legal and OWNER's HSE requirements.

• Traffic Management Plan for the WORKSITE.

• Lifting operations procedure.

• Permit to Work procedure.

• ENVIRONMENTAL MANAGEMENT PLAN.

• Waste Management Plan.

• Environmental coordination procedure.

• Chemical management procedure.

• HSE & Security requirement for SUB-CONTRACTORS.

• HSE Incentive scheme.

CONTRACTOR shall also produce for OWNER's review and approval, a number of work instructions / HSE guidelines & Safety Risk Assessments (as described above) which will cover the following areas of HSSE concern, as a minimum, but not limited to:

• Health and medical management guidelines and requirements.

• HSE training and BBS guidelines.

• Traffic management and road HSE management.

• HSE requirements for explosive / blasting works.

• HSE requirements for excavation works.

• Energy isolation – lock out – tag out procedure.

• Handling, transporting and storage of radioactive material.

• NDT / ultrasonic / radiographic testing HSE requirements.

• HSE requirements for painting and blasting works

• HSE requirements for confined spaces.

• HSE requirements for lifting / crane operations (any kind of lift).

• HSE requirements for man-riding cranes.

• Handrails and grating removal procedures.

• Severe weather guidelines.

• HSE requirements for hot works / oxy-cutting/ grinding/ machining/ welding.

• HSE requirements for cleaning of equipment / machinery using high pressure hydro-jet tools, chemical solutions or electrical appliances.

• HSE requirements for high pressure testing.

• Personal Protective Equipment (PPE) guidelines.

• HSE requirements for scaffolding (e.g. erection and inspection).

• HSE requirements for work at height & fall protection.

• Hazard observations, near miss & incident reporting templates.

• HSE requirements for electrical appliances & electrical works.

• Construction safe work practices for the WORKSITE.

• HSE requirements for COMMISSIONING.

• Guidelines for security personnel.

• Manual handling HSE precautions.

• Guidelines for security precautions of personnel and equipment on the WORKSITE.

The documentation classification, defining the level of review by OWNER, for the above deliverables shall be defined according to Section C – Part II – Chapter 12.0 - DOCUMENT MANAGEMENT, REVIEW AND APPROVAL.

Additional activities may be determined by CONTRACTOR and OWNER to be reviewed and risk assessed on the WORKSITE and OWNER may require relevant HSE work instructions to be developed.

END OF CHAPTER

ZERO TOLERENCE GUIDELINES

No	HSE Non-Compliance	Example of cases	Category of Non-Compliance	Remarks
1	PTW	1.1Working without Permit ToWork ("PTW") (ZeTo Rule 1) 1.2Working with expired PTW (ZeTo Rule 1) Non-compliance with PTW Requirements Damaged or loss of PTW	**Major** **Major** **Major** **Minor**	
2	Energy Isolation	2.1 Failing to verify energy isolation before starting work (ZeTo Rule 2) 2.2Working with expired Physical Isolation Certificate(PIC)/Electrical Isolation Certificate(EIC)/Radiation Certificate 2.3 Non-compliance with PIC/EIC/Radiation Certificate requirements 2.4 Damaged or loss of PIC/EIC/Radiation Certificate	**Major** **Major** **Major** **Minor**	
3	Safety Equipment Bypass	3.1 Failing to obtain authorisation before overriding or disabling safety critical equipment (ZeTo Rule 3) 3.2Working with expired Safety Critical Equipment (SCE) Bypass Certificate 3.3 Non-compliance with SCE Bypass Certificate requirements 3.4 Damaged or loss of SCE Bypass Certificate	**Major** **Major** **Major** **Minor**	

4	Working in Confined Space	4.1 Failing to obtain authorisation before entering a confined space (ZeTo Rule 4) 4.2Working with expired Confined Space Entry (CSE) Certificate 4.3 Non-compliance with CSE Certificate requirements 44 Damaged or loss of CSE Certificate	**Major** **Major** **Major** **Minor**	
5	Working at Height	5.1 Failing to protect yourself against a fall when working at height (ZeTo Rule 5)	**Major**	
6	Chemical Handling	6.1 Failing to use personal protective equipment when handling hazardous chemicals (ZeTo Rule 6)	**Major**	
7	Excavation	7.1 Failing to obtain authorisation before excavation or entering a trench (ZeTo Rule 7) 7.2 Working with expired Excavation Certificate 7.3 Non-compliance with Excavation Certificate requirements 7.4 Damaged or loss of Excavation Certificate	**Major** **Major** **Major**	
No	**HSE Non-Compliance**	**Example of cases**	**Category of Non-Compliance**	**Remarks**
8	Lifting Operations	8.1 Position yourself under a suspended load (ZeTo Rule 8) 8.2 Working with expired Lifting Certificate 8.3 Non-compliance with Lifting Certificate requirements 8.4 Damaged or loss of Lifting Certificate	**Major** **Major** **Major** **Minor**	
9	Ignition Source Control	9.1 Smoking outside designated areas in the process area (ZeTo Rule 9) 9.2 Bringing in potential ignition sources into process area with authorisation (ZeTo Rule 9) 9.3 Non-compliance with Hot Work Permit requirements 9.4 Damaged or loss of Hot Work Permit	**Major** **Major** **Major**	
10	Driving	10.1 Using your mobile phone / walkie-talkie while driving (ZeTo Rule 10) 10.2 Failing to follow speed limit (ZeTo Rule 10) 10.3 Failing to use seatbelt (ZeTo Rule 10)	**Major** **Major** **Major**	

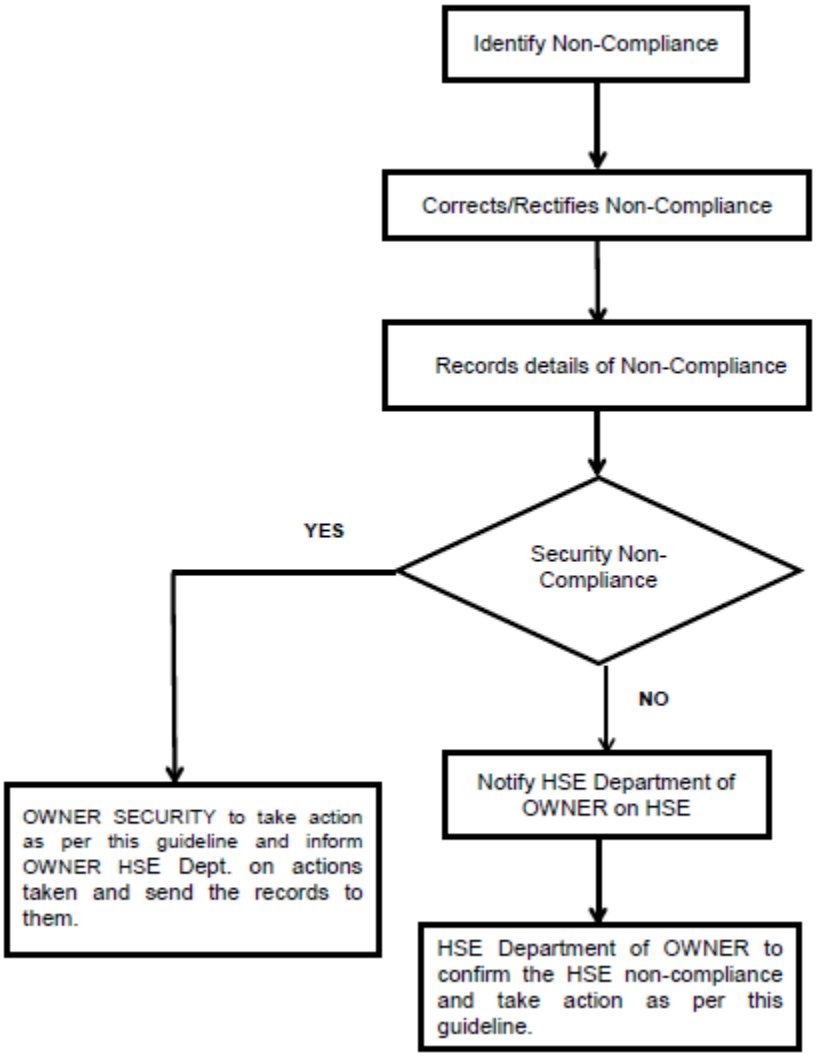
10	Driving	10.4 Traffic violations e.g. driving/ operating vehicle without license 10.5 Parking violation e.g. unauthorised zone, obstructed other traffic, access way 10.6 Overloading / transport material or passengers in unsafe manner	**Major** **Minor** **Minor**	
11	Regulatory non-compliance	11.1 Non-compliance with regulatory requirements e.g. Occupational Safety and Health Act, Environment Quality Act, Factories and chinery Act, Atomic Energy Licensing Act, Fire Services Act etc. that may expose OWNER to stop work order, written i fi	**Major**	
12	Substance Misuse	12.1 Tested positive for Alcohol 12.2 Tested positive for prohibited drugs	**Major** **Major**	Samples shall be sent to OWNER approved laboratory for confirmation. Personnel shall be banned temporarily until final test result is id
13	Plant and Emergency Equipment	13.1 Tampering with / Damaging plant or emergency equipment	**Major**	
14	Criminal/ civil offenses	14.1 Criminal / civil offenses committed anywhere within the site – e.g. gambling, theft, falsification of documents, harassment, vandalism sabotage or fighting	**Major**	
No	**HSE Non-Compliance**	**Example of cases**	**Category of Non-Compliance**	**Remarks**
15	Sleeping/ Horseplay	15.1 Sleeping while on duty/Horseplay	**Major**	
16	Tools & Equipment	16.1 Misusing / Modifying / tools or equipment/ Using substandard tools or equipment	**Major**	
17	Personal Protective Equipment (PPE)	17.1 Failing to use / Misusing / Modifying PPE/ Using substandard PPE	**Major**	
18	Others	17.1 Any non-compliance not listed above	Shall be based on decision made by OWNER	

Consequence Management for HSE Non-Compliance Penalties

Type of Non-Compliance	CONTRACTOR'S Personnel	Remark
Minor	1st offence – verbal warning / counseling 2nd offence – 1 day suspension from entering working areas at PEC SITE 3rd offence – suspension up to 7 days from entering working areas at PEC SITE	Repeated Minor offence for more than 3 times will escalate to Major offence
Major	1st offence – suspension up to 1 month from entering working areas at PEC SITE 2nd offence – Ban from	

	entering working areas at PEC SITE	

Process Flow on Consequence Management for HSE Non-Compliance


Identify Non-Compliance
Corrects/Rectifies Non-Compliance
Records details of Non-Compliance
Security Non-Compliance
YES
NO
OWNER SECURITY to take action as per this guideline and inform OWNER HSE Dept. on actions taken and send the records to them.
Notify HSE Department of OWNER on HSE
HSE Department of OWNER to confirm the HSE non-compliance and take action as per this guideline.

PEC TECHNICAL STANDARDS
HEALTH, SAFETY AND ENVIRONMENT

GUIDELINE
MANAGEMENT OF FATIGUE IN THE WORKPLACE
(Doc.No.: PEC-03C4)

PREFACE

PEC Technical Standards (PTS) publications reflect the views, at the time of publication, of PEC OPUs/Divisions.

They are based on the experience acquired during the involvement with the design, construction, operation and maintenance of processing units and facilities. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good technical practice to be applied by PEC's facilities, refineries, gas processing plants, chemical plants, marketing facilities or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to users for their consideration and decision to implement. This is of particular importance where PTS may not cover every requirement or diversity of condition at each locality. The system of PTS is expected to be sufficiently flexible to allow individual operating units to adapt the information set forth in PTS to their own environment and requirements.

When Contractors or Manufacturers/Suppliers use PTS they shall be solely responsible for the quality of work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, the Principal will expect them to follow those design and engineering practices which will achieve the same level of integrity as reflected in the PTS. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the Principal or its technical advisor.

The right to use PTS rests with three categories of users:

1. PEC and its affiliates.
2. Other parties who are authorized to use PTS subject to appropriate contractual arrangements.
3. Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) and 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

Subject to any particular terms and conditions as may be set forth in specific agreements with users, PEC disclaims any liability of whatsoever nature for any damage (including injury or death) suffered by any company or person whomsoever as a result of or in connection with the use, application or implementation of any PTS, combination of PTS or any part thereof. The benefit of this disclaimer shall inure in all respects to PEC and/or any company affiliated to PEC that may issue PTS or require the use of PTS.

Without prejudice to any specific terms in respect of confidentiality under relevant contractual arrangements, PTS shall not, without the prior written consent of PEC, be disclosed by users to any company or person whomsoever and the PTS shall be used exclusively for the purpose they have been provided to the user. They shall be returned after use, including any copies, which shall only be made by users with the express prior written consent of PEC. The copyright of PTS vests in PEC. Users shall arrange for PTS to be held in safe custody and PEC may at any time require information satisfactory to PEC in order to ascertain how users implement this requirement.

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FOREWORD

Excessive fatigue can have significant adverse outcomes for performance, health and well-being. Fatigue impairs our performance and, particularly in safety critical industries, like the Oil and Gas Industry, can contribute to serious accidents. Excessive fatigue affects millions of people around the world, and costs billions of dollars per year in medical expenses, accidents, injuries and lost productivity.

This guideline outlines the signs of fatigue and the management of fatigue in the work place. Sleep and the body clock are discussed and the health and safety consequences of shift work and the best practices in designing shift work are explained. The different shift schedules and work sets in PEC are examined and hours of service limit outlined. Fatigue mitigation is addressed in detail through the Fatigue Management Plan.

This guideline on Management of Fatigue in the Workplace ("Guideline") serves as guidance to understand, recognize and manage fatigue in the work place.

Group HSE Division

PEC

1.0 INTRODUCTION

1.1 Objective

This Guideline is intended to provide understanding on issues related to fatigue and guidelines on prevention, management and mitigation of fatigue in the workplace.

1.2 Scope

This Guideline outlines:

- The health and safety risks posed by fatigue
- Background information on sleep and the body clock
- The main causes of fatigue and provides strategies for managing the causes
- Hours of service limit for work groups in PEC
- Fatigue mitigation addressed through the fatigue management plan

1.3 Applicability

All requirements established in this Guideline shall be applicable to all employees of PEC in Domestic and International Operations.

In locations where local statutory requirements are more stringent, the more stringent requirements shall take precedence.

In locations where the local law prohibits any of the requirements stated in this Guideline, the local law shall take precedence.

1.4 Responsibility

Principal Occupational Health/Health Adviser, HSED shall be the custodian of this Guideline. He shall be responsible for periodically reviewing and revising/updating its contents and distributing the revised/updated documents to relevant end users.

Operating Unit HSE Managers/HSE Focal points shall be responsible for communicating the requirements set forth in this Guideline and its revisions to the relevant personnel in their respective Operating Units.

They shall also be responsible, where applicable, for modifying the requirements of this Guideline in consultation with Principal Occupational Health/ Health Adviser, Group HSE Division, PEC to suit local statutory requirements and Operational Unit needs.

All employees shall adhere to the requirements of the Guideline.

1.5 Review Of Document

This Guideline shall be reviewed every 5 years or as and when deemed necessary. All queries, interpretations, clarifications and proposed amendments shall be addressed in the first instance to the custodian of this Guideline

1.6 Language

In this Guideline, the acronym PEC and the term Company are used interchangeably and refer to PEC Group of Companies. Additionally, the use of the following terms shall carry the following meaning:

SHALL - Mandatory action required. Deviation requires PEC Management's approval

SHOULD - Preferred action. Deviation requires Operating Unit Management's approval

MAY - Recommended action

1.7 Definitions And Abbreviations

Cognitive:

Pertaining to mental process of perception, memory, judgment, and reasoning.

Work Sets:

Consecutive shifts with a minimum of 36 hours off before starting another work set.

Holdovers:

A periodic, occasional extended shift, where employees are at work beyond their regular shift to participate in training, safety meetings and the like. This does not include time needed for normal shift handover

Sleep debt:

Cumulative sleep loss or lost sleep over repeated days accumulates a sleep debt

Shift work:

An organization of work where workers succeed each other at the same workplace while performing similar operations at different times of the day thus allowing longer hours of operation than feasible for a single worker.

Extended shift:

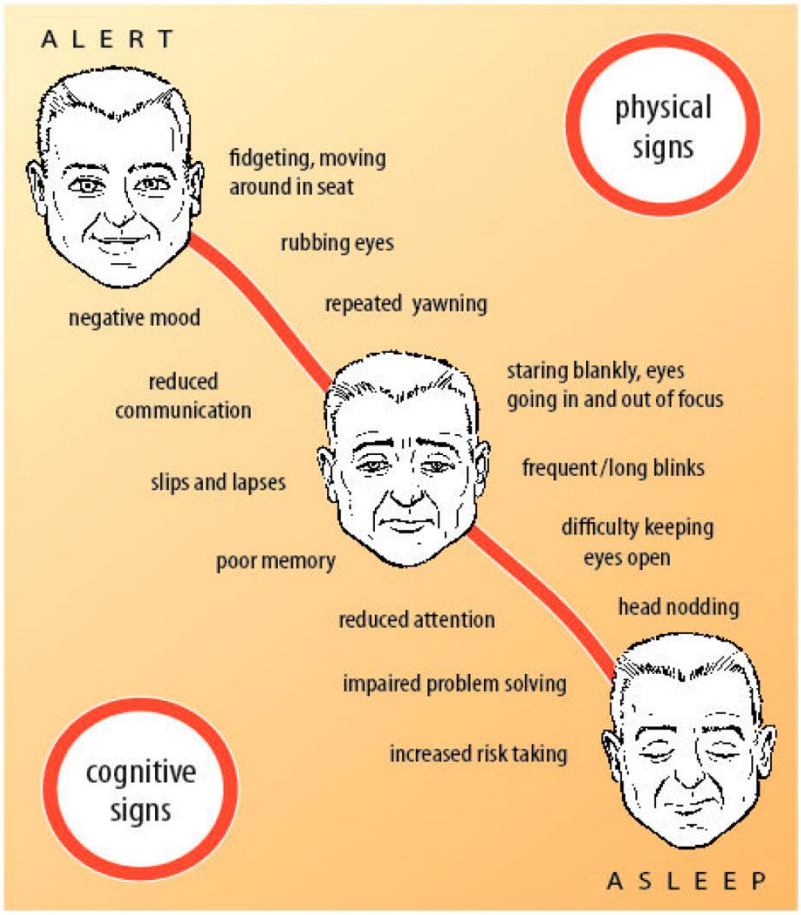
Time an employee is assigned to work that extends outside the regularly scheduled shift hours and into other shifts

2.0 FATIGUE

Fatigue can be defined as a progressive decline in alertness and performance that results in sleep. Fatigue is an everyday occurrence and in an ideal world would not pose a significant health and safety risk. The 24/7 society in which we live, however, requires that many people work outside of 'standard' office hours and thus experience an elevated level of fatigue. Shift work, long work hours and international travel can all promote fatigue. Other causes of fatigue include medical disorders, medications, drugs and alcohol.

2.1 COGNITIVE SIGNS OF FATIGUE

Figure 1: Cognitive Signs of Fatigue



The cognitive signs of fatigue include:

2.1.1 Negative Mood

Fatigue has a negative impact on our emotions and reduces our tolerance for what is going on around us. When we are fatigued we become more irritable and more easily frustrated. Fatigue can make us feel lethargic and lacking in initiative and motivation. We would also have reduced willingness to interact with others.

2.1.2 Reduced Communication

Fatigued people have both a reduced willingness and a reduced ability to communicate. When we are fatigued, we tend to use descriptive language and may neglect to pass on important information to colleagues which can be particularly problematic during changeover of shift groups.

2.1.3 Slips And/Or Lapses

An increase in slips and/or lapses is one of the easiest detectable cognitive sign. A slip is defined as accidentally doing the wrong thing, for example picking up the wrong tool, while a lapse is defined as accidentally not doing the right thing, for example forgetting to tighten a nut.

2.1.4 Poor Memory

Fatigue impairs a person's short term memory so that he/she does not always remember what he has done and what he/she has not done. When a person is tired he may not be able to recall recent conversations or information read.

2.1.5 Reduced Attention

Fatigue decreases a person's ability to maintain attention. When fatigued, people find it more difficult to divide their attention adequately between multiple tasks and to plan for future actions. People are more likely to suffer lapses in concentration and are more easily distracted from the task at hand.

Fatigue can lead to a person becoming fixated on one particular task. This 'narrowing of focus' or 'cognitive tunneling' can cause people to pay too much or insufficient attention to peripheral events and auxiliary tasks.

2.1.6 Impaired Problem Solving

Fatigue disrupts many of the processes involved in effective problem solving, including: the identification and evaluation of alternative courses of action; construction of mental images; and the integration of incoming information with existing knowledge. When fatigued a person tends to persevere with ineffective solutions, to keep trying the same old solution even if it doesn't work.

2.1.7 Increased Risk Taking

Fatigue affects our ability to assess risks and increases our willingness to accept risks. The more tired we become, the more likely we are to cut corners and to accept lower standards in accuracy and performance.

2.2 WHY MANAGE FATIGUE?

2.2.1 Accidents

Investigations into some of the worst industrial and environmental accidents of the past 30 years have identified fatigue as a major contributory factor to the incidents. In some of these cases fatigue was not the sole cause.

There were initial difficulties such as technical faults but because the operators were fatigued they did not manage the situation adequately, thus allowing the situation to escalate to an accident.

Fatigue contributes to accidents by impairing performance and at the extreme end of the scale by causing people to fall asleep while doing work.

2.2.2 Performance

A person's performance is impaired because fatigue reduces (deactivates) the electrical activity of some regions of the brain. Reductions in activation are especially evident in areas which control functions like situational awareness and problem solving, general alertness levels and attention, and in areas that are important for mental tasks such as mathematical calculations.

2.2.3 Health

Fatigue can make a person irritable and short tempered. In addition to having a negative impact on mood, fatigue has adverse consequences for health. There is increasing evidence to suggest that sleep loss is a risk factor for obesity and diabetes. Shift workers encounter a particularly high degree of sleep loss and it seems likely that fatigue plays a role in the health complaints encountered by this group.

2.3 Sleep and The Body Clock

There are a multitude of causes of fatigue ranging from long working hours, high workload and jet lag to intense domestic demands, health issues and drug/alcohol use. Nonetheless, the prime underlying mechanism via which fatigue is generated is insufficient sleep, prolonged wakefulness, being awake when one would normally be sleeping or trying to sleep during the day.

2.3.1 Why Do We Sleep?

Sleep is a highly complex physiological process throughout which the brain is active, and some parts of the brain are as active during sleep as when a person is awake. It seems likely that sleep serves a variety of purposes, including tissue repair and the consolidation of memory and learning

2.3.2 How Much Sleep Do We Need?

We differ in the amount of sleep that is required for us to perform optimally. Most adults need 7 to 8 hours of sleep in every 24 hours to be at their best, and a small proportion need as little as 6 hours or as much as 10 hours sleep. The amount of sleep that a person needs is not something that can be changed. If our daily sleep requirement is 9 hours, and we regularly obtain 6 hours, the body will not adapt to getting less sleep. We may become accustomed to feeling tired, to the point that we don't even recognize it anymore, but will always require 9 hours to be at our best.

2.3.3 The Body Clock

All living beings, including plants animals and humans are regulated by 24 hour biological rhythms, known as circadian rhythms, which prime us for activity during the day and sleep during the night. In humans the source of circadian rhythms is the body clock which is primarily located in a cluster of cells in the brain. The body clock is comparable to the conductor of a symphony orchestra. It instructs almost all of the body systems, including the sleep/wake cycle, cardiovascular activity and hormone secretion, to vary in a circadian rhythm.

Figure 2: Circadian Rhythm In Sleepiness

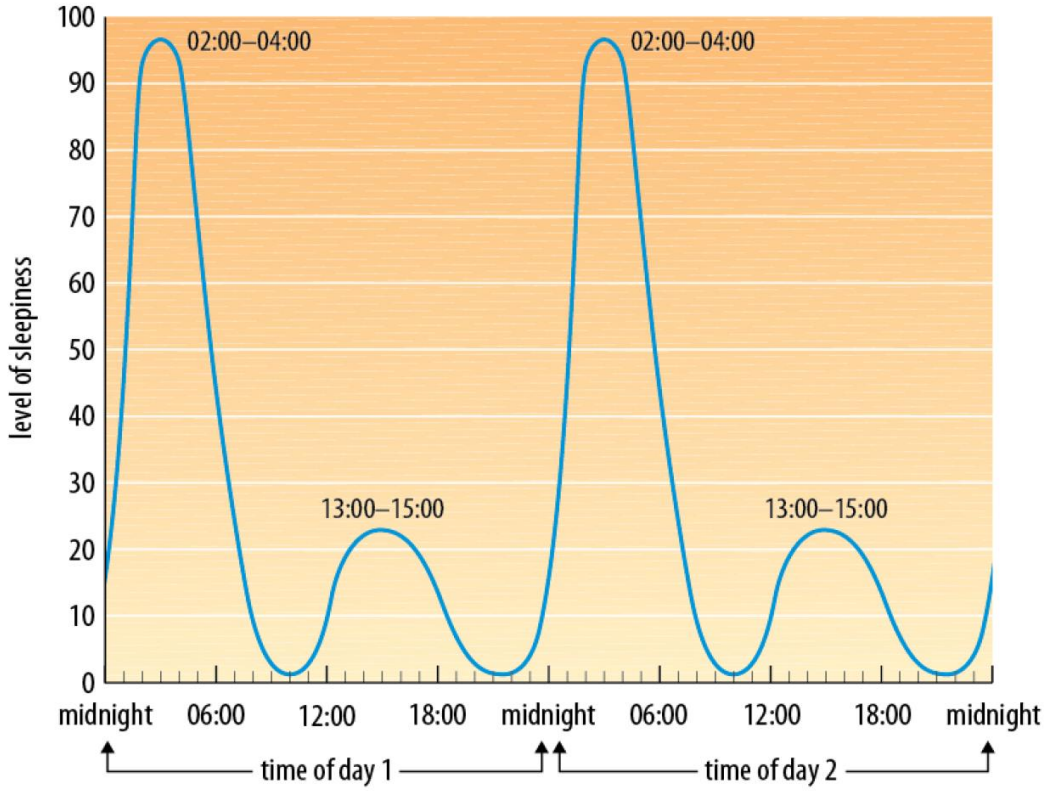


Figure 2 shows the circadian rhythm in sleepiness. Sleepiness is relatively low in the evening and increases late at night to reach a peak in the early hours of the morning (approximately 02:00 to 04:00). It then declines and remains low during the day, except for a second small increase that occurs in the afternoon (approximately 13:00-15:00). The pattern repeats itself every 24 hours. Researches have shown that fatigue related accidents are likely to occur during these two peaks.

2.3.4 The Body Clock and Sleep

The circadian rhythm in sleepiness has an important influence on sleep and ensures that we must get most sleep when we go to bed between about 22:00 and 02:00. It is also the reason why we have most difficulty sleeping approximately between 08:00 and 12:00 noon, and again between 17:00 and 21:00. These times are known as 'forbidden zones' for sleep. The forbidden zone in the evening is an important reason why sleep loss is problematic when working early shifts. Employees may try to go to sleep early knowing they have to be awake at 04:00 but the forbidden zone prevents them from falling asleep around 22:00.

2.4 SHIFT WORK

Shift work is an employment practice designed to make use of the 24 hours of the clock rather than a standard working day. The term shift work includes both long term night shifts and work schedules in which employees change or rotate shifts.

2.4.1 The Health and Safety Consequences of Shift Work

For people working 'typical office hours' work and sleep occur at times that are aligned with the timings of the body clock. Work is scheduled for daytime hours when alertness is high and sleep is initiated when the body clock has prepared the body for sleep.

For people working in industrialized countries that are involved in shift work, work and sleep occurs at times of the day which conflicts with the underlying body clock.

Shift workers encounter fatigue because they need to sleep when the body is programmed for wakefulness and are at work when the circadian rhythm in sleepiness is high. The degree of fatigue that shift workers encounter depends on the schedule that is being worked, but is generally most severe on night shifts and shifts that start early in the morning. Unpredictable work hours, for example call-out arrangements, are also particularly problematic.

2.4.2 Designing Safer Shift Work Arrangements

It is necessary to assess the risks associated with the work schedules. There are a number of key risk factors in shift schedule design, which should be considered when assessing and managing the risks of shift work. These are the workload, the work activity, shift timing and duration, direction of rotation and the number and length of breaks during and between shifts. Other features of the workplace such as the physical environment, management issues and employees welfare can also contribute to the risk associated with shift work.

a) Good practice guidelines for shift design

- Plan an appropriate and varied workload
- Where employees are working rotating shifts these should be forward rotating (e.g. early shifts, day shifts, late shifts)
- Ideally, where rotating shifts are operated, rotation should be rapid (e.g. every two to three days)
- Avoid early morning starts. Shift change over time should take into account the length of commute and the availability of public transport
- Limit shifts to 12 hours including overtime
- Encourage workers to take regular breaks and allow some choice as to when they are taken.
- Consider the needs of vulnerable workers, such as young workers, and new and expectant mothers. The ageing workforce brings with it the additional challenges in managing shift operations.
- Limit consecutive work days to a maximum of five to seven days and restrict long shifts, nights and early shifts to two to three consecutive shifts.
- Allow two nights of full sleep when switching from days to night shifts and vice versa.
- Build regular free weekends into the shift schedule

b) Good practice guidelines for the work environment

- Provide night workers with similar facilities (e.g. canteen, food storage and preparation) and access to training opportunities to those available during daytime.
- Ensure temperature and lighting is appropriate and preferably adjustable.
- Provide training and information on the risks of shift work and ensure supervisors and management can recognize problems.
- Consider increasing supervision during periods of low alertness
- Control overtime, shift swapping and on-call duties and discourage workers from taking second jobs.
- Allow time for communication at shift handovers
- Provide opportunities for interaction between shift workers and support for lone workers.
- Encourage workers to tell their family doctor and occupational health physician that they are shift workers

- Ensure the workplace and surroundings are well lit, safe and secure.

2.4.3 Personal Countermeasures

How well an individual copes with shift work is dependent on a range of factors including their age, the ease with which childcare arrangements can be organized, commute time and their health. Young adults seem to cope better with shift work than older workers, one reason being because from middle age onwards the structure of our sleep changes. With increased age we spend less time in deep sleep and sleep becomes more disrupted.
The following sections provide suggestions for shift workers that may help them cope better with their work hours.

a) At work

- Schedule tedious and boring tasks for times of the day when alertness is high, and leave the stimulating and motivating tasks for times of the day when alertness is lower.
- Use a 'buddy system' so that colleagues help to keep each other alert and encourage breaks if signs of drowsiness appear.
- Exercise, walk around or do some physical activity during breaks
- Use caffeinated drinks (coffee, tea, cola) strategically – avoid them at times when you are alert and use them as a countermeasure when alertness is low.
- Advise your supervisor if you have had insufficient sleep, feel tired or are exhibiting any of the signs and symptoms of fatigue
- For many shift workers the most high-risk task that they perform is driving home in the morning or at the end of a tour of duty. If possible, avoid driving home by using an alternative form of transport or arranging a lift. If you have to drive ensure you are properly rested before setting off.

b) Naps

Naps can be used to prepare for, or recover from, work (e.g. before a night shift; before driving home).

c) At home

To improve the degree to which employees cope with shift work they will need the help of their families and friends. Below are some of the things that they can do at home to improve their quality of life:

Try to schedule your social/domestic responsibilities around sleep

- Explain to your family/friends why it is important that you obtain sufficient sleep and the consequences that tiredness can have for you, them and safety.
- At the same time, schedule special times for the family and friends so they know when to expect to spend time with you.
- Put your roster on the refrigerator (or somewhere prominent) so others know when you will be at home and at work.
- Use a "Do Not Disturb" sign on the bedroom door

Diet and exercise:

A healthy diet provides longer-lasting energy – concentrate on complex carbohydrates (e.g. oats) rather than simple carbohydrates (sugar) and avoid fatty food and junk food. Sitting down to have a glass of warm milk before bed can be relaxing, particularly if part of a bedtime routine.

Regular exercise taken earlier in the day can be an effective aid for sleeping, partly because it is a means of relieving stress. It is important that you don't exercise just before sleep though as the adrenaline released during exercise can make it difficult to get to sleep.

Avoid alcohol:

Many people belief that drinking alcohol can help them get a good night's sleep. However, while it is true that alcohol has a relaxing and sedative effect, it actually disrupts sleep. Alcohol increases the likelihood of snoring, causes early awakening, disrupts sleep quality and increases fatigue the next day.

Evening preparation:

During the evening as bedtime approaches there are a number of strategies that can be implemented to promote sleep. These strategies concentrate on helping you to gently unwind and prepare both your body and mind for sleep.

- Unwind by avoiding anxiety: In the hours before bedtime, avoid activities that will make you mentally active or anxious. Using the internet or playing computer games prior to bedtime can make it more difficult to unwind for sleep.
- Have a warm shower or bath: Another particularly useful strategy for promoting sleep and relaxation is to take a warm bath or shower. Research has shown that we fall asleep when we have warm feet.
- Being too full or hungry: Obviously going to bed hungry can disturb your sleep. A light snack before bed, such as a bowl of cereal with milk, can stave off hunger pangs during the night. To avoid being kept awake by indigestion steer clear of acidic, spicy or high fat foods. Another reason for avoiding fat and sugar in the evening is that our metabolism falls to its lowest point at nights, meaning we are less likely to burn off the extra calories.
- Write a 'to-do' list: Make a list of things to do before you go into the bedroom. Rather than lying awake and worrying about forgetting things that you have to do, keep a pen and paper by your bed.
- Establish a bedtime routine: To train your mind and body to prepare for sleep you should establish a consistent bedtime routine. By following the same pattern of daily behaviour, over time your body will come to associate this with sleep. An example routine could be: to switch everything off downstairs, lock the front door have a light snack, a relaxing bath, brush teeth, prepare clothes for tomorrow, get into bed, set alarm clock, read for 15 minutes and put the lights out.

Prepare an ideal bedroom environment:

- Keep the bedroom for sleep: The bedroom should be comfortable and relaxing and reserved for sleep. It should not be used for surfing the internet or other activities that will make you mentally active or anxious.
- Block out light: Street lights, daylight and the light from a television can all upset circadian rhythms and send a signal to the brain that it is time to wake up. Try to keep your bedroom as dark as possible by fitting heavy curtains. Alternatively wear an eye mask.
- Keep your bedroom quiet: Below are some of the basic things you can do to help minimize the chances that you will be disturbed by noise when trying to sleep:
  - Turn off the phone and switch your mobile phone off or to silent mode
  - Put a 'Do Not Disturb' sign on the front door
  - Use ear plug or fit double glazing

- Keep your bedroom cool: Our ability to regulate our body temperature is diminished when we are asleep. Therefore, if during the night it is too cold or too hot, we spend more time in the lighter stages of sleep, or awake (so that we can control temperature better). We sleep best when bedroom temperature is slightly cool (approximately 180C)

- Ensure your bed is comfortable: As a rule your bed should be neither too hard nor too soft. If your mattress is lumpy or worn, it is worth investing in a new one: after all, you spend a third of your life in bed. Use a suitable pillow.

2.5 HEALTH AND SLEEP DISORDERS

There are a multitude of medical causes of sleep loss including pain, chronic cough, mental ill health and sleep disorders. Sleep disorders can lead to a significant increase in accident risk.

The following are sleep disorders:

2.5.1 Obstructive Sleep Apnoea (OSA)

Obstructive sleep apnoea is a sleep disorder associated with obstruction of the airway in the throat. Complete obstruction can last from a few seconds to up to 30 seconds and may occur many times an hour. Each closure of the airway results in hypoxia (oxygen deficiency) which causes the sufferer to awaken momentarily to re-open the airway. OSA is always accompanied by loud snoring and sometimes by gasping or choking sounds. As OSA causes repeated awakening it is inevitably associated with poor sleep quality, excessive fatigue and performance impairment.

The disorder can affect anyone but is particularly common in middle-aged men; it is associated with obesity and large neck size. The majority of people who suffer from OSA do not know they have the disorder. People can suffer from the condition – undiagnosed – for many years, and be unaware of their debilitation.

If someone has OSA their sleeping partner is more likely than them to be aware of the loud snoring and respiratory pauses. A partner may also note frequent awakening, body jerking and gasping.

2.5.2 Insomnia

Insomnia is a disorder of too little or poor quality sleep and usually takes one or more of the following forms:

- Difficulty falling asleep – more common among young people
- Sleeping lightly and restlessly, waking often, lying awake in the middle of the night
- Waking early and being unable to get back to sleep – this is more common in older people and anyone worrying about something in particular.

Insomnia can be an acute problem, lasting for a few night or weeks, or may persist in the long term, lasting for several weeks, months or even years. It can be caused by a range of factors including stress, grief, job worries, acute illness (fever, coughing, nasal obstruction, etc.), preexisting medical, physical or psychological conditions as well as poor daytime and bedtime habits. Prescribed medications as well as illicit drugs and alcohol use may provoke insomnia.

2.5.3 Periodic Limb Movements In Sleep (Plms)

Periodic limb movement in sleep is a condition characterised by twitching, jerking or bending of the limbs (usually only the feet or toes) during sleep. The movements briefly wake the individual, although they will not remember this, and lead to poor quality sleep and some will complain that no matter how long they sleep they still feel tired.

Anyone with a suspected sleep disorder should seek diagnosis and treatment from a doctor and, ideally, from a qualified sleep specialist.

2.6 MEDICATION

Medication can elevate fatigue in two ways – directly, by reducing alertness (eg. sedatives) and indirectly, by disrupting sleep. Aside from sleeping medications, prescription medicines that can have sedative effects include painkillers, muscle relaxants and treatments for high blood pressure, anxiety and depression. Medications that can promote fatigue by disturbing sleep include stimulants such as

theophylline (a respiratory stimulant used to treat asthma) and treatments for epilepsy and psychiatric disorders.

Many of the treatments for colds, flu and hay fever contain one or more of a group of substances called 'antihistamines'. Besides reducing a runny nose, sneezing, allergies etc., some antihistamines have a strong sedating effect. Taking antihistamines during the day can impair your performance at work and your ability to drive safely.

Employees should be advised to always tell their doctors and pharmacists what they do for a living, to make sure that the medication they are taking does not interfere with their responsibility to be fit for work.

2.7 JET LAG

'Jet lag' is the term applied to the effect on the body of crossing time zones. It is caused by the disruption of the body's circadian rhythms. The effects of jet lag depend on the number of time zones crossed and are subject to each individual's susceptibility. Symptoms can include insomnia, disorientation, tiredness, irritability, as well as changes in eating, sleeping and bowel habits.

To limit jet lag, try to avoid alcohol, caffeine and excess food on flights. Ensure that you are not dehydrated – drink plenty of water prior to and during a flight. The rule of thumb is that recovery from jet lag takes 24 hours per time zone crossed. You should avoid critical meetings on the day of arrival and avoid driving, certainly long distance, for at least a few days.

On business trips that only last few days you are unlikely to adapt to your new time zone. When possible, it is therefore best to try and maintain your home sleep/wake pattern. If you are staying in a new time zone for an extended period you can speed up the rate at which you adjust by trying to synchronise sleeping patterns and meal times to your new environment as soon as possible.

3.0 MANAGING FATIGUE IN WORKGROUPS IN PEC

The different shift schedules and works sets among the various work categories in PEC are examined and hours of service limit are specified for each work group.

The work categories examined are as follows:

- Office Work
- Normal Plant Operations
- Plant Shutdown
- Land Transport
- Airport Workers
- Seafarers
- Port Workers
- Business Travel
- Emergency Responders
- Offshore Workers

For any category of workers not mentioned in this Guideline, OPU Management shall syndicate with the relevant stakeholders to examine work schedules and specify appropriate hours of service limit.

Notwithstanding the recommended hours of service limit for each of the work group categories as specified in this Guideline, the hours of service may be extended beyond this recommended hours of service limit in the case of emergency, including but not limited to the following situations, provided that such extended hours of service is not in contravention of any applicable laws and regulations –

Accident at place of work

- Work essential to life of community

- Work essential for protection, defense or security of the country and/or the company
- Urgent work to machinery and plant
- Interruption of work which is impossible to foresee

3.1 OFFICE WORK

Work Group	Office Worker
Shift Type	9 hour shifts (daytime)
Hours of Service Limit	• 9 hours per day including 1 hour lunch break • 1 off day and 1 rest day per week • Working beyond normal working hours, on weekends or public holidays should be discouraged. • Maximum of 104 hours overtime per month (applies to nonexecutive staff)

3.2 NORMAL PLANT OPERATIONS

Work Group	Plant Operators
Shift Type	12 hour shifts

Hours of Service Limit	• Work sets shall not exceed 7 consecutive days.
	• To permit 2 consecutive nights of sleep after a work set, there shall be:
	  ○ a minimum of 36 hours off* after a work set (of less than 84 hours)
	  ○ a minimum of 48 hours after a work set containing 4 or more night shifts, or a minimum of 48 hours off after a total of 84 or more hours worked regardless of day or night shift
	• Shifts are routinely scheduled for 12 hours and holdover periods should not exceed 2 hours and, where possible, occur at the end of the day shift.
	* Off hours are calculated from the time the last shift ends.

3.3 PLANT SHUTDOWN

Work Group	Plant personnel working during: • Turnarounds • Unit Shutdowns • New Plant Commissioning • Projects • Operational Responses
Shift Type	12 hour shifts
Hours of Service Limit	• Work sets should not exceed 14 consecutive days.

	• There will be a minimum of 36 hours off after a work set. • Shifts are routinely scheduled for 12 hours and holdover periods should not exceed 2 hours and, where possible, occur at the end of the day shift. • The startup and shut down of a process is a critical time in operations and due consideration should be provided to ensure the critical personnel are well rested and fit for duty. * Off hours are calculated from the time the last shift ends.

3.4 LAND TRANSPORT

Work Group	Drivers of PEC owned operated motor vehicles: Passenger cars, vans, buses, lorries, tankers etc.
Shift Type	12 hour shifts
Hours of Service Limit	• Maximum hours of continuous driving shall not exceed 4 hours. • Rest duration in between driving should be a minimum of 30 minutes every 4 hours. • Maximum driving hours per day should not exceed 9 hours. • Maximum working hours per day should not exceed 12 hours. • Minimum of 12 hours in between work shifts. • Work sets shall not exceed 6 consecutive days per week. • Maximum working hours per week shall not exceed 72 hours. • Permit a minimum of 36 hours off after a work set (this is to permit 2 consecutive nights sleep after a work set).

3.5 BUSINESS TRAVEL

Work Group	Employees on Business Travel (Domestic & International)
Shift Type	Not applicable
Hours of Service Limit	• For outstation travel by road, it is advisable not to drive between 2200hrs and 0500hrs. Stop and find suitable accommodation to rest. • Maximum hours of continuous driving should not exceed 4 hours • Superiors are requested to allow staff adequate rest before business travel and after returning from business travel. For overseas travel, jet lag shall be taken into account. It should be ensured that an employee has enough rest before returning to work • During international travel, the effects of jetlag depend on the number of time zones crossed and to each individual's susceptibility. • To select direct routes and avoid multiple transit stops

	• For flights of more than 6 hours duration, there should be at least 10 hours of rest in between arrival and the starting of work

3.6 SECURITY PERSONEL

Work Group	Security Personnel including Auxiliary Police and contracted Security Personnel
Shift Type	Shift Type 8 hours or 12 hours
Hours of Service Limit	• For a 12 hours shift, overtime is not allowed at the end of shift. • An employee is permitted to work up to a limit of 104 hours of overtime in any one month

4.0 FATIGUE MANAGEMENT PLAN (FMP)

Fatigue Management is important in PEC Operations as workplace fatigue is a known risk to safe operations. Hours of Service rules shall be incorporated in work groups particularly those working in Process Safety Sensitive Positions.

Operating Units (OPUs) shall develop a Fatigue Management Plan (FMP) which shall include but not be limited to the implementation of the recommendation under this Guideline.

The FMP shall be OPU and work group specific and shall be developed in consultation with the various stakeholders who are involved in operational issues in the OPU. The FMP should have a scientific basis and should incorporate day to day issues and emergency situations that could be the cause for fatigue among the employees in the OPU.

4.1 COMPONENTS OF FATIGUE MANAGEMENT PLAN

4.1.1 Roles and Responsibilities:

The roles and responsibilities of all levels of Management, and the employees in the management of issues related to fatigue in the OPU shall be defined.

Those with key support functions and those involved with Human Resource Management workforce planning, shift scheduling, etc. have important roles to play and their responsibilities shall be explained in detail.

In OPUs with medical personnel, the medical personnel will have an important role in identifying and managing issues of fatigue among employees.

4.1.2 Work Groups Under The Fatigue Management Plan

The Fatigue Management Plan should cover all work groups involved in process safety-sensitive actions and all work groups involved in making process safety-sensitive decisions. Those involved in emergency response, and contractors who work in the OPU and may be involved in process safety sensitive actions should also be included.

4.1.3 Review of Manpower Planning

The FMP shall include an initial and ongoing assessment of staffing levels and workload balance to ensure that the appropriate number of workers is allocated for a specific task.

Hours of service guidelines must be implemented to ensure that fatigue risk is adequately managed. The hours of service limit shall not exceed those in this Guideline.

The FMP should recognise the workload variability across shifts, weeks and months. It must take into account start-ups, shutdowns (planned and unplanned), turnarounds or projects where work is physically demanding and require longer duration than normal working hours. Unplanned events (e.g. flooding, curfew) and emergency situations in the OPU should also be addressed. The assessment should also assess current and anticipated staff turnover and absentee issues.

4.1.4 Training, Education and Communication

Education on the causes, risks and consequences of fatigue must be given to employees through awareness training The awareness training should include the basic scientific principles of sleep, sleep disorders, alertness, circadian rhythm, medication causing sleep, jet lag, etc. The importance of rest breaks, good posture, etc. should also be inculcated. With this knowledge, employees will understand fatigue issues better and this will help them reduce the fatigue risk for themselves, other employees and the people they may supervise and manage.

4.1.5 Identification and Evaluation of Fatigue

The management shall ensure that the normal risk assessment through the Hazard and Effect Management Process (HEMP) includes an evaluation on the potential fatigue issues a particular job may have.

Evaluation of the work, whether routine or non-routine, that may potentially cause fatigue issues should be done through the Health Risk Assessment (HRA), Job Hazard Analysis (JHA) or other tools. The required input may include analysis of health data, number of clinical attendance, surveys and previous fatigue related incidences.

Work environment must be evaluated in detail. This will include determining the nature of work (e.g. whether the work involves physically and/or mentally exhausting activities; time of the day when the work is carried out [outdoor work should preferably not be carried out in midday]; type of shift etc.).

In addition to the formal assessment through risk assessment tools like HRA and JHA, individual risk assessment should also be practiced, and this includes:

i. Self-monitoring

Employees should be continuously aware of their level of fatigue and take appropriate steps to enhance their alertness while on duty. An employee who is too fatigued to work safely, shall report this to their superior.

Individuals doing shift work and others who may be involved in working extended hours during plant shutdowns, turnarounds etc. shall use their free time off the job to get appropriate sleep and maintain their alertness and fitness for duty.

ii. Peer to peer monitoring

Individuals should be alert to evidence that others in the workplace may be fatigued. Their concerns should be highlighted to the superior.

iii. Superior monitoring

Superiors shall be alerted to signs of excessive fatigue in employees and contractors. They shall be given the authority to take the necessary steps to ensure that an individual who is fatigued is removed from his work. Individuals who experience repeated bouts of excessive fatigue shall be referred to a health professional for further evaluation and advice.

4.1.6 Preventing and Controlling Fatigue

The prevention and control of fatigue risks should start at the design stage of a work procedure, facility, operation and organisation or manpower planning. The comprehensive risk assessment through HRA, JHA or other tools can assist the management in prioritising the type of control measures that should be in place based on the “as low as reasonably practicable” or ALARP concept.

A review of process/facility/work design may be done to minimize the need for rigorous physical activities or manual handling, repetitive work, awkward postures or other situations that may pose as fatigue issues. The use of mechanical means for minimising the need for manual handling may be suggested e.g. pulley for lifting, automated system and forklift.

Sufficient and appropriate work breaks should be made available, based on the nature, duration and complexity of the work. While it is well understood that workers doing heavy work require frequent breaks, workers performing sedentary work that requires constant vigilance such as panel operators also need breaks so that they do not lose conscious attention.

Work space should be well lit, utilising indirect lighting to avoid glare and eye strain.

Indoor temperature should be controlled at a comfortable range. Temperature should be adjustable so that the temperature can be increased for comfort during night shifts.

Workstations should be designed utilising ergonomic principles to prevent musculoskeletal fatigue associated with repetitive work and awkward posture.

A review of manpower planning to ensure appropriate staff-workload balance may be done. Sleep Disorder Screening, diagnosis and treatment may also be done with the aim to control fatigue in the workplace.

4.1.7 Incident/ Near Miss Investigation

When investigating incidents, where applicable, fatigue shall be taken into consideration when determining the root cause or contributing factors of the incident.

Information collected as part of the investigative procedure involving the individual involved in the incident shall examine:

- time of the incident
- shift pattern
- number of consecutive shifts worked
- number of hours awake
- number of hours of sleep in the past 24 hours by the individuals involved
- shift duration (and any overtime worked)
- whether the incident occurred under normal operations or shutdown
- other fatigue factors (e.g. medication etc.)

Although, for individual incidents, often no definitive conclusion regarding the role of fatigue may be possible, aggregate analysis of incidents may reveal patterns suggestive of the role of fatigue as a contributing factor in incidences.

4.1.8 Periodic Review of The FMP

The FMP should be subjected to periodic assessments of its effectiveness for continuous improvement. Targets should be set for key parameters of the FMP which should include but not limited to:

- number of holdovers
- maximum number of overtime, etc.

Analysis and monitoring of data should include but not be limited to the following:

- actual versus planned shift schedule
- absenteeism
- incident investigations
- noncompliance records
- incident reports

The need for revision of the FMP may include factors such as the occurrence of fatigue related accidents or illnesses, or significant change in work procedures/facilities/processes.

PEC TECHNICAL STANDARDS

HEALTH, SAFETY AND ENVIRONMENT

GUIDELINE ON HEALTH ASSESSMENT FOR FITNESS TO WORK (Doc.No.:PEC-03C3)

PREFACE

PEC Technical Standards (PTS) publications reflect the views, at the time of publication, of Jurong Aromatic Complex.

They are based on the experience acquired during the involvement with the design, construction, operation and maintenance of processing units and facilities. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good technical practice to be applied by PEC' OPUs in oil and gas production facilities, refineries, gas processing plants, chemical plants, marketing facilities or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to users for their consideration and decision to implement. This is of particular importance where PTS may not cover every requirement or diversity of condition at each locality. The system of PTS is expected to be sufficiently flexible to allow individual operating units to adapt the information set forth in PTS to their own environment and requirements.

When Contractors or Manufacturers / Suppliers use PTS they shall be solely responsible for the quality of work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, it is expected of them to follow those design and engineering practices which will achieve the same level of integrity as reflected in the PTS. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the owner.

The right to use PTS rests with three categories of users:

1. PEC and its affiliates.
2. Other parties who are authorized to use PTS subject to appropriate contractual arrangements.
3. Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) and 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

Subject to any particular terms and conditions as may be set forth in specific agreements with users, PEC disclaims any liability of whatsoever nature for any damage (including injury or death) suffered by any company or person whomsoever as a result of or in connection with the use, application or implementation of any PTS, combination of PTS or any part thereof. The benefit of this disclaimer shall inure in all respects to PEC and/or any company affiliated to PEC that may issue PTS or require the use of PTS.

Without prejudice to any specific terms in respect of confidentiality under relevant contractual arrangements, PTS shall not, without the prior written consent of PEC, be disclosed by users to any company or person whomsoever and the PTS shall be used exclusively for the purpose they have been provided to the user. They shall be returned after use, including any copies which shall only be made by users with the express prior written consent of PEC.

The copyright of PTS vests in PEC. Users shall arrange for PTS to be held in safe custody and PEC may at any time require information satisfactory to PEC in order to ascertain how users implement this requirement.

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FOREWORD

Employees' health is vital to ensure they are physically and mentally capable of doing their assigned jobs, and at the same time not being a health hazard to themselves or others. Towards this, employees' health status should be regularly screened from the time they first join the company until the day they retire.

Health assessments for fitness to work are objective assessments of the health of employees in relation to their jobs and job environment. Consideration should be given to the potential impacts at a person's health on his job as well as the impacts of the job on his health. Additionally, a person's health should also be viewed with regards to its potential impacts on the health and safety of others in the workplace as well its impacts on a company's business and image.

To be useful to the employee and employer and compliance with applicable legislations, all health assessments should be conducted in a structured manner so that they are specific to the working conditions and job requirements.

This Guideline on Health Assessment for Fitness to Work serves as guidance for evaluating employees' fitness to perform their work in the respective working environment. It is the minimum requirement to be used in the identification of any medical condition which may adversely affect the employees' ability to work safely and efficiently.

Group HSE Division, PEC

1.0 INTRODUCTION

1.1 Objectives

This document was developed with the following objectives:

- To provide information and guidance to Employees and Managers on the requirements and procedures on Health Assessment for Fitness to Work within PEC.
- To ensure the Fitness to Work Programme is implemented in a structured and consistent manner throughout PEC
- To ensure the Fitness to Work Programme complies with Company, industry and legislative requirements as a minimum

1.2 Scope

This Guideline outlines the following:

- Requirements and procedures on the various types of health assessments conducted to establish fitness for work
- Fitness standards for employment of PEC employees
- Requirements and procedures related to selection and appointment of Approved Medical Examiners
- Management of health assessment records
- This Guideline does not cover health assessment requirements for offshore workers, aircrew, marine crew and divers. Please refer to Section 4 - Job Specific Fitness to Work Standards.

1.3 Applicability

All requirements established in this document shall be applicable to all Employees of PEC worldwide. In locations where local statutory requirements are more stringent, such requirements shall take precedence.

In locations where the local law prohibits any of the requirements stated in this document, the local law shall take precedence.

1.4 Responsibility

PEC Group Health Advisor shall be the custodian of this document. He shall be responsible for periodically reviewing and revising/updating its contents and to distribute the revised/updated document to relevant end users.

Operating Unit HSE Managers/HSE Focal Points shall be responsible for communicating the requirements set forth in this document and its revisions to the relevant personnel in their respective Operating Units. They shall also be responsible, where applicable, for modifying the requirements of this Guideline in consultation with PEC Group Health Adviser to suit local statutory requirements.

1.5 Review Of Document

This Guideline shall be reviewed every 5 years or as and when deemed necessary. All queries, interpretations, clarifications and proposed amendments shall be addressed in the first instance to the custodian of this Guideline.

1.6 Language

In this document, the acronym PEC and the term Company are used interchangeably and refer to PEC Group of Companies. Additionally, the use of the following terms shall carry the following meaning:

SHALL - Mandatory action required. Deviation requires PEC Management approval.

SHOULD - Preferred action. Deviation requires Operating Unit Management approval.

MAY - Recommended action.

1.7 Definitions And Abbreviations

Please refer to Appendix A.

2.0 FITNESS TO WORK PROGRAMME

2.1 Introduction

Fitness to Work Programme refers to the planning, implementation and monitoring of a systematic approach in the evaluation of employees' personal health in relation to their work and work environment. Its main objective is to ensure employees have adequate access to health assessment facilities and are protected from unacceptable health risks arising from their work and work environment.

Effective Fitness to Work Programme requires clearly defined policy, responsibilities and resource requirements. Its implementation requires collective approach where employees and management are equally responsible to fulfill all the requirements.

This section outlines the requirements of PEC Fitness to Work Programme and covers the following:

- Fitness to work requirements
- Roles and responsibilities
- Resource requirements
- Health assessment guidelines and procedures
- Fitness to work standards

2.2 FITNESS TO WORK REQUIREMENTS

2.2.1 Effective implementation of this programme requires that:

- PEC OPU and HCU Management shall be responsible to ensure the implementation of the programme within their constituents meets the expectations outlined in this Guideline.
- All Employees shall be given adequate access to the programme.
- All Employees shall ensure that he/she is physically and mentally fit for his/her assigned work and work environment
- All Employees shall ensure that his/her health condition does not compromise the health and safety of other employees and/or the safety of the operations at all times.
- All Employees shall undergo the required health assessments as prescribed by PEC.
- Contractors working for PEC shall ensure that their employees working in PEC workplaces are physically and mentally fit for their assigned duties at all times.

2.2.2 Non-Compliance

Non-compliance to the above requirements by any Employee shall be construed as a breach of Company rules and regulations and they may be subject to disciplinary action.

Non-compliance by Contractors shall be construed as breach of contractual agreement and should be managed according to existing procedures on such matter.

2.3 ROLES AND RESPONSIBILITIES

The roles and responsibilities of the relevant parties in the implementation of the Fitness to Work programme are as follows:

2.3.1 Operating Unit Management/ Holding Company

- Responsible to plan, implement and monitor the programme
- Responsible to provide the required resources including access to the programme to all Employees
- Responsible to determine health fitness requirement for all jobs in the OPU workplaces and Employees doing these job undergo and pass the required health assessment for the jobs.
- Responsible to make the required updates and reporting to PEC (Group HSE Division) on agreed performance targets and implementation issues

2.3.2 Group HRM Division

- Ensure all new Employees undergo and pass pre-employment health assessment prior to starting their employment with PEC.
- Ensure all Employees for international placement undergo and pass the required health assessment prior to their effective posting date.
- Advice PEC Management (after consultation with GHSED) on the suitability for placement / transfer of any Employee with known fitness to work problem.

2.3.3 Group HSE Division

- Develop and periodically review/ revised the relevant guideline, standards and procedures
- Promote the Fitness to Work Programme implementation among the Operating / Holding Company Unit's Management and Employees.
- Provide guidance and monitor/ review the implementation of the programme Company wide for enhancement as and when required.
- Advice HRM Division and/ or OPU/HCU Management on the suitability of a person for employment and work.

2.3.4 Employees

- Give full cooperation to their Operating Unit management on the implementation of the programme and provide input to improve its implementation.
- Submit to the prescribed health assessment and fully adhere to the procedures.

2.3.5 Approved Medical Examiners

- Performed the required health assessment and determine Employees fitness to work status in accordance to PEC's fitness standards outlined in this Guideline as well as any other instructions that may be given by PEC from time to time.

2.3.6 PEC Health Advisors

- Responsible to provide technical advice and monitor the implementation of the programme
- Where applicable to review health assessment reports and recommend appropriate decision on Employees fitness to work status
- Report to GHSED on the performance of the program being implemented by OPU/HCU within their respective constituent.

3.0 HEALTH ASSESSMENT FOR FITNESS TO WORK

3.1 INTRODUCTION

Health assessment for Fitness to Work is a specific form of assessment on the employee's health to determine his/her physical and mental fitness for his/her assigned job and the job environment.

The following outlines the reasons for, type of and frequency of the health assessment required by this Guideline. This section also details the procedures involved in carrying out the assessments.

3.2 AIM OF HEALTH ASSESSMENT

The aim of health assessment is to determine the fitness of a person to perform his/ her assigned job and to work/live within certain workplace environment. It may also helps to identify health issues useful in the planning of employees' health management programmes.

Health assessment should adhere to the following guiding principles:

- Use appropriate methods to detect relevant health problems which may impact future work
- Performed by a competent, employer designated Approved Medical Examiner in approved facilities
- Maintain employee confidentiality
- Comply with local government legislation and industry standards

3.3 TYPE OF HEALTH ASSESSMENT

The following health assessments are covered by this Guideline:

- Pre-employment Health Assessment
- Pre-placement Health Assessment
- Job-Specific Health Assessment
- Periodic Health Assessment
- 'For cause' Health Assessment

3.3.1 Pre-employment Health Assessment

This assessment is done to evaluate a person's physical and mental suitability for the work he is being employed for. Additionally, it is also used to establish the baseline of the person's general health status and predict the employee's suitability for short or long term employment.

Pre-employment medical assessment should be carried out as close as possible to the actual date of commencement of employment. Assessment done more than 6 months prior to the start of employment should be repeated. Pre-employment Health Assessment is also applicable to all employees employed through manpower Supply Companies.

3.3.2 Pre-placement Health Assessment

Also known as pre-deployment medical assessment, it is performed prior to the employee's deployment into another job and/job location which exposes the employee to a different or higher level of health hazards. Its purpose is to determine the presence of medical conditions that may render the employee not suitable for his new assignment.

For example, an employee who has history of chemical-induced Bronchial Asthma may not be suitable for work where the work environment contains chemicals that may exacerbate his condition.
Deployment that may require pre-placement medical examination includes, but is not limited to, the following:

- Office- based employees deployed to work in plants
- Plant operators deployed to another plant with different hazards (e.g. onshore plant to offshore, refinery to petrochemical plant, etc.)
- Overseas posting

The type of job and work area requiring pre-placement health assessment should be determined by the Operating Unit Management based on the Health Risk Assessment (HRA) done.

Pre-placement medical examination should be carried out as close as possible to the actual date of commencement of deployment. Assessment done more than 6 months prior to the start of employment should be repeated.

3.3.3 Job Specific Health Assessment

Medical examination carried out for employees assigned for specified work. This type of examination imposes additional requirements on the employees over and above those which are specified in the general requirements.

For example, a crane operator requires better visual acuity and normal colour perception compared to an ordinary office worker.

This type of health assessment shall be done within 6 months prior to starting the work. Usually the assessment is only valid for specified period and should be repeated at regular interval to determine the continued suitability of the person medical fitness for the job.

Detailed requirements of this type of medical examination are specified under the standards for such work (refer to Section 4).

3.3.4 Periodic Health Assessment

Periodic health assessments are carried out to screen employees' health for early signs of medical problems so that timely intervention can be instituted to prevent premature disability or death. The finding may also be useful in determining the employee's suitability to continue his current work.

The frequency for periodic health assessment depends on an employee's age group, with more frequent for the older group. Assessments usually focus on health problems related lifestyle and known exposure to health hazards in the workplace.

Periodic health assessment done close to an Employee retirement or termination may serve as his/ her exit health assessment.

3.3.5 'For Cause' Health Assessment

Medical examination carried out for reasons other than those listed above. These include:

3.3.5.1 Return to Work Health Assessment

This is done on employees who have been away from work due to illness and/or where his fitness to work may be affected by the illness/ injury. The assessment may be required to determine his physical and mental fitness to continue with his pre-illness/ injury work.

The request for an Employee to undergo this type of assessment should be made by the Employee's workplace manager or person-in-charge after consultation with a Health Adviser.

Employees placed under the Medical Removal Protection Programme (MRP) due to exposure to workplace health hazard should also be subjected to this type of assessment prior to returning to work.

3.3.5.2 Post-accident Health Assessment

Carried out on identified employees following a workplace accident where health related problems such as illnesses and drug abuse of those involved may be contributory to the cause of the accident.

3.3.5.3 Others

Referral by a supervisor following suspicion that an employee may have developed a medical condition that affects his fitness to work. Examples include employees with unexplained behavioural changes, suspected drug abusers, etc.

3.4 FREQUENCY OF HEALTH ASSESSMENT

The frequency of health assessments may vary depending upon:

- Type of employment and duty
- Work environment (geographical risk, exposure to travel and/or health risk)
- Statutory requirements and industry standards
- Past medical history
- Employee's age

All health assessments should be carried out as close as possible to the actual date of employment or placement or for periodic assessment, as close as possible to the expiry date of the last assessment.

Assessments carried out more than 6 months prior to the start of employment or placement should be repeated.

Different health assessments due within the same period of 6 months may be combined to optimise cost and minimise inconvenience to Employees. For example, an Employee placed in a new position within 6 months of his pre-employment may not undergo pre-placement health assessment provided no additional information on his fitness is required by the new job.

Table 2.1 – Frequency and Types of Health Assessments

Medical Examination	Frequency	Remarks
Pre-employment	Once. Within 6 months prior to employment	Mandatory for all employees
Pre-placement	Within 6 months prior to starting job identified by OPU requiring such health assessment.	Mandatory for specified job Holders
Periodic	39 years and below – every 3 years 40 years and above – every 2 years	Non-mandatory
Job Specific	Initial done within 6 months of starting work. To be repeated as per schedule specified by the job type	Mandatory for job holders
For Cause	As and when required	Mandatory for identified Employee

3.5 CERTIFICATION OF FITNESS TO WORK

All health assessments and fitness certification shall be carried out by PEC Approved Medical Examiners. Certification by non-Approved Medical Examiners may be accepted in locations where PEC' Approved Medical Examiner is not available. Such acceptance shall be at the discretion of the Group/ Regional/ Company Health Adviser.

For cases that require specialist referral in determining the employee's health status and fitness, Approved Medical Examiner should make such referral with approval from PEC. However, the responsibility to certify the employee's fitness remains with the Approved Medical Examiner.

Final acceptance of an employee's fitness for work/ placement/ return to work, etc. shall be at the absolute prerogative of PEC.

3.6 PROCEDURES FOR HEALTH ASSESSMENTS

The following are the steps involved in administering health assessment of Employees under this Guideline.

3.6.1 Request for Health Assessment

All requests for Health Assessments should be channeled to the respective Holding Company Unit's or Operating Unit's Human Resource Department which shall provide the Employee with the necessary guarantee letter and the list of Approved Medical Examiners the Employee can choose from.

In post-accident health assessment, the manager of the facility may send an employee to the Approved Medical Examiner for examination if such examination is required urgently for the subsequent investigation. For example, an employee suspected of drug abuse requires drug testing and examination to determine if his fitness to work must be done fast less the evidence from the examination and drug testing may not be accurate. The manager should also inform his Human Resource Management department of the request so that guarantee letter can be provided.

3.6.2 The Assessment

- All health assessment shall be done in medical facilities approved by PEC.
- Based on the type of assessment required by the employee's, the Approved Medical Examiners shall carry out the necessary medical examination and clinical and/or laboratory tests to determine the employee fitness status. The medical assessment must be done in accordance with the PEC' Guideline for Approved Medical Examiners on Health Assessment for Fitness to Work.
- For cases that require referral to other medical specialists, attending Approved Medical Examiner shall inform the requesting Human Resource Management department on the need for such a referral. Referral shall then be made once approval from the department is obtained.
- If approval is not given, no referral should be made unless the employee agrees to pay for the cost of the referral.
- If the required referral cannot be carried out, Approved Medical Examiner shall certify the employee as unfit.

3.6.3 Reporting of Assessment Results

- Approved Medical Examiners shall record findings from the assessment and certify the employee fitness status using the prescribed form Appendix B (MEDEX 001 and 002)

- Approved Medical Examiners shall submit within 3 working days copies of all assessment reports (including those found unfit) to the requesting HR Department as follow:

- Submission of the reports may be done through facsimile or e-mail (with scanned copy of the medical reports).
- Approved Medical Examiners shall keep the original copy of the reports.
- On receipt of the reports, the requesting HR Department should send the reports to the relevant Group/ Regional/ OPU Health Advisers for review and recommendation on the Employee fitness to work status.

3.6.4 Health Adviser Review

- The Health Adviser concerned shall review the assessment report and fitness certificate and shall advise the relevant HR Department within 3 working days from the receipt of the reports on the fitness status of the Employee.
- The Health Adviser shall complete the Form MEDEX 002 and return it to the requesting HR Department.
- For health assessment of permanent employees requested by OPU HRM Department (example - routine, for cause and job specific health assessment), a copy of MEDEX 002 shall also be send to Group HRM Division.

- For post-accident health assessment, the result of the assessment shall also be communicated to the requesting line managers
- The Health Adviser shall update the database on the employee if applicable, and file the reports.

3.6.5 Acceptance of Fitness Certification

- For permanent employees
    - Suitability for employment and/or international placement of individual shall be determined by Group HRM Division.
    - Suitability of an employee for placement with particular OPU/ HCU, including placement into jobs with specified fitness to work requirements shall be determined by the OPU/ HCU concerned.

- For Direct Hire and MSC Personnel
    - Suitability for employment and placement, including placement into jobs with specified fitness to work requirements, shall be determined by the OPU/ HCU concerned.

- The above determination should be done after consultation with the reviewing Health Adviser/s.

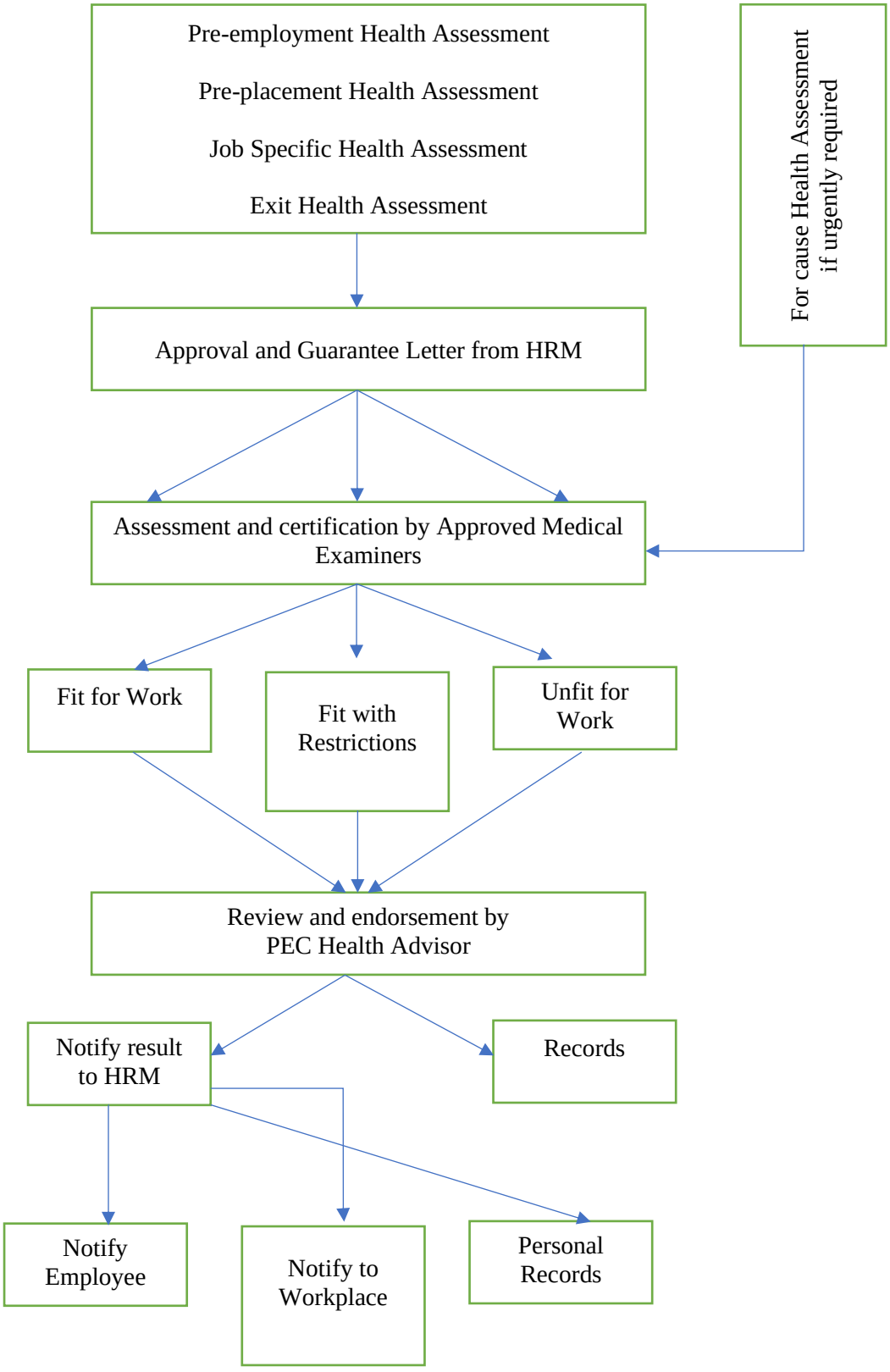
3.7 APPEALS

- Line managers may appeal against Company Health Adviser's decision on employee's unfitness.
- Such appeal should be confined to:
    - Those whose skill is crucial to the operation of the facility and the employee's health problems do not expose other employees to unacceptable health risks
    - Those whose condition does not expose the Company to unacceptable business risks.
    - The employment is only for short term.
- All appeal shall be made in writing to the Health Adviser concerned with justifications.
- The final decision regarding employment of such employee shall be the prerogative of the Operating Unit Management after consultation with the HR Department and the Health Advisor.

3.8 HEALTH ASSESSMENT RECORDS

- All health assessment results and reports shall be kept confidential.
- Access to these reports shall be limited to the Health Advisors and identified medical personnel of the Company.
- Release of the reports to PEC management, Approved Medical Examiners or other employees requires written consent from the employee concerned.
- All health assessment records of permanent employees shall be kept by GHSED. Records for non-permanent employees should be maintained by OPU/ HCU employing them.
- All records shall be retained by the Company for a period of 30 years from the date of the employee's retirement or exit from the Company.
- Records may be stored in electronic media form unless specifically prohibited by applicable local laws and regulations.

Figure 2.2 – Process Flow of Health Assessment



4.0 FITNESS TO WORK STANDARDS

4.1 INTRODUCTION

Physical and mental fitness or unfitness to work is judged by a set of criteria or fitness standards agreed by a company for its employees. As fitness level requirements vary between jobs, fitness standards for these jobs also differ.

To assist Approved Medical Examiners and Health Advisers in determining the fitness of an Employee, this section outlines the various requirements on the conduct of the assessments and the fitness standards used for the assessments. The details of the requirements and of the fitness standards are available in the Guideline for Approved Medical Examiners on Health Assessment for Fitness to Work.

This section covers the following:

- Recommended content for the various types of medical examinations
- Definition for the various categories of Fitness to Work certification
- General fitness requirements for all types of work within PEC
- Job specific fitness requirements

4.2 CONTENTS OF HEALTH ASSESSMENT

Essential elements of Fitness to Work health assessment include:

- Determine the presence or absence of a permanent impairment that significantly limits one or more major life activities.
- Evaluate the patient's mental and physical capacity.
- Assess work and workplace demands (mental and physical) including during emergencies.
- Ascertain the patient's ability to perform the essential functions of the job with or without accommodation.

All assessment shall cover the following:

4.2.1 Personal History

Depending on the type of assessment being done, detailed past and present medical, occupational, social and family history should be solicited from the employee.

4.2.2 Physical and Mental Examination

Full physical and mental assessment should be done covering all systems and organs of the body.

Emphasis should be given to determine the presence of diseases that may be indicated by the employee’s medical and occupational history and work demands.

4.2.3 Clinical Tests

Routine recommended clinical tests should include the following:

- Chest X-Ray for all pre-employment health assessments. X-Ray for other health assessment may be done if clinically indicated.
- Electrocardiogram (ECG) should be routinely prescribed for employees above 40 years old or if clinically indicated.
- Lung function test should be routinely prescribed only if required by the job type or if clinically indicated.
- Audiometric test should be prescribed in pre-employment or pre-placement health assessment and thereafter if clinically indicated or required by the job type.
- Other tests may be prescribed if clinically indicated.

4.2.4 Laboratory Tests

Recommended laboratory tests include the following:

- Full blood count/electrolytes, blood group, blood glucose, lipid profile, liver function and kidney function tests should be prescribed during pre-employment or pre-placement health assessment.
- HIV and Hepatitis testing for pre-employment or if required by job type. (In countries where HIV and Hepatitis testing are prohibited by law, this requirement shall be waived)
- Blood glucose, lipid profile and kidney function test should be routinely prescribed for periodic medical examinations.
- Urine drug testing during all pre-employment and pre-placement health assessment.
- For other types of health assessments, only if requested by the Company. Refer to

4.1.5 below.

Other laboratory tests may be prescribed if required by the job type or if clinically indicated.

4.2.5 Urine Drug Testing

Sample collection, on-site screening and laboratory confirmatory testing shall adhere to PEC approve methods and procedures.

Table 3.1 – Recommended Routine Laboratory Tests

TYPE OF ASSESSMENT	RECOMMENDED LABORATORY TESTS								
	FULL BLOOD COUNT	SERUM ELECTROLYTE	BLOOD GROUP	URINALYSIS	BLOOD GLUCOSE	SERUM LIPIDS	SERUM UREA & CREATIN	URINE DRUG TEST	LIVER FUNCTION TEST
PRE-EMPLOYMENT	X	X	X	X	X	X	X	X	X
PRE-PLACEMENT	X	X		X	X	X	X	X	X
PERIODIC	X	X		X	X	X	X		
JOB SPECIFIC	IF REQUIRED BY THE JOB TYPE								
FOR CAUSE	IF REQUIRED TO DETERMINE THE CAUSE OF THE PROBLEM. URINE DRUG TEST SHOULD BE CONSIDERED FOR ALL ACCIDENT RELATED HEALTH ASSESSMENT								

4.3 CATEGORY OF FITNESS CERTIFICATION

Based on the assessment done, Approved Medical Examiners shall determine the employee's fitness to work status according to the following categories:

4.3.1 Fit for work

Employee assessment results meet the required fitness standards and employee is considered physically and mentally fit for all types of work and work locations within the Company.

4.3.2 Fit for work with restrictions

Restrictions refer to the type of work or work location that the employee may not be fit for due to his health problem.

This category usually applies for fitness to work in specific job types such as food-handlers, crane operators, electricians, etc. The restrictions may also apply to the work location such as in extremely cold workplaces.

Examples of the restrictions include:

- Employee with abnormal colour perception may be restricted from jobs like crane operator, electrician, fire-fighters, etc., that require normal colour vision.
- Employee with bronchial asthma may be restricted from working with chemicals that may aggravate the illness
- Employee with chronic sinus problem may be restricted from working in cold climate.

Restriction may also refer to modification of work or workplace necessary to accommodate the employee. For example, a hemiplegic employee may be declared fit to work with restriction if provided with appropriate wheelchair and other modification to the workplace such as toilet for the handicapped, etc.

4.3.3 Unfit for work

Employee assessment results do not meet Fitness to Work standards of the Company.

Note: Temporary Unfitness should not be used as fitness certification for an employee. Employees judged to have problem rendering them temporarily unfit should be certified as fit with restriction or unfit. His assessment should be repeated once his problem is treated or controlled and final certification made.

4.4 GENERAL FITNESS TO WORK STANDARDS

A person's physical and mental fitness to work are assessed based on the following requirements:

- Acceptable level of physical strength and stamina that meet the requirements of the job at all times including during emergencies.
- Absence of medical condition that may impede one's ability to perform his assigned duties.
- Absence of medical condition that may directly or indirectly lead to sudden incapacitation.
- Absence of medical condition that may be exacerbated by exposure to work and workplace hazards.
- Absence of health condition that may affect other employees' physical or mental well being.

It should be emphasised that individuals differ in their physical and mental attributes. Thus, assessing these attributes and their acceptance for fitness to work require some degree of understanding on the relationship between physical and mental fitness and the assigned duties.

Certain medical conditions may progress over time. Health assessment of an employee with a medical condition that may progress, the short and long term prognosis need to be considered together with the potential impacts predicted on the employee's productivity and general health.

Additionally, certain medical problems can be treated or controlled with medication. In such cases, the effect of the treatment should be considered as some medication may render a person unsuitable for certain work.

The following are some of the attributes that should be considered in determining the employee's Fitness to Work and suitability for employment.

4.4.1 General Physical Strength and Stamina

Most jobs require a certain level of physical strength and stamina to complete the tasks involved. Some jobs such as those with manual handling, climbing, etc. and jobs with long shift work require a higher level of physical strength and stamina.

Employees' with reduced physical strength due to medical reasons may be acceptable for job with low requirement on physical strength such as in office environment.

4.4.2 Cardiovascular System

Normal heart function and vascular system are essential to healthy living and working. Diseased heart and/or the blood vessels may lead to a decrease in work capacity, sudden incapacitation and death. Persons with heart or vascular system problems should be evaluated fully (by a cardiologist, if need be) prior to employment or placement into a particular job.

Any heart or vascular system disease that may directly or indirectly lead to sudden incapacitation and poor work capacity should be considered unsuitable for most work unless the conditions are successfully treated or controlled.

Hypertension and diabetes, which may lead to the above heart and vascular problems should also be carefully evaluated prior to employment or placement into a job.

For the purpose of reference, normal blood pressure is measured as systolic <140mmHg and diastolic <90mmHg.

4.4.3 Respiratory System

Good lung function is essential for a person's ability to work especially in jobs that require a certain level of manual efforts such as lifting, climbing, etc. including egress during emergencies. Certain problems involving the lungs may restrict these abilities rendering such person unfit for the work. Other problems of the lungs may also lead to sudden incapacitation and death.

Full evaluation of the lung conditions including lung function testing may be required to ascertain a person's fitness to work especially if the assigned duties require a substantial amount of manual efforts. Referral to a qualified respiratory physician may be required for this purpose.

Lung conditions that should be carefully evaluated include bronchial asthma and other restrictive and obstructive respiratory conditions. History or evidence of conditions that are caused or exacerbated by work related hazards such as dust and chemicals may render a person not suitable for work in plants where chemicals and dust are part of its health hazard inventory.

4.4.4 Central Nervous System (CNS)

Employees with conditions affecting the brain, spinal cord and the peripheral nerves that may lead to severe problems including sudden incapacitation and death should be considered unfit for most work. These conditions include stroke and epilepsy. Restriction of one's mobility and function due to poor muscle power, coordination and sensory abilities may lead to other problems.

Persons with these problems should be fully evaluated prior to being certified fit for the assigned works. This may include evaluation by a qualified neurologist. Some cases e.g. post-stroke with physical disabilities, may also require evaluation of physical abilities to conduct the assigned duties prior to employment or placement.

4.4.5 Musculoskeletal System

Proper functioning of the joints and muscles are essential for a person's mobility and ability to do work. Those with musculoskeletal problems should be assessed carefully to determine their degree of disability and the work they are assigned to.

As a minimum requirement, a person should be free of any musculoskeletal problems that limit his ability to safely egress from the workplace during emergencies.

4.4.6 Genitourinary and Reproductive System

Pregnancy and other reproductive problems may render a person unfit for work if the work exposes them to certain health hazards which may exacerbate their medical conditions. As a general rule, pregnant and lactating persons should be restricted from work that exposes them from chemicals hazardous to the foetus/ child

4.4.7 Vision

This refers to requirement on visual acuity, depth perception, binocular vision, visual fields and colour perception. Certain requirements such as depth perception and colour perception may need evaluation using trade test to ascertain their acceptability for the work to be performed.

Good vision requirement is applicable to work where limitation of visual abilities pose safety problems. This includes jobs such as aircraft pilots, professional divers, security personnel, plant control panel operators, etc.

4.4.8 Hearing

This refers to requirement on hearing acuity. Good hearing is applicable for work where limited or poor hearing may pose safety hazard or communication hazards to the person and his work. This includes jobs like security personnel, emergency response team, etc.

The minimum requirement should be for each employee to be able to hear auditory warning signals in their respective workplaces. Particular attention should be given to those working in high noise areas where one's hearing ability can deteriorate from exposure to workplace noise.

4.4.9 Mental state

This refers to the mental and emotional stability requirement of the job. Those with severe anxiety, depression, psychosis, phobias, behaviour disorders, etc. may not be suitable for most jobs. Those exhibiting some form of mental and emotional problems should be referred and evaluated by a qualified psychiatrist before being accepted for work.

Drug abuse shall provide the grounds for unfit for work during pre-employment medical examinations.

4.4.10 Treatment for medical condition

Attention should be given to those presently on treatment for medical condition on long term basis. The evaluation should consider:

- The effects of the medication – drowsiness, slow reaction time, agitation, etc. that may affect the person's safety and ability to do his duties.
- The effects if medication (e.g. insulin) is not available, such as during emergencies
- The underlying conditions and their effects on the person's ability to perform his duties.

4.4.11 Use of Medical Prostheses and Appliances

Refers to the use of implanted aids e.g. pace-maker; use of wheelchair to move; prostheses and other appliances that may not be suitable for the work. The use of such appliances should be assessed on their safety of use apart from assessing the user's own physical and mental fitness to work with them.

4.4.12 Metabolic and endocrine diseases

This refers to conditions such as diabetes, gout and other endocrine problems like hyperthyroidism etc. These conditions apart from affecting a person's ability to work, may progress to cause other health problems such as ischemic heart disease (e.g. due to diabetes) and others. As such, those having such

conditions should be fully evaluated to ascertain their fitness to work as well as to predict the prognosis prior to accepting them for employment.

As the general rule, metabolic conditions that are not complicated by organ dysfunction and are satisfactorily controlled by oral medication should be acceptable for most work.

A diagnosis of diabetes mellitus should only be made after positive fasting blood sugar and glucose tolerance test. Good control of diabetes may be considered with a serum level of Hb1AC of around 7.

Obesity should be assessed based on the personal overall health status. Consideration should be given to the work and workplace demands as well as his physical strength and mobility (including during emergencies) and presence of other medical conditions. For critical jobs such as offshore and plant operations, BMI of 35 or lower without other medical problems should be considered fit to work.

4.4.13 Communicable Diseases

Communicable diseases, apart from affecting a person's health may also pose health risks to others. Some communicable diseases like AIDS/HIV, though poses low risks to other workers, carry a social stigma.

Assessment for persons with serious communicable diseases should always include considerations on interpersonal issues associated with the diseases, taking into account the socio-cultural aspects of the workers and the workplaces.

4.4.14 Malignancy

An employee with a benign growth may be acceptable for most work unless it limits his ability to work safely. For those with a malignant growth, evaluation should consider its prognosis, treatment requirement and possible exacerbation of the condition by the work and/or workplace environment.

4.5 JOB- SPECIFIC FITNESS TO WORK STANDARDS

The following are the additional requirements for the listed job types. Fitness standards listed should be considered the minimum requirements for each job.

4.5.1 Food Handlers

Medical Examination

- Annual periodic medical examination or, if indicated post illness and after returning from areas with water/food borne disease outbreak.
- Evaluation to focus on food and water borne diseases and other communicable diseases affecting the skin, hairs, ears, upper respiratory, urinary and gastrointestinal tract.
- Laboratory tests including stool examination may be required if clinically indicated.

Fitness Standards

- Meet the general fitness requirements
- Free of any food and water borne pathogens such as Typhoid, Hepatitis A, etc.
- Free of infection and/or infestation (lice, etc.) on skin, hairs, mouth, ears, eyes and nails
- Free of non-communicable skin condition that may be unacceptable to others e.g. weeping eczema, etc.

Special requirements

- Hepatitis A vaccination with 10 yearly booster
- Typhoid vaccinations once every 3 years
- Cholera vaccination during local epidemic

4.5.2 Users of Respiratory Protective Equipment and Breathing Apparatus

Medical Examination

- 2 yearly periodic medical examination or more frequently if clinically indicated
- Focus on respiratory, cardiovascular system and facial skin condition
- Lung function and ECG tests should be routinely prescribed.

Fitness Standards

- Meet general fitness requirements
- Absence of respiratory diseases problem that may be compromised by restrictive breathing imposed by wearing of RPE and BA.
- Absence of ischemic heart diseases
- Absence of allergic skin diseases that may be triggered by RPE seals.
- Absence of facial deformity and facial skin infection that may render poor fitting of RPE.

This includes beard and moustache.

4.5.3 Confined Space Workers

Medical Examination

- 2 yearly periodic medical examination or more frequently if clinically indicated
- Focus on respiratory, cardiovascular system
- Lung function and ECG tests should routinely be prescribed.

Fitness Standards

- Meet the general fitness standards
- BMI not greater than 35
- No long term use of medication that may affect alertness
- Visual acuity must be at least 6/12 (corrected).
- No vestibular ear disease such as recurrent vertigo
- No ischemic heart diseases
- No obstructive or restrictive airway lung diseases including bronchial asthma
- No anaemia (minimum Hb 8 gm%)
- No physical deformity or musculoskeletal problems likely to reduce mobility
- No skin conditions that interfere with the wearing of RPE
- No history of epilepsy
- No claustrophobia

4.5.4 Drivers

Medical Examination

- Applicable to all heavy vehicle drivers such as tankers, lorries,etc.
- Every 3 years for below 40 age group. 2 yearly for above 40 age group. Period may be shortened if clinically indicated
- Focus on cardiovascular, musculoskeletal, CNS and mental functions
- Urine drug testing and audiometry required for every medical test
- ECG required for above 40 age group

Fitness Standards

- Meet general fitness standards

- BMI not more than 35
- Visual acuity of 6/12 (corrected)
- Good colour vision
- Good hearing acuity
- Absence of ischemic heart diseases
- No history of epilepsy
- Absence of physical deformities and musculoskeletal problems

4.5.5 Healthcare Workers

Medical Examination

- Applicable for all medical personnel doing clinical work
- 3 yearly periodic medical examination, or if indicated as post exposure
- Focus on communicable blood borne diseases
- HIV and Hepatitis B testing should be prescribed routinely

Fitness Standards

- Meet general fitness requirements
- Free of blood borne communicable diseases such as HIV/AIDS and Hepatitis B and E. Special Requirements
- Hepatitis vaccination with 10 yearly booster

4.5.6 Electrician

Medical Examination

- Pre-employment or pre-placement
- Eye colour perception test shall be required

Fitness Standards

- Meet general fitness requirements
- Good colour perception

Special Requirement

- Trade test may be required to evaluate severity of condition

4.5.7 Crane Operators

Medical Examination

- 3 yearly periodic medical examination for below 40 age group. 2 yearly for above 40 age group
- Focus on cardiovascular, respiratory, CNS, musculoskeletal systems and mental status
- ECG may be routinely prescribed

Fitness Standards

- Meets general fitness requirements
- BMI not more than 35
- Visual acuity of 6/12 (corrected)
- Good colour vision
- Good hearing acuity
- Absence of ischemic heart diseases
- No history of epilepsy

- Absence of physical deformities and musculoskeletal problems

4.5.8 Firefighters and Emergency Response Personnel

Medical Examination

- 3 yearly periodic for below 40 age group and 2 yearly for above 40 age group
- Focus on cardiovascular, respiratory, eye, CNS systems and mental status
- Lung function test, ECG, audiometry and blood tests for HIV and Hepatitis B should be routinely prescribed.

Fitness Standards

- Meets general fitness requirements
- Meet requirements for confined space entry workers as well as those routinely using RPE and BA.
- Free of communicable blood borne agents (HIV and Hepatitis B)

5.0 APPROVED MEDICAL EXAMINERS (AME)

5.1 INTRODUCTION

As the person who physically assess the Employee's health, Approved Medical Examiners form the crucial link in the success of the Fitness to Work Program. As such their competency is critical. And to ensure this competency requirement, PEC outlines below the requirements on the selection and monitoring of the Company's Approved Medical Examiners.

5.2 SELECTION OF APPROVED MEDICAL EXAMINERS

The following forms the minimum criteria for selection of PEC Approved Medical Examiners. Notwithstanding, the selection and appointment of Approved Medical Examiners shall be at the sole discretion of the Company who may impose additional requirements or waive some requirements to suit local and business requirements.

5.2.1 Qualifications

- Possess medical degree recognised by PEC
- Possess the license to practice in the country of abode (if applicable)
- Possess the necessary approval to perform Fitness to Work assessment for industrial workers (if applicable)
- Possess post-graduate qualification in Occupational Medicine recognised by PEC

5.2.2 Experience

- Minimum of 5 years in clinical practice (post graduation)
- Minimum of 3 years experience performing Fitness to Work assessments for industrial workers

5.2.3 Training

- Trained on PEC Fitness to Work standards and medical examination procedures
- Trained on the Medical Review Officer procedures on Drug and Alcohol Testing

5.2.4 Place of Medical Practice

- Place of practice conforms to applicable local laws and regulations

- Equipped with / have access to the required equipment for performing health assessment for Fitness to Work. This should include ECG, Lung Function Test, Audiometry and X-Ray machines and clinical laboratory.

5.3 PROCEDURES ON APPOINTMENT AND RENEWAL OF AME

5.3.1 Application and Selection

- Application shall be opened to all eligible medical practitioners
- All application shall be in writing and made to the Senior General Manager, Group HSE Division, PEC.
- Application shall be reviewed and verified by a team set up by Group HSE Division led by the Group Health Advisor.
- For overseas operations, the team may be led by the respective country health advisor.
- Application review may include clinic or medical facility visit for verification.
- The review team shall make its recommendation on the suitability of the applicant to the Group HR Division, PEC or to the country manager for overseas operations.

5.3.2 Approved Medical Examiners Appointment

- Recommendation made by the team shall then be reviewed by the Group HR Division, PEC or the country manager where applicable.
- HR Division/ country manager shall make the final decision and appoint or reject the application.
- All appointments shall be valid for a period of three (3) years.
- Appointment may be renewed subject to Approved Medical Examiners meeting PEC requirements.

5.3.3 Condition for Renewal

- Approved Medical Examiner makes written application to renew their appointment (same procedure for new application)
- PEC is satisfied with the delivery and quality of the Approved Medical Examiner services
- Approved Medical Examiner has satisfactorily completed the required corrective action as instructed by PEC (such as those made during assurance exercise or based on complaints received from employees).

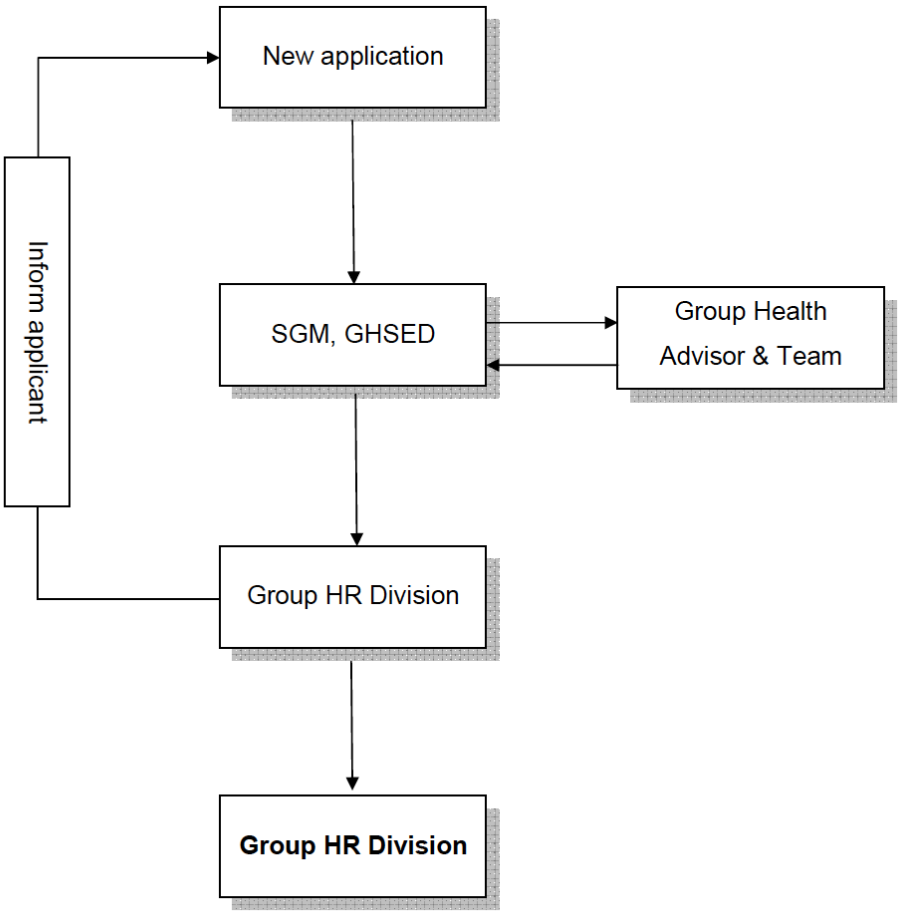
5.3.4 Withdrawal of Appointment

- Approved Medical Examiner appointment may be revoked at any time by PEC.
- Revocation shall be done in writing by PEC Human Resource Division, in consultation with Group HSE Division or for overseas operation, by the country manager after consultation with the health adviser concerned

5.3.5 Appeal and Reinstatement

- Approved Medical Examiner whose appointment is revoked by PEC may appeal for reinstatement.
- All appeals shall be made in writing similar to new application procedures.
- All appeals shall be reviewed and decided along the procedures used for selecting and approving new applications as above.

Figure 5.1 – Selection and appointment of new Approved Medical Examiners (Malaysian Operation)



Note: For overseas operation, application and selection will be made by the respective country health adviser and country manager.

APPENDIX A: LIST OF TERMINOLOGIES AND ABBREVIATIONS

Approved Medical Examiner (AME):

Refers to registered medical practitioners approved by PEC to carry out health assessment for Fitness to Work for the Company's employees.

Company:

Unless specified, refers to PEC and its group of companies.

Employees:

Persons employed by PEC on permanent or short contract basis.

Fitness to Work:

Fitness to Work refers to medical professional judgments on the physical and psychological fitness of an employee to carry out Specific Work, without significant risk to him/herself, the business and/or third parties.

Group Health Adviser:

Refers to the technical head for the Health sub-discipline of the SKG 18 (Health, Safety and Environment Skill Group). The position resides in Group HSE Division.

HCU (Holding Company Unit):

Business units and divisions under PEC Holding Company. Example – Petroleum Management Unit (PMU), HRM Division, Group Finance Division, etc.

Health Advisers:

Unless specified refers to medical doctors employed by PEC to provide health and medical services.

Health Assessment:

Means applying appropriate procedures and tests in examining an individual to enable a medical professional to decide on his/her fitness for a specific purpose.

Medical Removal Protection Programme (MRP):

An arrangement to place an employee away from his usual workplace due to exposure to health hazards as determined by health surveillance programme. It also covers pregnant and breast-feeding ladies. The arrangement maybe permanent or temporary depending on the risks identified.

Trade Test:

The process of evaluation, in controlled circumstances based on actual the working condition of an employee's proficiency to complete a required task, e.g. colour vision task testing carried out at the usual workplaces under the various lighting conditions routinely encountered by such work.

APPENDIX B: SAMPLE OF FITNESS TO WORK CERTIFICATION FORM (MEDEX 002)

Fitness to Work Certificate

Type of Health Assessment:

Pre-employment	☐	Pre-placement	☐	Overseas Posting	☐		
Routine	☐	Job-specific	☐	Others	☐		

Employee's name: .....Staff /NRIC/ Passport No.....

This is to certify that I have examined the above named person and found him/ her to be (please tick one):

Fit to work	☐
Fit to work with restriction	☐
Unfit to work	☐

Remarks/ Restriction:

.....

.....

AME Signature:..... Date: .....

AME Name: ..... AME Stamp

For Company use only.

Employee's fitness to work status: .....

Health Adviser's comments: .....

....

Health Adviser Signature/ Name Date

PEC TECHNICAL STANDARDS
HEALTH, SAFETY AND ENVIRONMENT

GUIDELINE
GRIEVANCE MANAGEMENT PROCEDURE
(Doc.No.: PEC-04D4)

PREFACE

PEC Technical Standards (PTS) are based on the experience acquired during the involvement with the design, construction, operation and maintenance of processing units and facilities of Aromatic Complex Project in Singapore. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good technical practice to be applied by PEC' OPUs in oil and gas production facilities, refineries, gas processing plants, chemical plants, marketing facilities or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to users for their consideration and decision to implement. This is of particular importance where PTS may not cover every requirement or diversity of condition at each locality. The system of PTS is expected to be sufficiently flexible to allow individual operating units to adapt the information set forth in PTS to their own environment and requirements.

When Contractors or Manufacturers / Suppliers use PTS they shall be solely responsible for the quality of work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, it is expected of them to follow those design and engineering practices which will achieve the same level of integrity as reflected in the PTS. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the owner.

The right to use PTS rests with three categories of users:

1. PEC and its affiliates.
2. Other parties who are authorized to use PTS subject to appropriate contractual arrangements.
3. Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) and 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

Subject to any particular terms and conditions as may be set forth in specific agreements with users, PEC disclaims any liability of whatsoever nature for any damage (including injury or death) suffered by any company or person whomsoever as a result of or in connection with the use, application or implementation of any PTS, combination of PTS or any part thereof. The benefit of this disclaimer shall inure in all respects to PEC and/or any company affiliated to PEC that may issue PTS or require the use of PTS.

Without prejudice to any specific terms in respect of confidentiality under relevant contractual arrangements, PTS shall not, without the prior written consent of PEC, be disclosed by users to any company or person whomsoever and the PTS shall be used exclusively for the purpose they have been provided to the user. They shall be returned after use, including any copies which shall only be made by users with the express prior written consent of PEC.

The copyright of PTS vests in PEC. Users shall arrange for PTS to be held in safe custody and PEC may at any time require information satisfactory to PEC in order to ascertain how users implement this requirement.

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1 INTRODUCTION

This document is the Grievance Management Procedure (GMP) for Pengerang Energy Complex ("PEC"), or Company, and forms part of the PEC Environmental and Social Management System for the project. The GMP is designed to outline the procedure for accepting, assessing, resolving and monitoring grievances from those affected by the Project. The aim is to identify and manage grievances from individual stakeholders or stakeholder groups. Timely redress or resolution of such grievances is vital to ensure successful implementation of the Project. EPC Contractors and subcontractors will be required to develop Grievance Management procedures that are aligned with this Procedure and track and report contractor-related grievances to PEC.

Grievances can encompass minor concerns as well as serious or long-term issues. They might be felt and expressed by a variety of parties including individuals, groups, communities, or other parties affected or likely to be affected by the social or environmental impacts of the Project. It is essential to have a robust mechanism to systematically handle and resolve any complaints that might arise in order that they do not escalate and present a risk to operations. If well-handled, an effective grievance mechanism can help develop positive relationships and build trust with stakeholders.

PEC has placed a high priority on establishing a permanent dialogue and communicating with communities and stakeholders. One of our goals is to show respect for, inform and respond to people's concerns and queries on a permanent basis. This GMP provides a simple means for stakeholders to express their concerns and for PEC to take corrective actions as required to ensure project commitments are effectively implemented.

The specific objectives of the GMP include:

- Establishing a mechanism for responding to grievances in an understanding, transparent and culturally suitable manner.
- Developing an easy access, no cost and efficient grievance procedure for project affected peoples and other stakeholders.
- Ensuring effective dialogue and open lines of communication with the public.
- Helping to prevent unrealistic expectations and/or negative perceptions from the local population towards the Project.
- Establishing a system of investigation, response and quick grievance resolution.
- Reducing the number of grievances received over time.
- Improving social performance through the analysis of grievances and refinement of work practices.
- Ensuring that non-compliances with project environmental and social commitments are adequately corrected in a timely fashion and are subsequently monitored.

To maximize the effectiveness of the Grievance Procedure, PEC will apply the following factors during implementation and operation of the system:

- Commitment to fairness in both process and outcomes.
- Clear grievance management rules, and accountability.
- Validity of all complaints submitted.
- Confidentiality if requested.

The GMP is expected to help improve the Project's environmental and social performance over time as the number and nature of grievances received is an indicator of the behavior of our employees, contractors, and the overall effectiveness of our Project execution. This GMP has been considered in parallel to the Stakeholder Engagement Plan (SEP) due to the inter-relationship between the two. It has been designed to meet the legal requirements of Malaysia and the requirements of the International Finance Corporation (IFC) in relation to grievance management.

2 POLICY & LEGISLATIVE REQUIREMENTS

2.1 Corporate Objectives

The corporate objectives of PEC are set out in the Health, Safety and Environmental (HSE) Policy which states that “Aromatic Complex will consult with, listen to and respond openly to our partners, employees, contractors, regulators, customers, local communities and public interest groups. We aim to be a proud neighbor with our focus firmly fixed on sustainable development of the organization through continuous improvement”.

It also states that we will provide information about our project, products, services and operations to partners, customers, employees, government agencies, contractors and the public, as appropriate.

2.2 Malaysian Legislative Requirements

Grievance legislation in Malaysia is mainly under the umbrella of the Ministry of Human Resources and trader unions.
Employment Act 1955 of the Malaysia Employment and Labour Law, states that Employers should ensure that they have a clear complaint or grievance policy. Any complaints or grievances made pursuant to this policy should be handled promptly and thoroughly.

Confidentiality must be maintained where reasonably possible and there should be no retaliation against employees who have made complaints/grievances in good faith. One mistake commonly made by employers is to ignore the complaint or to just hope it will go away. It probably won’t and might just get bigger.

The aforesaid procedures must provide that the employee shall have the right to submit his complaint or grievance to the employer or the employer's representative”.

2.3 EIA Commitments

The Project EIAs require that a grievance mechanism be established. Commitments included in the EIA include:

- Grievance redressal mechanism is set up by PEC ESG and social responsibility team for construction and operation phase.

- Create independent team which will be reporting to Independent board of directors for ESG/ CSR initiatives.

- Implement a grievance redressal policy and a community engagement plan
- The Project will develop and implement a Grievance Protocol
- Implement a grievance redressal policy and a community engagement plan

2.4 International Guidelines

The main international guidelines applicable to Grievance Management are the Equator Principles III and those from the International Finance Corporation (IFC, Performance Standard (PS) 1 and 2).

EP6 and IFC PS1 require that a grievance mechanism be established by the project “designed to receive and facilitate resolution of concerns and grievances about the Project’s environmental and social performance”. The procedure should be geared towards Affected Communities as its primary user and should be tailored to be culturally appropriate and without retribution to the party that raises the concern. The procedure should be disseminated to the Affected Communities through the stakeholder engagement process.

The process should not impede access to any judicial or administrative remedies.

PS2, Labour and Working Condition also requires that PEC provides a grievance mechanism for workers (and their organizations where they exist) to raise workplace concerns. This procedure should be made available to the worker during recruitment and make it easily accessible to them, with no retribution and it should not restrict access to judicial or administrative remedies through the law or substitute any grievance mechanism through collective agreements.

3 ROLES AND RESPONSIBILITIES

In addition to PEC, the Project will involve a number of third parties (e.g. EPC Contractors, government authorities, Suppliers, employment agencies, etc). CONTRACTORS will play a significant role during the construction process and, as such, will share the responsibility for using the Grievance Procedure through aligning their Procedure.

Following best practice guidelines, responsibility for the management and resolution of grievances ultimately rests with PEC, even in situations where CONTRACTOR fails to reach an acceptable resolution. For example, with respect to a community grievance related to noise or vibration generated by CONTRACTOR traffic within a residential area, the COMPANY would usually delegate resolution to the CONTRACTOR. However, should the CONTRACTOR'S attempts to resolve the complaint and fail to reach an acceptable settlement, the Project Lenders will require that PEC takes responsibility for the eventual grievance resolution.

The COMPANY and CONTACTOR (including subcontractors) must specifically address grievance management, resolution and respective responsibilities.
Guidelines to CONTRACTORS for the development of their own Grievance Management procedures (and responsibilities) are included in contract documentation that defines minimum requirements and specific responsibilities.

3.1 PEC Responsibilities

COMPANY will appoint one Head of ESG/CSR, Social Relationship officer with relevant qualification and experience which will be directly reporting the independent board of directors to achieve effective implementation of the Grievance Procedure and its monitoring.

The role and responsibilities for the Head of ESG/CSR are :

- Final Approval of the Grievance Procedure.
- Publicizing the COMPANY grievance mechanisms.
- Allocation of a dedicated budget for the management of Grievance Mechanism and addressing grievances through financial or in-kind compensation where appropriate;
- Implementing and overseeing the Grievance Procedure and all other social plans and programs.
- Providing accurate and timely information to stakeholders about the GMP.
- Obtaining, organizing and documenting feedback from the project stakeholders regarding perceptions, concerns and requests.
- Taking appropriate actions to address major Non-Conformities by the CONTRACTOR based on audit reports, performance monitoring reports and on proposed approach and actions.
- Coordinating with COMPANY Project/Construction Management team in the resolution of a complaint where applicable.
- Evaluating and transmitting feedback obtained from stakeholder's grievances to PEC project management team and contractors if relevant to project decision-making.
- Centralizing grievance tracking and monitoring.
- Reviewing and approving CONTRACTORS' Grievance Management Procedures. Also ensure that GM process made clear to all their workers and having access to all the workers.

- Overseeing the effectiveness of the CONTRACTOR'S Grievance Procedures and make sure the implantation and monitoring.
- Reporting KPIs applicable to this Procedure based on information from CONTRACTORS and PEC.
- Consolidating and submitting monthly reports to BOD for review.

Implementation of the PEC Project Grievance Mechanism will be the ultimate responsibility of the COMPANY, ESG/CSR team leader within the Sustainability Department, supported by the wider PEC Project team when required.

PEC Management will:

- Ensure that this Grievance Management procedure is applied through all departments and levels that are undertaking activities related to the PEC project. The Management will apply necessary controls to minimize risks that could result in stakeholder grievances.

- Grievance Management procedure will be applicable for internal (direct employees) and external parties (Contractors, Suppliers, employment agencies, local authorities and govt agency etc.

- Contribute to the resolution and sign off of any grievances which have international repercussions.

Chief Labour Officer

COMPANY will also appoint Chief Labor Officer with relevant qualification and experience which will be directly reporting the Head of ESG/CSR to achieve effective implementation of the Grievance Procedure and **Labour Management Plan (Doc.N0.: PEC-04D1** and it monitoring.

The role and responsibilities for the CLO are :

- He/She will be responsible for the implementation of labor management plan during constructions and operation phase.
- Implement the labor management procedure for contractor and sub-contractors. Also responsible for the compliance and audits process and submitting report to the management
- He/she will evolve, prepare and implement grievance handling procedure for the social local / specific issues related to employees, workers, community etc.
- Compliance as per the local and Malaysian laws, Employment Acts, Minimum Wages Acts etc
- Advice management in the fulfillment of obligations as per statutory or otherwise concerning, prevention of personal injuries and maintaining safe working environment.
- Develop communication methods for creating awareness for the grievance mechanism for all the stakeholder related to the project during construction and operations.
- Provide training related to GM for direct employees, workers and contractors

3.1.1 Grievance Redressal for direct employees

Grievances may be real or imagined, but in either case, it is essential that the grievance is brought to light, discussed and the matter resolved to the satisfaction of all concerned. Failure to do so will only result in the grievance becoming a worsening source of conflict and eventually ending in a far more serious problem.

Objectives :
It is the policy of the company to redress grievance of employees as satisfactory and speedily as possible.

Policy and Procedure:
The grievance procedure is aimed at resolving work related grievances within the organization as fairly and swiftly as possible. Grievances are feelings of injustice or dissatisfaction affecting an employee.
This procedure is not used for appeals against disciplinary actions. Those will be governed by the disciplinary procedure of code.
This procedure is not to be used for the resolution of issues related to performance appraisal, promotions, increment, compensation etc.
Employees may lodge grievance without fear of victimization.
Grievance should be resolved at the lowest possible level within the company.
Records will be kept for all the statements and decisions.

Grievance Procedure will be implemented as Follows:

Step 1: Immediate Supervisor
In step 1 the employee must discuss his grievance with his / her immediate supervisor or the latter's supervisor in the event of a grievance against an immediate supervisor.
The supervisor must endeavor to solve the problem with in three (3) working days and inform the employee.
Should the employee not be satisfied with this outcome he or she may procced to step 2.

Step 2: Head of Department
The employee gives his / her grievance in writing, with all relevant details to the HOD. He may be assisted by the HR in completing the forms.
The HOD shall endeavor to solve the problem within three working days (3) and inform the employee.
Should be employee not be satisfied with the outcome, he or she may procced to step 3

Step 3: Grievance Hearing
the matter is referred to ESG/CSR team leader/CEO together with all relevant written information.
ESG - CSR team leader/CEO shall convene a grienace hearing and attempt to resolve the matter within a period of ten (10) working days. A decision taken at this level shall be final.

Sexual Harassment

PEC is an equal employment opportunity employer and is committed to provide a safe and conducive work environment that enable employees to work without fear of prejudice, gender vias and sexual harassment. In an effort to promote and protect the well being of all employee at work place, the organization has laid down the polices and procedures under anti-harassment policy and compliance procedure which is effective August 01, 2020. This policy applies to all the employees on the rolls of the company, including those on deputation, training, contract, temporary etc. ESG/CSR team leader to make sure that these procedures are implemented to all the EPC contractor and stakeholders. For more details refer to company anti-harassment policy.

3.1.1 Publicizing the Grievance Management Procedure

Prior to the start of the construction works, the PEC Human Resources and Community Relations Team Leader within the Sustainability Department will proactively publicize the grievance mechanisms and inform local communities and the wider stakeholder group of the details of the Grievance Management Procedure. This will include information about where people can go and who they can talk to if they have a grievance. This information shall be widely and regularly publicized (both by COMPANY and CONTRACTORS), throughout the duration of the Project.

3.1.2 Handling a Worker Grievances

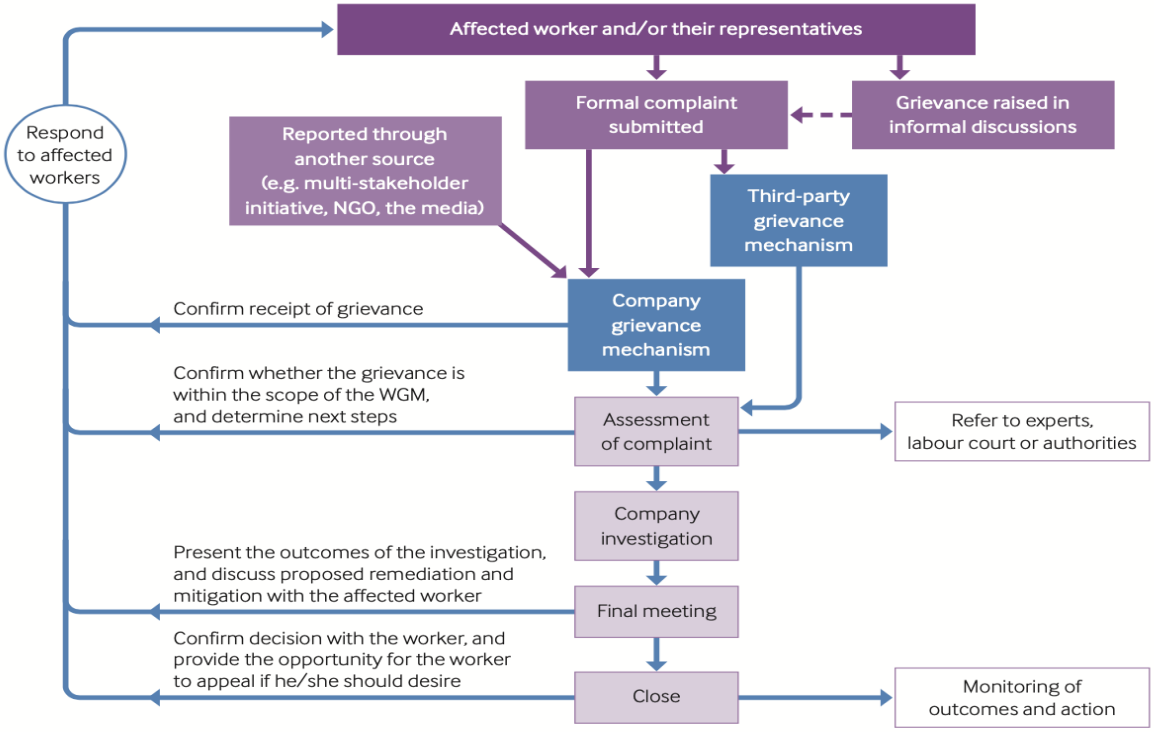
This section offers step-by-step guidance on managing worker grievances. Details of how to handle anonymous complaints are also included

OVERVIEW OF THE GRIEVANCE MECHANISM PROCEDURE

Figure 2 gives an overview of the different channels through which grievances may be raised, along with the overarching steps that may be needed to resolve the grievance.

More details on the considerations that need to be given to each of these steps are provided under Handling a grievance, below.

Figure 2 Channels through which grievances may be raised, and steps which may be needed to resolve them



HANDLING A GRIEVANCE

Figure 3 sets out the considerations that companies may take into account at the different stages of handling a grievance. While acknowledging that companies will have different processes for handling worker grievances, Figure 3 sets out the key activities that should be considered for any grievance to be handled effectively. Some of these considerations may be different in cases where a grievance is raised anonymously. Key to designing and operating a system is that the worker should be able to choose which approach he or she feels happiest with.

Figure 3: Stages of handling a grievance

Informal Discussion	If workers have a grievance or complaint regarding their work, they should, wherever possible, raise their concern with a supervisor or manager as it may be possible to find a solution informally. This makes it more likely that disputes can be resolved quickly, closer to the source of the problem, making it less likely that the issue escalates into an intractable problem. The issue and response should still be logged and tracked from the perspectives of checking outcomes and monitoring. If discussions with supervisors/managers fail to resolve the issue, it is still possible to pursue an informal approach without triggering a formal procedure. For example, a further option would be for the HR manager to facilitate an informal meeting or discussion about the grievance. Any such options taken should be logged.	Ideally, raising a formal grievance should be a last resort. If a company is implementing good HR management practices where there are clear avenues of communication between management and workers, it should be able to handle most issues in an informal manner. However, informal arrangements and procedures should not be made a pre-requisite for commencing more formal complaints. For example, it may be that the complainant has a complaint about the behaviour of his/her own supervisor or manager, in which case it would not be appropriate for the complainant to raise the matter informally with that person.
Formal Complaint	If the matter is serious and/or the worker wishes to raise the matter formally, the worker should set out the facts of the grievance in writing to the nominated manager under the mechanism.	Where a worker has a grievance against his/her supervisor or manager who is also the nominated contact for reporting grievances under the mechanism, it would not be appropriate for the worker to raise the complaint with that person. In such a case, the worker should raise the grievance through another entry point.
Assessment of Complaints	Once a grievance has been raised, the company should provide an acknowledgement to the complainant that it is in receipt of the details. An early assessment of the complaint should identify the key issues that have been raised, together with any root causes, and should determine the outcome that the worker is looking for from the process. Any additional information should be gathered to allow a full assessment. As part of this process, managers will need to determine the appropriate next steps. A key consideration will be whether or not the grievance raised falls within the scope of the mechanism. If it does not, the management may choose not to proceed further with the investigation as there may be other more appropriate means of handling the complaint, for example if a case of forced labour is alleged, it is usually better to refer the complaint to relevant authorities or experts.	If there is potential for disciplinary proceedings to be started against another worker or manager as a result of the grievance, it may be appropriate to suspend the grievance procedure.
Company Investigation	The appropriate form of investigation will depend on the type of grievance and the seriousness of	Where there are allegations of harassment or discrimination, or

	the allegation. In general terms, managers handling grievances should try to understand the key issues and interview the individuals involved in a complaint, e.g. those managing the workers, or those responsible for the activity or service that is raised in the grievance.	other particularly sensitive issues, the manager involved should handle these issues with care and sensitivity; this may require special training and protocols. It may be that an independent investigation is required, requiring external expert input.
Final Meeting	If the grievance is substantiated, a designated manager will invite the worker to a meeting, within a determined period after receiving the complaint, to discuss the worker's grievance.	The worker should have the right to be accompanied by a colleague or trade union representative at the meeting upon request. After the meeting the grievance manager will give the worker a decision in writing, within a determined period.

Communication and appeals

Companies should always acknowledge receipt of a grievance at the outset, and should aim to provide workers with regular updates on the progress of their grievance. This information should be sufficiently clear to allow the worker to understand the reasons behind all decisions taken at each stage. When a final decision is made, companies should also set out what a worker can do if they disagree with the decision and wish to appeal.

If the worker is particularly unhappy with the decision in relation to his or her grievance and wishes to appeal, he or she should notify the grievance manager. The worker should be invited to an appeal meeting within a defined period of time, and the appeal will be heard by a more senior manager. Some companies establish an appeals committee, which operates independently from company management, to fulfil the functions of hearing an appeal, deciding on the outcomes, undertaking mediation and finding a resolution. Every effort should be made to secure a resolution that is in the best interests of the worker(s) and the company. After the appeal meeting, the senior manager/ committee will give the worker a decision in writing.

Understanding the root causes of an issue

If a company wants to address an issue and prevent future complaints about the same issue, it is critical that the root causes of the issue are understood. Simply taking the complaint at face value may not actually lead to a resolution of the underlying factors that are causing the problem. For individual complaints—or where there are particular trends in types of complaint—time should be taken to analyse the complaint and the situation in which it has been raised.

HANDLING ANONYMOUS COMPLAINTS

Companies should provide a means by which all workers are able to raise anonymous complaints. This gives the most vulnerable workers confidence that they will not be retaliated against for raising concerns, and can be fundamental to shifting power dynamics in the workplace.

However, the normal practice a company takes when investigating a complaint—i.e. meeting with the affected worker and responding to them directly—may not be possible when anonymous grievances are raised. This can make it harder for a company to verify whether the complaint is genuine, but more importantly it is also difficult to ensure that the outcomes are satisfactory for the affected worker.

It is important to maintain anonymity, unless disclosure is required by law. Efforts should be made to protect the source from retaliation, in collaboration with national authorities or experts (where authority involvement could lead to retaliation or retribution against the worker).

It may be appropriate for anonymous complaints to be handled by independent third parties, which allows for the complainant's confidentiality to be maintained.

Alternatively, where a worker is willing to disclose his/her identity to individuals within the company that are not closely associated or affiliated with the accused parties— for example a committee at headquarters—the company can engage directly with the worker during investigations without disclosing anyone's identity to those being accused.

Responses to receiving an anonymous grievance

Where a worker wishes to remain completely anonymous, and no independent third party is acting on behalf of the affected worker, the company is able to do much less to investigate the specific issue (especially if there is a lack of information) and respond to the complainant directly. Nonetheless, there are some useful approaches that can be taken that can enable a company to investigate, demonstrate that they are acting, and potentially prevent further harm while maintaining the anonymity of the worker.

Examples of actions that the company can take:

Launching a broad campaign about appropriate workplace behaviours, providing some focus on the issue that was raised and on the area from which the complaint was generated.

- If there are a number of reports against the same person or workplace practice, the company can instigate its own independent investigation or audit observing all general labour issues in addition to the one that has been raised.
- HR management might initiate a 360 review in an area where no formal complaints have yet erupted, but in which anonymous reports suggest grievances are being harboured.
- A small number of similar complaints from the same area might justify timetabling some targeted training.
- Surveys might be used to further test concerns where a flow of reports suggest abiding issues of concern.
- It is also possible that those responsible for perpetrating the issues begin to stop the practice once it is known that workers have access to an anonymous complaints mechanism.

3.2 CONTRACTORS' Responsibilities

3.2.1 CONTRACTOR and Subcontractors

PEC Human Resources and Community Relations' team leader within the Sustainability Department and the CONTRACTOR personnel responsible for the Grievance Procedure implementation will liaise regularly to discuss the status of construction activities and any critical grievance issues. If the received grievance was caused by the activities of the CONTRACTOR, the PEC Human Resources and Community Relations team leader will discuss it with the CONTRACTOR about appropriate solutions so that both sides agree as to how the corrective action will be carried out. The CONTRACTOR then will report formally to COMPANY on the resolution of the grievance and what else might need to be done for the grievance to be closed.

CONTRACTORS will also need to provide sufficient and qualified resources allocated on an ongoing basis to achieve effective implementation of their Grievance Procedures.

CONTRACTORS also need to provide relevant monitoring data/reports to COMPANY as indicated in their contracts and also in Section 4.4 of this procedure.

CONTRACTORS' specific responsibilities for grievance management include:

- Following all COMPANY policies and plans, including this procedure.

- Developing and executing their own grievance mechanism which will be in accordance and aligned with the COMPANY'S Grievance Management Procedure.
- Receiving grievances directly from the individuals or groups concerned, including community members, employees and workers (see below), or through sub-contractors.
- Handling grievances resolution through their own Community Liaison (CL) teams but in close coordination with PEC Human Resources and Community Relations team.
- Reporting to PEC Human Resources and Community Relations teams regarding grievances tracking (received, registered, in process and resolved) on a daily and weekly basis.
- Resolving a grievance immediately in the field when practicable.
- Informing PEC Human Resources and Community Relations team in writing about any grievance, including those immediately resolved in the field.
- Proposing alternative approaches to activities which may result in an impact of concern to stakeholders, in order to avoid and to reduce the number of grievances received.
- Attending all coordination meetings requested by PEC Human Resources and Community Relations team leader on a daily and weekly basis, and as needed.
- Reporting to PEC Human Resources and Community Relations team on a daily and weekly basis and as needed to manage social incidents and other community relations issues.

4 GRIEVANCE PROCEDURE

This Grievance Management Procedure is designed to facilitate the lodging, acceptance and closure of grievances coming primarily from Affected Communities, but also from other interested stakeholders and project workers.

Grievances may arise from local hiring, unplanned impacts and infrastructure damage as they relate to the Project's environmental and social commitments. The GMP is available to any party that wishes to communicate a grievance to PEC whether it be an individual, non-governmental organization, community based organization, other community group, local national employee. A grievance will be considered genuine and evaluated if a party considers itself genuinely impacted due poor environmental and social performance.

The GMP is available on a voluntary and non-excluding basis. It does not affect anyone's rights to use the Malaysian judiciary system in any way, nor does it replace the public mechanisms of grievance and conflict resolution. However, PEC believes most grievances can be quickly resolved by discussing the issues and agreeing mutually acceptable solutions in a less official setting.
PEC will assure the implementation of the Engineering, Procurement and Construction Contractors' own Grievance Procedures, which are aligned with the PEC Grievance Procedures and are fully enforced. This is done by reviewing and approving their Grievance Procedures, ensuring their Community Liaison Officers understand their responsibilities, and by ensuring that grievances are being logged, followed-up and closed-out in a timely manner. PEC retains the right to intervene if a Contractor has not closed-out any genuine grievances after the second attempt or within a reasonable period of time.

Specific grievances in relation to labour or procurement contracts and In Country Value are beyond the scope of the Grievance Procedure and should be followed up through the PEC or Contractor Procurement or Human Resource Departments, as applicable.

Grievances will be handled through the Human Resource and Community Relations team within the Sustainability Department. These specialists will be trained prior to the start of EPC and shall receive, centralise and process all grievances for their area of responsibility.

They will deliver grievances to the appropriate departments in PEC or Contractor organisations, implement systems to organise, track and document all responses and deliver summary reports to management.

The HR and Community Relations team will propose means to resolve grievances, monitor the Procedure, and hold regular meetings to collect grievances in the field and provide feedback to

communities. Grievances may also be raised during formal stakeholder meetings which will be handled through this procedure.

PEC will inform the local communities, its workers and sub-contractors' workers about the Grievance Mechanism and provide (on posters) contact details how people can launch a complaint via:

- The HR and Community Relations team within the Sustainability Department - verbally;
- Telephone;
- Email;
- Letter; or
- Website.

All contact details and means of submitting a complaint will be widely and regularly publicised, throughout the duration of the project, through posters at key locations (e.g. outside a local market, etc), advertisements in local papers/radio and verbally by PEC employees.

4.1 Contact Details

All stakeholders with internet access are able to contact PEC with a grievance or feedback through the following mechanisms:

corporate website: https://www.pengerangenergy.com/contact.html
email address: info@pengerangenergy.com

Telephone: +65-65367055
Address: Unit 30-01, Level 30, Tower A, Vertical Business Suite Avenue 3, Bangsar South, No 8, Jalan Kerinchi, 59200 Kuala Lumpur, Malaysia

Company also in process of designing website for community engagement, stakeholder engagement and grievance mechanism procedure on the corporate website.

During EPC, an office will be established where individuals may lodge a grievance verbally, or in writing using the form in Appendix A.

Valid anonymous responses will be posted on bulletin boards located in the office as appropriate. Anonymous grievances are not expected to be common due to the community structure in the area.

Workforce grievances or feedback to be handled through anonymous locked drop boxes in worker accommodation and canteens, or through a system designed by the EPC contractor in accordance with their welfare plans. Bulletin boards will be used to post responses to anonymous complaints as appropriate.

All forms will be in Malay and English. For EPC Contractors, forms should be in the language understood by its workforce as well as Malay and English. The HR and Community Relations team will speak both Malay and English. The PEC website can be viewed in both languages.

4.2 Grievance Handling and Resolution

Grievances should be handled according to the following steps:

1. The HR and Community Relations team will learn as much as possible about the case, including:
   - Who?
   - What?
   - Where?
   - When?
   - Why?

2. PEC shall acknowledge receipt of any grievance as soon as possible, but up to seven days from the date it was submitted and shall inform the complainant about the timeframe in which a response can be expected. For reasons of confidentiality and to protect the safety and security of PEC personnel, the contact details of individual staff members will not be released to external parties/complainants.

3. The findings of the all investigations will be entered into the grievance file and used to determine eligibility (see above Grievances to be Directed Outside of the PEC Grievance Procedure). If the Grievance is considered to be ineligible the HR and Community Relations team will contact the complainant within 3 working days and explain that the complaint was not recognised as eligible.

4. For all types of Grievances, the HR and Community Relations team will listen attentively to the person while he/she expresses his/her grievance. In many cases, simply listening with empathy helps to calm the situation.

5. During this first meeting if the grievance is resolved, the case is considered closed and it is registered as such.

6. If a grievance is more complex, PEC and/or the contractor conduct an investigation to verify whether the grievance is genuine as related to project commitments. This is done in the presence of the person or the representatives of the local community lodging the grievance. PEC will investigate fully all grievances submitted, and will involve other departments, contractors and senior management as required in the process in order to fully understand the circumstances that led to the grievance being raised. This should be performed in a timely manner to avoid delaying the resolution of a grievance. PEC will aim to resolve any grievances within 30 days from the date that it was received. This timeframe can be extended to 60 days for more complex grievances, if required.

7. The local authorities and/or representatives may be invited to attend the investigation if the grievance is warrants their involvement.

8. The HR and Community Relations team will communicate and explain the grievance to the appropriate person in PEC or in the Contractor organisation.

    - Example, if the grievance involves one of the workers, they will contact the head of human resources of his/her company, and also his/her direct supervisor, as well as the worker himself/herself. If the complaint is environmental in nature it will be reviewed by an environmental professional within the team and so on.

9. The HR and Community Relations team will consult other departments to determine the practical corrective action(s) or mitigation of the grievance.

    - nature of the corrective action;
    - time in which it must be implemented;
    - person responsible for implementation; and,
    - log information in the Grievance Registry.

10. Contractors responsible for constructing the PEC facilities and ensuring compliance with construction related environmental and social commitments:

    - consider proposed solutions with their construction team for agreement and execution;
    - notify and discuss proposed corrective actions with PEC Human Resources and Community Relations team and Construction Management and the party that raised the grievance within 7 days and agree an implementation schedule;
    - obtain written authorisation to proceed with the corrective actions, as needed, e.g. repair third party infrastructure etc; and,

- execute corrective actions under supervision of PEC HR and Community Relations team.

11. PEC and/or the contractor implement this solution.

12. If the complainant accepts the corrective actions, they sign a letter of acceptance and the grievance is closed subject to a 15 days monitoring period.

13. If the proposed solution or executed solution is not accepted by the complainant, the grievance is elevated to a Grievance Review Committee (Section 4.3).

14. PEC and/or the Contractor HR and Community Relations team will consider if refinements to procedures or practices could reduce the probability of recurrence. PEC coordinates any changes to plans, procedures and methods with the Contractors within contractual restrictions.

4.3 Grievance Review Committee (GRC)

The GRC will be set up by PEC to address complaints as a result of the project implementation. The GRC will include the Human Resources and Community Relations team leader, representatives from PEC, EPC Contractors and at least two representatives from local communities. A coordination of resolutions within the GRC will be the HR and Community Relations team's responsibility.

All grievances shall be dealt with on a case by case basis. However, all will require further discussions with complainants and community members to mitigate perceptions that resolutions unfairly benefit PEC.

If attempts to resolve a grievance through the steps in Section 4.2 above do not result in an acceptable grievance resolution, the grievance may be elevated by the HR and Community Relations team to a specially-formed grievance committee. The committee may include local representation from the authorities, with a defined chair.

Documentation pertaining to an unresolved grievance will be given to the Chair of the Committee, who will seek and give opinion about how to resolve the case and who will attempt to resolve the case through conciliation.

As a last resort, aggrieved parties have a right to take legal action. This is a more formal rights based approach that shall only be taken if all other approaches have failed or when there are serious conflicts about facts and data. The final decision will be taken by the arbitrator or courts based on compliance with laws, policies, standards, rules, regulations, procedures, past agreements or common practice.

4.4 Grievance tracking

Once a verbal or written grievance is received, it will be screened for validity (e.g. to ensure that nothing is blatantly false) and logged into a central grievance mechanism database within 3 business days. An extract of the database can be found in Appendix B. Grievances shall be assigned a case number and records of communication/consultation shall all be attached with the relevant entry and filed. The database shall be monitored regularly for recurring grievances so that appropriate mitigation can be developed.

Grievances will be categorised into the aspect it relates to such as the type of activity, geographical area (e.g. Tanks, Pipeline, Camps, Refinery, Liquid Terminal), which EPC contract it covers (EPC1, EPC2 or EPC3 where applicable), HSE Management System Element, or overall Project Environmental and Social Performance.

PEC anticipates that the following direct impact grievances could be categorised as follows:

- Possible impacts on marine life

- Possible impacts on fish and fisheries catch
- Job issues
- Third party injuries or conflicts
- Damages to infrastructure
- Loss of livestock (goats, cows)
- Damage and temporary interruption of access roads
- Road congestion
- Nuisance caused by noise or dust
- Unplanned use of land
- Environmental issues (soil and water contamination, erosion, damage to wildlife or vegetation, hunting and fishing, improper right of way restoration etc)
- Behaviour of personnel
- Community health and safety
- Cultural issues.

Categorising grievances will allow PEC to establish trends and adapt its own, and Contractor's management system where needed to improve environmental and social performance and reduce the overall number of grievances resolved.

If a grievance is the result of a non-compliance to project environmental and social project commitments and could result in harm to people or serious environmental impact, the HR and Community Relations team will consult directly with the Construction Management Team and CSR Manager and may recommend a temporary suspension of an activity. Any member of staff or contractor has the right to refuse or stop work that is unsafe.

Should PEC receive a grievance that is not related to PEC-executed projects but within the larger PIP area, it will be forwarded to PIP for them to coordinate a response with the appropriate third party. The complainant will be informed accordingly. These grievances will not be tracked.

In addition to categorising a grievance, the following information will also be collected in a standards format:

- Name, address, contact number, place or community of residence.
- When and where the grievance was received.
- Name of the HR and Community Relations team members who received the grievance.
- Basic information about the party making the grievance for providing feedback.
- Corrective actions and dates when they were initiated and completed;
- Dates when the required notifications and feedback were given to the affected party
- Date when all parties agreed the grievance was closed-out.

It is voluntary for the individual making the grievance to provide personal information.

4.5 Grievances Outside of the PEC Grievance Procedure

Following best practice, all grievances and claims from local communities should be accepted and no judgment made prior to investigation, even if complaints are minor. However, several types of grievances deserve special consideration and possible redirection to other grievance resolutions channels, such as:

• **Complaints clearly not related to the Project:** It is sometimes difficult to determine which issues are related to the project and which are not. If in doubt, employees designated to receive grievances should accept the complaint and assess its legitimacy. Making upfront agreements with communities as to which types of claims are and are not project-related will help avoid misunderstandings in individual cases.

• **Complaints constituting criminal activity and violence:** In these cases, complainants should be referred to the formal justice system.

• **Commercial disputes (i.e. CONTRACTOR not paying to third parties):** Commercial matters should be stipulated for in contractual agreements and issues should be resolved through a variety of commercial dispute resolution mechanisms or civil courts.

• **Issues related to Governmental policy and Government institutions:** It is not uncommon for communities to use company grievance mechanisms to bring complaints related to aspects of project implementation that are a responsibility of, and implemented by, public institutions and their officials—for example, issues related to the resettlement process handled by local governments for the project needs. The private sector is not obliged to address such complaints. Communicating clearly to local communities about the role, responsibilities, and limitations of the PEC Grievance Mechanism is a must, but it may not suffice in practice. Governments may not have enough capacity (either resources or processes) to handle grievances, or they may be inaccessible to affected communities. At a minimum, such grievances can be captured through the PEC system, and then COMPANY may choose to pass the grievances to authorities and let the communities know how to follow up.

5 CONSULTATION AND DISCLOSURE

The disclosure of this procedure is done through the corporate website. A simplified summary procedure will be documented in the Project Offices and the HR and Community Relations team will be well versed and trained in the Grievance Procedure. Contractors should train their personnel on how the PEC grievance procedure must be followed. The procedure and forms should also be easily accessible and the same forms will be used by all EPC Contractors to ensure consistency of collecting and analysing received grievances.
During Stakeholder Engagement sessions and community engagement meetings, the grievance process will also be explained.

6 VERIFICATION AND MONITORING

PEC will carry out monitoring to ensure that Contractor and subcontractors are adhering to the requirements and commitments contained in the PEC Management Plans and Contractor Implementation Plans. All monitoring requirements shall be established within the Contractor Plans with details of resources, monitoring, and assurance methods included within the Contractor's ESMS.

This entails good record keeping of complaints raised throughout the life of the construction and operation of the Project. On receipt of grievances, electronic notification to management must be distributed. Grievance records must be made available to management at all times.

Monthly internal reports will be compiled by the HR and Community Relations Team leader, supported by CLOs as required and distributed to the management team. These grievance reports will include:

- The number of grievances logged in the proceeding period by level and type (with further details of the location of the incident/issue).
- The number of stakeholders that have come back after 15 days of monitoring period stating they are not satisfied with the resolution.
- The number of grievances unresolved – by type - after 30 days for relatively straightforward grievances and 60 days for complicated cases.
- The number of grievances resolved after 30 days, without accessing legal or third party mediators, by level and type
- The number of grievances of the same or similar issue
- PEC responses to the concerns raised by the various stakeholders.
- The measures taken to incorporate these responses into project implementation.

These reports and other records will be made available for external review if required.

EPC Contractors shall also submit monthly reports aligned to the PEC reports

.
An appropriate grievance report should be part of PEC annual reporting. Annual reports will be made available to the public (through the PEC website).

APPENDIX A – Grievance Form – Sample

<table>
<tr><td colspan="4">Grievance Action Form</td></tr>
<tr><td>Part – A</td><td>Location:</td><td>Complaint Number (to be taken from the consultation tracking database)</td><td>Date Received:</td></tr>
<tr><td colspan="3">Name :</td><td rowspan="2">Method of Response

Verbal in Person ☐
Verbal on Telephone ☐
Written – handed ☐
Written – Email ☐
Written – Notice Board ☐</td></tr>
<tr><td colspan="3">Address:

Contact Number:</td></tr>
<tr><td>Part B</td><td colspan="3">COMPLAINT</td></tr>
<tr><td colspan="4">Description:

Name:</td></tr>
</table>

Signature:	Date:

Part C Response from PEC

Description:

Name: Position:

Signature: Date:

Part D Verification of Response and Corrective Action if required

Follow Up details:

Close Out Date: Signature:

Part E Acknowledge Receipt of Response

Name:

Signature: Date:

Appendix B Grievance Database Template

Sr.No	Code	Date	Name	Organization	Contact	Description	Method	Action Outcome	Responsible	Result	Target Date of Completion	Actual Completion Date	Status	Re-apeal	Date

PEC TECHNICAL STANDARDS

HEALTH, SAFETY AND ENVIRONMENT

GUIDELINE

LABOUR WELFARE FOR CONTRACTORS

(Doc.No.: PEC03D3)

PREFACE

PEC Technical Standards (PTS) are based on the experience acquired during the involvement with the design, construction, operation and maintenance of processing units and facilities of Aromatic Complex Project in Singapore. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good technical practice to be applied by PEC' OPUs in oil and gas production facilities, refineries, gas processing plants, chemical plants, marketing facilities or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to users for their consideration and decision to implement. This is of particular importance where PTS may not cover every requirement or diversity of condition at each locality. The system of PTS is expected to be sufficiently flexible to allow individual operating units to adapt the information set forth in PTS to their own environment and requirements.

When Contractors or Manufacturers / Suppliers use PTS they shall be solely responsible for the quality of work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, it is expected of them to follow those design and engineering practices which will achieve the same level of integrity as reflected in the PTS. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the owner.

The right to use PTS rests with three categories of users:

1. PEC and its affiliates.
2. Other parties who are authorized to use PTS subject to appropriate contractual arrangements.
3. Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) and 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

Subject to any particular terms and conditions as may be set forth in specific agreements with users, PEC disclaims any liability of whatsoever nature for any damage (including injury or death) suffered by any company or person whomsoever as a result of or in connection with the use, application or implementation of any PTS, combination of PTS or any part thereof. The benefit of this disclaimer shall inure in all respects to PEC and/or any company affiliated to PEC that may issue PTS or require the use of PTS.

Without prejudice to any specific terms in respect of confidentiality under relevant contractual arrangements, PTS shall not, without the prior written consent of PEC, be disclosed by users to any company or person whomsoever and the PTS shall be used exclusively for the purpose they have been provided to the user. They shall be returned after use, including any copies which shall only be made by users with the express prior written consent of PEC.

The copyright of PTS vests in PEC. Users shall arrange for PTS to be held in safe custody and PEC may at any time require information satisfactory to PEC in order to ascertain how users implement this requirement.

Document Summary

Pengerang Energy Complex mandates Contractors to Comply with Malaysian laws with respect to Contract Labour Welfare. It supplements the HSE Guidelines for Contractors by providing specific details / checklist for the Workers Transportation, Housing / Living Condition.

PEC has decided to implement International Finance Corporations Performance Standard 2 Dated January 01 2012 on Labour and Working Conditions. Additional requirements of worker welfare management like appointment of a Welfare Compliance Officer/ Representative, Fair HR policies with respect to leave, transfer, termination, salary, recruitment, freedom of movement, passport retention, mental well-being, grievance mechanism etc. have been included in the guideline. The Guidelines is intended to make prospective Contractors aware of the basic Welfare requirements to be implemented in the Management of its workers deployed on PEC Contract and to ensure its implementation in its contract.

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1.0 Introduction

Pengerang Energy Complex SDN BHD (the “COMPANY”) mandates contracting Companies to Comply with Malaysian laws with respect to Contract Labour Welfare. Some of the requirements of Malaysian Laws like Workers Transportation and Housing / Living Condition aspects are already addressed in existing PEC HSE Guidelines for Contractors. However, the current document is developed to cover all social related requirements of Malaysian Labour Law.

COMPANY has decided to implement International Finance Corporations Performance Standard 2 Dated January 01, 2012 on Labour and Working Conditions. This guideline is intended to make prospective Contractors aware of the basic Welfare requirements to be implemented in the Management of its workers deployed in relation to COMPANY Contract.

The Guidelines is not a comprehensive document of all applicable laws and regulatory requirements. Hence, Compliance with the applicable laws and requirements is the sole responsibility of the Contractor.

The Guidelines shall be applied to all types and classifications of contracts in the COMPANY.

2.0 Scope

Contractor is responsible for compliance with the Guidelines. The Guidelines will be applicable for all contracts that are signed after issuance of the Guidelines. All references to Contractor and Contractor employees equally apply to Sub-Contractors/Vendors and Sub-Contractors/Vendors employees. Contractor shall ensure that Sub-Contractors/Vendors are informed of the need to comply with all aspects of the Guidelines.

Contractor shall prepare a written Welfare Plan and submit the same for approval of COMPANY. Contractor shall ensure that the approved Welfare Plan and all supporting procedures are available for implementation at the start of manpower mobilization.

Contractors are expected to be familiar with, understand, and apply the information explained in the Guidelines. If there's a need for additional information, or have any questions about performing work in a safe manner, Contractor's employee should consult their supervisor or a COMPANY 'Representative as designated so or as Company's Superintendent in the respective contract ("Company's Representative").

3.0 Responsibilities

3.1 Company's Representative

All questions concerning the performance of Contractor's with respect to the Guidelines any workers welfare related issue and Labor Laws shall be communicated through the Company's Representative or as otherwise specified in the respective Contract and the Guidelines.

The Company's Representative shall be accountable for ensuring the compliance of Contractor to the Guidelines and shall continuously monitor the Contractor's Welfare performance

3.2 Contractor

Contractor's Representative as defined in the respective Contract is responsible for compliance to the Guidelines and for informing Contractor's employees and Sub-Contractor's employees of the requirements in the guidelines and all specific instructions pertinent to the work.

Contractor shall, at all times, provide a Welfare Compliance Officer who shall be in full charge of the welfare of Contractor's employees and maintain liaison between Contractor and Company's' Representatives ("Contractor's Representative") as follows:

<500 (including shutdown and short term manpower) Employees: One Functional Engineer/ Supervisor (With Minimum Bachelor Degree with one year experience / received training on worker welfare issues of not less than 5 days / Familiar with Workers welfare guidelines/ Performance Standards 2 of International Finance Corporation) will be nominated as part time Welfare Compliance officer for the Workers Welfare Program.

>500 (including shutdown and short term manpower) Employees: One full time Welfare Compliance Officer for the Workers Welfare Program with Bachelor Degree (Preferable in Social Welfare/ Labor Welfare / Law or Equivalent or received SA8000 Auditor training or bespoke modern slavery training or equivalent/ labor law) / equivalent approved by PEC and at least 2 years' experience in handling workers welfare issues.

Welfare Compliance Officer for the Workers Welfare Program shall assist Contractor's Representative to ensure implementation of the guidelines and other related laws, manage and carry out Contractor's own Audit, submit the audit report to respective Contract

Superintendent, follow up on closure of grievances and audit recommendation and support Company by providing reports and participating in Audit.

3.3 Legal Requirements

Contractor, Contractor's employees, all Sub-Contractors/Vendors and all employees of Sub-Contractors/Vendors shall comply with all Malaysian laws and regulations relating in any way to welfare of individuals. These include but are not limited to:

- IFC Performance Standard 2 Year 2012.
- Environment Protection Law number 42 of 2014 and any other amendments.

4.0 Procedure

4.1 HR Policies:

Contractor shall implement policies and supporting procedures to describe the management of workers. These policies and procedures shall be in accordance with all applicable laws and regulations.

4.2 Employment Contracts:

Contractor shall ensure that employment contracts issued to workers are written in both English and the predominant language of the individual. The employment contract shall comply with all applicable laws and contain as a minimum:

- Job description
- Monthly wages (As per minimum Take Home Salary mentioned in the Contract)
- Working hours
- Probation period
- Leave entitlement
- Duration of Contract.

4.3 Recruitment:

Contractor shall ensure that private employment agencies engaged for the recruitment of workers have all applicable licenses from the concerned Ministry / Government Authority.

The charging of recruitment fees from workers by private employment agencies or Contractor is prohibited. Contractor shall maintain records of all recruitment and make available to COMPANY when requested.

4.4 Payment:

Contractor shall ensure payment of salaries as governed by Malaysian labour law and contract clauses.

4.5 Working Hours, Breaks and Weekly Rest:

Contractor shall ensure that working hours are in accordance with all applicable laws and regulations.

4.6 Leave Entitlement:

Contractor shall observe the official Public Holidays. During these Public Holidays, workers shall be entitled to time off work on full pay. Where this may not be possible and workers are required to work, compensation will be given to the worker as stipulated by labour law.

4.6.1 Sick Leave:

Workers will be entitled for sick leave as per Malaysian labour laws.

4.7 Workers Organisations:

Workers are permitted to join existing trade unions where applicable. Non-Malaysian workers are not permitted to form trade unions.

Where workers join a trade union, Contractor is not permitted to terminate their contract.

4.8 Grievances:

Contractor shall ensure that transparent mechanisms are in place to allow workers to raise grievances and provide feedback to individuals for closure. This mechanism shall be made aware to the workers through their induction program and other awareness program / communication. Contractor shall provide data about the grievances including the details of grievance not closed to the satisfaction of the worker raising the grievance to PEC. Contractor through its Management shall assure workers about protection from any reprisals.

Contractor will allow PEC to ensure install complaint / grievance boxes at its site/camps at a location which a worker can access without being observed by Supervisor/ Security. Contractor shall ensure these boxes are not vandalized / damaged.

Contractor implement the procedure as per the grievance mechanism procedure.

4.9 Child Labour:

Contractor shall not employ any worker under the age of 18 years. Refer Document of Social Plan.

4.10 Freedom of Movement, Debt Bondage and Forced Labour:

The retention of workers passports is illegal and not permitted.

Subject to the procedures set or as per the Labour Law, workers may transfer from one employer to another as per the law of the land. Such permission will not be denied without reason which shall be informed to Company and the employee in writing.

4.11 Health and Safety:

Contractor will take necessary actions to improve mental wellbeing of workers. Contractor shall arrange training / Counselling for Supervisors or experienced workers to identify signs of worry, depression and mental stress in their workers and colleagues. Contractor should encourage workers to seek help during depression / stress.

4.12 Accommodation:

Contractor shall provide suitable accommodation for all workers in accordance with all applicable PEC standards, contractual and legal requirements.

Contractor shall provide Global Positioning System (GPS) coordinates of all accommodation to COMPANY.

Contractor shall obtain approval on the housing provided for the workers from the Ministry of Health and Ministry of Social Affairs.

For the accommodation of the employees, the following thumb rule shall be used for minimum area for accommodation, which is subject for company inspection during any time of the entire duration of contract.

Sl #	**Employees Categories**	**Accommodation**
1	Engineers and above	Sperate Bedroom, Hall, Kitchen flat with attached toilet for each employee.
2	Supervisors	One person in one bedroom in 2 BHK (max. 2 person in one flat) with attached toilet(s). The hall, kitchen & toilets(s) of the flat shall be shared by all occupants.
3	Rest of the Categories	Two person in one bedroom in 2 BHK (max. 4 person in one flat) with attached toilet(s). The hall, kitchen & toilet(s) of the flat shall be shared by all occupants.

Contractor shall implement a formal audit program on a Quarterly basis utilizing Appendix-1"Contractor Employees Welfare Audit Checklist" and submit the outcome and scores to Company. Part B of the Audit should be filled for each Camp/ Accommodation Location.

Contractor shall ensure a regular maintenance and cleaning program is implemented.

COMPANY shall undertake formal inspections of workers accommodation as a part of monthly Workers Welfare Audit utilizing Appendix-1 "Contractor Employees Welfare Audit Checklist".
Further guidance can be found in Appendix-1 "Contractor Employees Welfare Audit Checklist" however, as a minimum, Contractor shall ensure the following is implemented within accommodation:

Bedrooms:

- Contain no more than 4 occupants and space per person minimum like 4 Sq.M.
- Bedding and blankets provided
- Storage cupboards for clothing and personal belongings provided
- Well ventilated
- Have air conditioning
- Provide adequate natural light
- Emergency lighting
- Windows fitted with dust screens
- Ensure free from Insects such as Bed Bugs, Cockroaches & Rodents...etc.

Washing Areas:

- Minimum of one washing area per eight workers.
- Provide both hot and cold water for drinking
- Non-slip surfaces
- Hot waters are available for bathing

Cooking Areas/Kitchens/Mess Facilities:

- Separate from bedrooms
- Sized accordingly to accommodate number of workers
- Non slip floors
- Waste bins fitted with heavy lids
- Kitchens to be fitted with ventilation fans suitable for ventilating size of room.
- Sufficient numbers of gas cookers, fridges and water filter
- Suitable number of appropriate fire extinguishers and appliance capable of extinguishing a fire

Fire Safety:

- Fire safety license, displayed in prominent place.

- Accommodation to be constructed of non-flammable materials i.e. concrete/cement blocks / steel structures.
- Fire alarm system suitable for size and type of accommodation
- Emergency Evacuation plan, posted in conspicuous areas identifying evacuation routes, elevators, stairways, main electrical switches and firefighting equipment, external muster points.
- Evacuation routes shall be well lit, free from obstruction, ventilated and provide adequate signage.
- Fire alarms/detection systems shall be tested on a regular basis and defects rectified by a licensed specialized body. Residents shall be notified in advance of testing.
- Evacuation Marshalls, appropriately trained and identified.
- Emergency Evacuation exercise schedule for all residents
- Unimpeded access to firefighting equipment
- Designated smoking areas provided, smoking in all other areas to be prohibited
- Separate designated storage areas for any flammable/hazardous materials
- Storage of items not related to accommodation is prohibited i.e. construction materials
- All doors and windows shall close automatically.

Electrical Safety:

- All electrical connections, wiring and fittings shall be maintained
- Electrical cut-off switches shall be fixed in suitable, easy to locate places
- Large building shall have electrical cables covered with fire proof/resistant material.

Security:

- Security staff employed on accommodation.

4.13 Transportation:

4.13.1 Contractor shall provide transport, free of charge to workers to and from the workplace or shall be compensated proportionally. Transport shall comply with all PEC, contractual and legal requirements.

4.13.2 Contractor Drivers shall be in possession of a current and applicable driving license for the vehicle they are driving.

4.13.3 Contractor shall ensure that all drivers have undertaken appropriate driver training.

4.13.4 (1) The Bus Drivers shall stop the bus at the designated parking area and the hand brake is applied before passengers are allowed to board or get down from the bus. He shall not move the bus until all passengers are seated or disembarked. He shall ensure that the doors including emergency door are closed before moving the bus.

4.13.4 (2) No standing passenger shall be allowed.

4.13.4 (3) If more than one bus is involved for any Contractor, buses shall be allowed to be boarded only one at a time and all buses shall not be allowed to be boarded simultaneously.

4.13.4 (4) For the major project Contractors with large number of employees requiring multiple buses can be allowed to make multiple boarding points for simultaneous boarding. At one boarding point only one bus is to be loaded at a time. The multiple boarding points shall also fulfill the requirements mentioned on item-8 below.

Such major project Contractors with multiple buses and boarding points, each bus shall have designated bus attendant to supervise the systematic embarking / disembarking of the bus.

4.13.4 (5) **A designated Contractor supervisor** for each Contractor / Sub-Contractor shall be permanently appointed (or assigned for the job) to ensure that the employees using the bus are boarded and seated in an orderly manner and without crowding at the entry / exit doors. Embarking and disembarking shall be in this presence.

(5.1) If circumstances required reversing the bus, the designated Contractor supervisor or bus attendant (for major projects sites) shall act as a signal man.

(5.2) The designated Contractor supervisor or bus attendant (for major projects sites) shall give clearance to the driver to move the bus.

(5.3) All contract employees shall be made aware of this performance standard.

(5.4) He shall monitor the adherence to this system on daily basis.

4.13.4 (6) **Welfare of Contractor Employees**. Ensure buses transporting laborers from/to site are air-conditioned and provided with sum film/tint as protection against heat radiation during summer.

4.14 Contractors' Employee Termination and Repatriation:

Contractor shall bear the costs of returning a worker to their country of origin and ensure that workers receive all their entitlements as governed under labor law.

4.15 Behavior in the Local Community:

Contractor shall ensure that all workers, as part of the initial induction process, are informed of the following:

- Contractor Senior Management's expectations of workers' behavior in the community
- Health risks including sexually transmitted diseases (STDs)
- Risks associated with prostitution
- Risks associated with drug, alcohol consumption & smoking
- Potential consequences and disciplinary process

It is important for the company to provide the information to the workers of the implication and consequences of above acts. Outcome from the above, the company shall however not be responsible for the payment of any costs or medical expenses arising from or related to any of the following:

- medical consultation and treatment for pre-existing illnesses.
- house-calls made by general practitioners.
- medical, surgical, optical or dental appliances.
- cosmetic / acne or related consultation and treatment.
- self-inflicted injuries or unlawful acts, provoked assault or any venereal diseases, as well as injuries received by participating in riots and unlawful assemblies.
- illness or disablement arising from attempted suicide and use of drugs not prescribed by a registered medical practitioner.
- medical expenses arising out of participation in or attending hazardous sports or pursuits or pastimes.
- treatment or medicines when these become necessary as a result of the misconduct, excessive use of alcohol, carelessness, indiscretion or negligence on the part of yourself.
- cost of treatment in mental cases or functional disorders of the mind, which have been certified by a Government Medical Officer or any registered medical practitioner.
- health screening.
- medical claims submitted after 3 months from the consultation date will not be reimbursed.

5.0 Training

Contractor shall provide training to workers on the requirements of the Guidelines as part of the initial induction process.

6.0 Audit

Contractor shall implement an audit schedule covering, as a minimum, all elements in Section 4.0 of this document, which shall include all Sub-Contractors and lower tier Contractors. The Audit Check list is provided in Appendix-1. The Scores will be submitted to the Company. Part B of the Checklist (Accommodation and Transport) will be filled for each Camp/ Accommodation Location.

The Contractor will undertake Part A of the Audit at least once in quarter and Part B of Audit at least once in a month. Part B Audit will be planned in a way to cover each site/Camp at least once in the quarter. Contractor will submit Audit report to PEC quarterly.

COMPANY will undertake audits, covering all elements in Section 4.0 of this document on a six- monthly basis utilizing the Checklist in Appendix-1.

6.1 *COMPANY may, at its discretion, undertake audits on a more frequent basis.*

6.1.1 Formation of Audit Team (Auditors)

Contractor HSE manager and other personal as required will be made available to be part of Audit team formed by Superintendent of contract.

6.1.2 Preparation of Audit Plan

The Contractor shall prepare his Annual Audit Plan for each Contractor and Sub- Contractor by Completing Appendix-2 (Audit Plan form).The Contractor shall obtain a copy of the company Audit Plan and include it in the Audit Plan maintained by it. The Contractor will inform the Superintendent of the contract if any new camp /site is created by it or if any audit by company or itself has not been completed as per plan. The Audit Plan shall be communicated to all concerned parties of the Company and Contractors.

6.1.3 Implementation of Audit Plan & Ensuring Appropriate Corrective Actions to close audit findings

Appendix-1 shall be utilized as reference in the conduct of the audit. An Audit findings and recommendation report shall be prepared and officially communicated to the Contractor, copy furnished to all Audit team members.

The respective Contractor will develop a time bound compliance plan to close all audit findings and submit the same to respective Superintendent of Contracts.

6.1.4 Tracking of Audit Recommendation to Closure

Contractor shall maintain a recommendation tracking system to ensure periodic update and tracking to closure.

Contractor's quarterly update on action taken for each recommendation shall be submitted to the Supdt. of the Contract. The same shall be discussed during the periodic Communication Meeting by the Supdt. of the Contract.

6.1.5 Monitoring Report

Contractor shall prepare a six months report for approval by Superintendent of the contract and submit ion to Team Leader. Environment for submitting self-monitoring report to Independent Environmental and social monitoring consultant.

7.0 Records

Contractor shall maintain full records on the following and make available to COMPANY on request:

- Accommodation & Transportation Maintenance records
- Log maintained by Security Staff employed on Workers Accommodation.
- Grievance register and supporting documentation
- Voluntary passport retention register
- Audit reports and supporting evidence for close out of actions

8.0 Migrant Worker Guidelines

PEC shall continuously strive to provide safe working conditions, treat its employees with respect and dignity, ensure its business operations are not harmful to the environment, and conduct all activities ethically and responsibly in full compliance with applicable local laws and regulations of the countries in which PEC operates its business. PEC is also dedicated to respecting and protecting human rights, and we consider this to be our most important obligation as a member of a global society.

Reflecting on the above commitment, the PEC Migrant Worker Guidelines (the "Guidelines") set out minimum requirements for the ethical and transparent recruitment process of migrant workers in PEC's worksites and its facilities operate. Namely, any recruitment or placement fees imposed on migrant workers by recruitment agencies, sub-agents, or third parties are strongly prohibited during the recruitment process. This procedure is to minimise impacts of immigrants worker's needs, meeting the requirement of IFC PS4 and a core requirement that contains a set of standards on social, environmental and ethical issues in the electronics industry supply chain.

Moreover, PEC worksites, contractors, subcontractors and suppliers providing goods or services to PEC, must comply with applicable local labor laws, as well as PEC's Business Conduct Guidelines, PEC Code of Conduct, and take immediate and effective measures to address instances of forced, bonded or indentured labor and human trafficking, and also ensure the prohibition and elimination of the worst forms of child labor. PEC shall also periodically conduct appropriate due diligence, monitoring, and training programs to screen and manage PEC suppliers, contractors and recruitment agencies.

PEC strongly supports the right of voluntary labor and is committed to banning participation in, or imposition of, forced labor by means of mental or physical bondage in accordance with the ILO. PEC also respects and protects fundamental human rights taking into account international human rights principles and standards set forth in the Universal Declaration of Human Rights, the UN Guiding Principles on Business and Human Rights, the Organization for Economic Co-operation and Development's guidelines for multinational enterprises, the UN Convention on the

Rights of the Child, the ILO Declaration on Fundamental Principles and Rights at Work, and the laws of the countries in which PEC operates its business.

PEC will also seek partnerships with key stakeholders such as NGOs, governments and local communities in order to improve the Guidelines continuously and make sure they are consistent with local labor law and PEC's Business Conduct Guidelines.

1. Objective

These Guidelines include minimum requirements for ethical and transparent recruitment which is essential for the eradication of forced, bonded, or indentured labor and human trafficking of migrant workers.

PEC recognizes that some of the requirements listed herein may exceed those under applicable local labor law or may not be legislated. In such cases where there may be a conflict of requirements, PEC will strive to meet the higher standard that offers the most benefit and protection to migrant workers. PEC also understands that some of these compliance initiatives may be new to our contractors and recruitment agencies. Therefore, PEC will provide support and guidance to our contractors and recruitment agencies in their compliance with the PEC Code of Conduct

2. Scope

The Guidelines apply to PEC worksites as well as all the contractors where PEC facilities are located and recruitment agencies which are used to select, recruit, manage or arrange transport for migrant workers to PEC and its contractors .

3. Definitions

For the purposes of the Guidelines, the following words shall have the meaning ascribed as herein below:

"Migrant Worker" – refers to a person who is engaged or has been engaged in a remunerated activity in a state in which he or she is not a national and has to move from one country to another for the purpose of employment.

"Sending Country" – refers to the country where the migrant worker was born and resided in or the country where the migrant worker was recruited.

"Receiving Country" – refers to the country where PEC's worksites and its contractors are located and where the migrant worker is employed.

"Recruitment Agency" – refers to labor recruiters, labor brokers, and any other third parties involved in the recruitment, selection, hiring, transportation, and/or in some cases management of migrant workers in either sending or receiving countries.

“Child Labor” – refers to any person under the age of 15, or under the age for completing compulsory education, or under the minimum age for employment in the country, whichever is the most stringent under applicable laws and regulations.

“Forced Labor” – refers to all work or service which is exacted from any person under the threat of any penalty and for which the said person has not offered voluntarily.

4. Recruitment Fees

4.1 PEC shall ensure that migrant workers shall not be responsible for paying any fees or expenses in connection with securing employment with the exception of the fees and expenses payable by migrant workers indicated below. The fees and expenses payable by company or their contractor listed below shall be paid after the employment offer has been made and accepted in writing.

Fees and Expenses Payable by PEC or their contractors

- Passport
- Work permit
- Police clearance fee
- Birth certificate fee
- Certificate of good behavior fee
- Other certificate, identity or clearance documents required for residing in the receiving country
- Recruitment Agency fees
  - Documentation, translation, service fees
- Medical test in the sending and receiving countries
- Visa fee including exit clearances and other related to immigration processing costs
- Transportation
  - From the sending country(migrant worker’s home) to the receiving country port of entry
  - From the receiving country port of entry to workplace or provided accommodations
  - Return to migrant worker’s home country at the end of employment
- Training or orientation in the sending and receiving countries

Fees and Expenses Payable by Migrant Workers

- ◊ Cost of replacing a visa, passport or work permit due to loss
- ◊ Costs for any legally-allowable levies.
- ◊ Expenses related to preparing for employment interview

- CV copies, photos, copies of existing document an certificates, incidentals, transportation, accommodation and meals

Expenses related to the migrant worker returning to their home country during leave or holiday

Reasonable costs of accommodation and meals provided by the employer or agency. Such costs shall be charged to migrant worker at fair market value

4.2 PEC shall continuously work to ensure that recruitment agencies in the sending and receiving countries do not impose directly or indirectly, in whole or in part, any fees or expenses on migrant workers during their hiring, recruitment, and employment.

4.3 PEC will regularly monitor fees, expenses, and any other costs related to recruitment through regular dialogue and communication between facility management and migrant workers and by auditing recruitment agencies.

5. Recruitment Agency

5.1 PEC shall seek to hire migrant workers directly whenever possible. When the subcontracting of recruitment and hiring is necessary, PEC shall ensure that migrant workers are recruited through agencies that are certified or licensed by the relevant authorities in the sending and receiving countries.

5.2 PEC and their contractors shall have a direct contract with recruitment agencies, which shall include the prohibition of imposing recruitment fees and expenses on migrant workers by the recruitment agency.

5.3 PEC and their contractors shall conduct regular training and audits of recruitment agencies to ensure that they understand the requirements specified in the contract and the Guidelines. If PEC finds that recruitment agencies are not in compliance with the terms in the Guidelines, PEC and the recruitment agencies will seek to take immediate steps to ensure compliance with applicable local laws, regulations, and the Guidelines.

6. Employment Contract

6.1 Employment contracts of migrant workers shall include, but are not limited to, the following contents (as permissible according to applicable local laws):

Contract Contents

- Name, address and national registration identification number of the company
- Migrant worker’s full name, date of birth
- Migrant worker’s emergency contact information

- Passport number or government-issued identification
- Period of employment contract
- Description of the nature of work and the place where the work is performed
- Working hours (regular, shift, overtime, maximum working hours)
- Wage rate (regular, overtime and holiday)
- Description of all deductions including specification of the type and amount of each deductions if exists
- Applicable allowances, bonuses, incentives
- Applicable leaves and holidays
- Estimated minimum net pay per month
- Description of living conditions including costs for transportation, meals and accommodation
- Description of additional benefits including medical insurance, accident/injury insurance
- Terms and conditions for contract termination including a notice period not to exceed one month, or as defined applicable local laws
- Description of repatriation process and specification of the costs
- Prohibition of recruitment fees
- Specification of document retention and safekeeping policy

6.2 A written employment contract shall be provided to migrant workers in their native language and shall be explained verbally to enable review and understanding prior to signing the employment contract and departure from the sending country.

6.3 Employment contracts shall be signed by the migrant workers directly and voluntarily without deception or threat of penalty, after a detailed explanation of the contract has been provided and a signed copy of the contract will also be provided to migrant workers in the sending country.

6.4 Changes to the employment contract at any point during the migrant worker's employment after signing the contract shall be prohibited. If there are any amendments to be made to the employment contract, they must be clearly explained to the migrant workers to get their full written consent before the amendments are formalized. If the migrant workers do not agree with the change, they shall be provided with the choice to terminate their contract voluntarily without any penalty and be provided with coverage of expenses related to returning to the sending country.

7. Document Retention

7.1 PEC shall not hold original migrant worker identification documents such as passports, government-issued identification, and other personal documents.

7.2 Secure, safe and lockable storage for documents and other valuable items shall be provided to each migrant worker and protected against unauthorized access. There shall be no barriers to storage access and stored items shall be freely and

immediately accessible to migrant workers at any time without restrictions or required permissions.

7.3 In the case that migrant workers specifically requests the company to hold documents for safekeeping, or if retention of specified documents is required by applicable local laws and regulations, PEC shall obtain the written consent of the migrant worker and have procedures in place for the safekeeping of personal documents. The written consent will be signed by the migrant worker and facility management. A copy of the written consent should be also given to the migrant worker.

7.3.1 Written consent will include a statement from the company that accepts responsibility for the safekeeping of migrant worker identification documents and commits to return the documents within 12 hours after a document return request has been made by the migrant worker.

7.3.2 Each migrant worker will be issued an identification document confirming employment with PEC along with a photocopy of the migrant worker's passport to ensure the migrant worker's freedom of movement.

8. Pre-departure and Post-arrival Training

8.1 PEC and their contractors shall conduct pre-departure training prior to signing the employment contract in the sending country and post-arrival training before commencing their employment in the receiving country to ensure their understanding in their native language.

8.1.1 If PEC and their contractors is unable to conduct the pre-departure training in the sending country, the recruitment agency shall conduct the pre- departure training using the contents that PEC and their contractors provides.

8.2 Pre-departure or post-arrival training contents will include, but are not limited to, the contents listed below.

Training Contents

- Information about the company's workplace
- Terms and conditions of the employment contract, including:
  - Wages and benefits
  - Working hours, overtime
  - Leaves
  - Accommodation, meals and transportation
  - Do's and Don't
- Company polices, including:
  - Grievance procedure and discipline
  - Health & Safety rules

- Identity document retention and safekeeping
- Freedom of movement
- Equal treatment
- Resignation, termination, repatriation

- Travel and repatriation arrangements
- Prohibition of recruitment fees and expenses
- Visa, work permit and medical examination requirements if required
- Legal protections mandated by the receiving country law
- Cultural practices of the receiving country
- Job-related training
- Embassy or consulate information
- Local organizations that can provide assistance

9. Employment

9.1 Non-discrimination

9.1.1 No discrimination shall take place during the hiring and employment of migrant workers based on gender, skin color, race, caste, ethnicity, nationality, religion, age, marital status, sexual preference, sexual identity, social status, disability, pregnancy, military status, protected genetic information, or political affiliation in all processes such as training, work, promotion, compensation, and disciplinary measures.

9.2 Age for employment

9.2.1 Based on the UN Convention on the Rights of the Child, The Children's Right and Business Principles, and ILO Convention 182, PECs Child Labor policy prohibits employment of migrant workers under the age of 15, or under the age of completion of compulsory education, or under the minimum age for employment in applicable local laws and regulations, whichever is the most stringent under applicable local laws. Also migrant workers under the age of 18 (Young Workers) shall not perform work that is likely to jeopardize their health or safety, including night shifts and overtime.

9.3 Valid work permit

9.3.1 PEC and their contractors shall only hire migrant workers who are legally permitted to work in the receiving country and all migrant workers shall have valid legal work permits for the duration of their employment.

9.4 Equal treatment

9.4.1 To respect migrant workers' fundamental human rights, as well as legal rights, PEC shall provide migrant workers with opportunities, treatment, working and living conditions, wage rates for jobs performed, shift arrangements, holidays, and working hours equivalent to that provided for local workers without discrimination in the workplace, except where different terms are specified under applicable local laws and regulations.

9.5 Working Hours

9.5.1 Total normal working hours per week are not to exceed limits set by applicable local laws and regulations, or 60 hours per week.

9.5.2 All overtime shall be genuinely voluntary. No migrant worker shall receive disciplinary action for refusing overtime and no migrant worker shall be made to work overtime under the threat of penalty, dismissal or denunciation.

Information shall be provided in a transparent manner to migrant workers about hours worked, rates of pay, and the calculation of legal deductions (if applicable).

9.6 Leave and holidays

9.6.1 Migrant workers shall be eligible for paid leave or holidays, at least one day off every seven days and legally mandated breaks as may be prescribed under the relevant and applicable local laws or as may be determined by the facility's management.

9.6.2 Migrant workers shall be free to return to their sending country during leave or holidays, without threat of penalty, termination of contract, or other retribution.

9.7 Wages

9.7.1 PEC and their contractors shall pay wages directly to migrant workers which are not less than the minimum wage prescribed by applicable local laws and regulations. The wages shall not be paid on the basis of piece work.

9.7.2 The payment of wages shall be credited to the bank account of the migrant worker no later than designated date of the following month by the facility. In case the migrant worker does not have a bank account, the wage shall be paid in cash directly to the migrant worker on the designated date of the following month.

9.7.3 PEC and their contractor shall provide a wage statement in the migrant worker's native language with an explanation of the basis on which they are compensated including regular wage, overtime, bonuses, deductions, and other components if any. There shall be no unlawful deductions taken from the wages. If migrant workers have deductions on their wages, a full listing of deductions including a specification of the types and amounts of each deduction (if any) shall be specified on the wage statement.

9.8 Deposits

9.8.1 PEC and their contractor shall not operate any migrant worker wage deposit or savings programs unless required by applicable local laws and regulations. In the event of a legally required deposit or savings programs, the migrant workers shall be able to freely access their account at any time. Neither PEC and their contractor nor recruitment agencies shall have direct control of or access to the bank accounts of migrant workers.

9.9 Freedom of movement

9.9.1 There shall be no unreasonable restrictions on migrant workers' freedom of movement in the facilities or accommodations, and excessive facility entry and exit restrictions shall not be imposed, except where necessary for worker safety.

9.10 Health and Safety

9.10.1 PEC and contractors shall regularly conduct appropriate workplace health and safety training in the native language of migrant workers. PEC shall also provide appropriate and well-maintained personal protective equipment to migrant workers which has been approved by authorities and meets industry standards for their safety.

9.10.2 Where dormitories are provided by PEC, Contractor or recruitment agencies for migrant workers, the dormitories shall be maintained so as to be clean and safe, and equipped with emergency exits, hot water for bathing and showering, adequate heat and ventilation, and reasonable personal space along with reasonable entry and exit privileges. Dormitory facilities shall have all relevant official permits related to health, safety, and security, including fire protection, sanitation and electrical, mechanical, and structural safety.

9.10.3 Migrant workers are to be provided with ready access to basic amenities such as toilet facilities and potable water as are necessary for their wellbeing inside the workplace and dormitory.

9.11 Cultural and Religious Identity

9.11.1 PEC and their contractor shall respect the cultural and religious identity of migrant workers.

10. Freedom of Association

10.1 Migrant workers shall have the right to freely join a trade union in accordance with applicable local laws and regulations, and no restrictions shall be placed on the exercise of freedom of association in accordance with applicable local laws and regulations.

11. Repatriation

11.1 PEC and their contractor shall pay the expenses of the migrant worker's return to the sending country upon completion of the migrant worker's employment contract or in the event of the facility closure or downsizing or other related event, unless the migrant worker finds legal employment in the receiving country upon completion of the employment contract.

11.2 PEC and their contractor shall consider providing for expenses related to migrant workers return to the sending country in the event that migrant workers resign without timely and reasonable notice due to extenuating circumstance such as critical illness or incapacity.

11.3 PEC and their contractor shall not be responsible for the costs of repatriating migrant workers in cases of termination for misconduct (including criminal activities), obtaining other employment or termination of the employment contract voluntarily of their own volition in the receiving country, or involuntarily

12. Termination

12.1 Migrant workers shall be free to terminate their employment contract prior to the contract end date voluntarily without any penalty, threat of punishment, fines, or withholding wages upon required notice as defined by applicable local laws and regulations, the employment contract, or a period of one month.

13. Grievance Mechanism

13.1 All workers have a right to have access to effective grievance remedies. To this end, PEC shall provide confidential and effective grievance redressal mechanisms and allow for reports to be made anonymously. The grievance procedures shall be made available in the migrant worker's native language and migrant workers shall be able to raise grievances without fear of discrimination, intimidation, retaliation, or any other penalty.

13.2 PEC shall provide a procedure to review and address grievances in a prompt manner. The result of the grievance procedure shall be reported back to migrant workers in their native language and explained to illiterate migrant workers in a language they understand between 3 and 7 days after receiving the grievance, depending on the concerns.

13.3 After receiving a result notice, if migrant workers are not satisfied with the result of the grievance procedure, or provided remedy, they can file an objection to the facility management or HR department. Migrant workers shall be able to file such

objections without fear of discrimination, intimidation, retaliation, or any other penalty.

14. Implementation Assessment and Improvement

PEC along with its designated person-in-charge or other nominated officials shall oversee and ensure the implementation of the Guidelines within its organization, suppliers and recruitment agencies.

PEC will conduct regularly assessment activities and identify improvement tasks through self-assessment and onsite audit or 3rd-party audits to ensure compliance. PEC will also provide training programs for internal employees, suppliers and recruitment agencies to give them a better understanding of migrant workers' rights and the requirements of the Guidelines.

In order to reduce risk factors that can negatively affect migrant workers' rights, PEC will actively seek partnerships with external stakeholders and engage in regular communication with internal employees to improve any inadequate implementation of the Guidelines as an opportunity for continuous and sustainable improvement.

Appendix –1

Contractor Employees Welfare Audit Checklist

The following is to be used as a guide by the PEC Team and Contractor's Internal Audit to Auidt and evaluate Contractors Performance with respect to Workers Welfare. Observations should be noted on the attached observation sheet and each category should be rated as per scoring guideline below.

GOOD	*80%-100%*	*IMPROVEMENT*	*60%-79.9%*	*UNSATISFACTORY*	*60% and Below*		
Contract		**Inspection #:**		**Max Point**	***Points Awarded***	**Overall Points**	
Locations Audited:		**Number of Workers:**					
Auditees:		**Date:**		720			
Audit Team:							

ITEM #	CATEGORY	AUDIT RESULT	SUMMARY PER CATEGORY
	Part A		
1	**Recruitment**		
2	**Payment**		
3	**Working hours, Breaks and Weekly Rest.**		
4	**Leave Entitlement**		
5	**Grievances**		
6	**Freedom of Movement**		
7	**Contract Termination and Repatriation**		
	Part B		
8	**Accommodation/ General**		
9	**Diner / Mess hall**		
10	**Kitchen**		
11	**Dry Storeroom/Pantry**		
12	**Freezer Storage**		
13	**Bathroom, Urinals, Toilets**		
14	**Laundry**		
15	**Housing and Living Quarters**		
16	**Recreation Facilities**		
17	**Waste Management**		
18	**Clinic / First Aid box**		
19	**Security**		
20	**Transport**		
21	**Fire Protection/Emergency Evacuation General**		
22	**Electrical**		
	Overall Rating:		

	PART A				
1.0	**Recruitment**	**Max**	**Awarded**	**%**	**Result**
1	All recruitments are conducted as per government laws	10			

	(Visa etc)				
2	Recruitment records are maintained	10			
3	Wages paid are not less than PEC take Home Salary as prescribed in the Contract Document	10			
	Overall Points for the Category	30			
2.0	**Payment**				
1	Wages are paid to workers on monthly basis	10			
2	Wages are not delayed more than 7 days	10			
3	Wages paid are not less than KNPC take Home Salary as prescribed in the Contract Document	10			
	Overall Points for the Category	30			
3.0	**Working hours, Breaks and Weekly Rest.**				
1	Working Hours are in accordance with government laws	10			
2	Overtime is permitted in line with national legislation	10			
3	Overtime is paid in accordance with national legislation	10			
	Overall Points for the Category	30			
4.0	**Leave Entitlement**				
1	Do Contractor observe official Public Holidays?	10			
2	Workers are entitled leave as per law.	20			
	Overall Points for the Category	20			
5.0	**Grievances**				
1	Transparent mechanisms are in place for workers to raise Grievance.	10			
2	Grievances are addressed and Feedback is provided to worker	10			
3	Grievance mechanism is communicated to the workers through posters/ Toolbox talk.	10			
4	Employment Contract does not have any clause to restrict workers from raising complaint/grievance.	10			
	Overall Points for the Category	40			
6.0	**Freedom of Movement**				
1	Workers are allowed to retain their passports or submit to Contractor with workers consent for safe keeping purpose	10			
2	Clear mechanism for easy retrieval of passport when requested	20			
	Overall Points for the Category	30			
7.0	**Contract Termination and Repatriation**				
1	Contractor bear the cost of returning worker to their country of origin.	10			
2	Contractor paid end of service to the worker in accordance with the Labor law.	20			
3	Employment Contract has no provision which restricts worker from leaving employment or seeking different employment.	10			
	Overall Points for the Category	40			

	PART B (Accommodation & Transportation)				
8.0	**General**	**Max**	**Awarded**	**Percent**	**Result**
1	(A) Accommodation provided free of Charges (or) (B.1) If the Contractor is exempted, then the allowance as per the clause # 4.12 is provided. (B.2) If allowance is 50% more than the minimum.	10 (or) 5 5			
2	Induction training provided to employees on arrival covering (Record exists for each employee) • Workers rights (Information provided is acceptable) • Safety and security requirements, • Cultural issues / behavior observance in community • Transportation and related rules • Grievance complaint/ process, location of complaint boxes/ email/ telephone numbers for complaints • Freedom of movement, passport retention service and it being voluntary. • Disciplinary procedures	10			
	Overall Points for the Category	**20**			
9.0	**Diner / Mess hall**	**Max**	**Awarded**	**Percent**	**Result**
1	Cleanliness and hygiene of the area adequately maintained. Checklist and system for monitoring are developed and used.	3			
2	Electrical Panels secured, outlets must be safe to use	3			
3	Illuminations evenly distributed and ventilations appropriately screened, cleaned and in good condition.	3			
4	Filtered and cool drinking water to be available. Quality of drinking water monitored. Filters changed at recommended intervals	3			
5	Dining hall space allowance 0.65m2 per person adequate tables and chairs provided	3			
6	Sufficient numbers of Cups/Dishes/Utensils adequately stored and covered.	3			
7	Fire Extinguishers available and inspected/sufficient type. Unobstructed access. Appropriate tagging systems implemented.	3			
8	Mess hall free from insects and pests. Pest prevention programme in place.	3			
9	Food available on time and the Food provided to an appropriate calorific/nutritional content i.e.(Meat, Fish, Poultry & Fresh Fruit)	3			
	Overall Points for the Category	**27**			

10	Kitchen	Max	Awarded	Percent	Result
1	All staff involved in catering/food preparation have undergone training on Basic Food Safety and Hygiene Awareness provided by approved relevant authority. Records available for auditing.	3			
2	All staff working involved food handling/preparation have undergone medical examination, maintain high degree of personal hygiene and wear appropriate clean protective clothing. Records available for auditing.	3			
3	Cleanliness and hygiene of the area adequately maintained at all times. Checklist and system for monitoring are developed and used.	3			
4	Grills and ovens regularly cleaned, free of grease, inspected and in good condition.	3			
5	Adequate shelves provided for food trays, pot/pans and cooking utensils stacked and secured.	3			
6	Exhaust hood Filters are clean and well maintained/ kitchen should have exhaust fans and maintained in working condition	3			
7	Food stored in such a way as to ensure good stock rotation using FIFO (first in, first out) practice.	3			
8	Colour coded chopping boards shall be used in food preparation. (Accepted coding system_ YELLOW: cooked meat, RED: uncook meat, WHITE: bread and dairy products, BLUE: raw fish, GREEN: salad and fruits, BROWN: raw vegetables)	3			
9	All cooked food kept separate from uncooked foodstuff to prevent cross-contamination.	3			
10	Cleaning chemicals, detergents, mops and brushes stored separately from food stores.	3			
11	Chilled and Hot food products transported in environmentally controlled and monitored containers/holding cabinets or vehicles.	3			
12	Effective Pest Control program in place. Log used to record pest control activity.	3			
13	Food preparation areas protected from pest and vermin entry (includes sealing of cracks and openings)	3			
14	Adequate ABC type of fire extinguisher provided and maintained in good operating condition	3			
15	Fire Extinguishers are regularly inspected and serviced	3			
	Overall Points for the Category	**45**			

11	Dry Storeroom/Pantry	Max	Awarded	Percent	Result
1	Cleanliness and hygiene of the area adequately maintained. Checklist and system for monitoring are developed and used.	3			
2	Illuminations evenly distributed and ventilation appropriately screened, cleaned and in good repair.	3			
3	Electrical Panels secured, outlets safe to use and meet NEC regulations.	3			
4	Shelving and storage racks free of dust, dirt and cobwebs.	3			
5	All Food labelled, dated and within use by dates	3			
6	Food stored off the floor and correctly segregated.	3			
	Overall Points for the Category	**18**			
12	**Freezer Storage**	**Max**	**Awarded**	**Percent**	**Result**
1	Cleanliness and hygiene of the area adequately maintained. Checklist and system for monitoring are developed and used.	3			
2	Door seals in good order to permit safe egress.	3			
3	Items stored in shelves and properly wrapped	3			
4	Meat types stored separately	3			
5	Temperature check completed daily. Temperatures are within requirement.(-30 ˚C to 0 ˚)	3			
	Overall Points for the Category	**15**			
13	**Bathroom, Urinals, Toilets**	**Max**	**Awarded**	**Percent**	**Result**
1	Number of bathrooms are suitable and sufficient	3			
2	Cleanliness and hygiene bathrooms adequately maintained, daily housekeeping checklist for monitoring is developed and used	3			
3	Bathrooms are adequately maintained and in good repair	3			
4	Number of toilets is sufficient	3			
5	Cleanliness and hygiene of the toilets adequately maintained, daily housekeeping checklist for monitoring are developed and use	3			
6	Toilets adequately maintained in good repair (one (1) for five(5)persons	3			
7	Electrical Panels secured, outlets safe to use.	3			
8	Illuminations should be evenly distributed and ventilations should be appropriately screened, cleaned and in good repair.	3			
9	Rest room and bathroom facilities supplied with clean hot and cold water	3			

10	All sewage connections free from nuisance odour, fly access to raw sewage and ground water contamination.	3			
	Overall Points for the Category	**30**			

14	**Laundry**	**Max**	**Awarded**	**Percent**	**Result**
1	Cleanliness and hygiene of the area adequately maintained	3			
2	Illuminations evenly distributed and ventilations appropriately screened, cleaned and in good repair.	3			
3	Electrical Panels secured, outlets safe to use.	3			
4	Laundry allowance (dry weight per person per day)	3			
5	All laundry equipment well maintained and in good condition. Equipment maintenance system in place.	3			
6	Cleaning chemicals stored in an appropriate location and available	3			
7	Suitable shelves available for cleaned clothes.	3			
	Overall Points for the Category	**21**			

15	**Housing and Living Quarters**	**Max**	**Awarded**	**Percent**	**Result**
1	Receptionist available to receive guest of employee	3			
2	Good housekeeping/cleanliness of beds and mattresses maintained	3			
3	Emergency Evacuation Route, Emergency Contact Numbers posted in each room near doors.	3			
4	Bedroom areas sufficient to accommodate persons, such that minimum area for each person is 4 square meter	3			
5	Suitable beds provided for each person	3			
6	Suitable storage for each residents personal belongings (Cupboard for clothes)	3			
7	Regular housekeeping for the entire facility and trash bins provided for each room.	3			
8	Appropriate Facilities for performing prayers provided	3			
9	Lift/Elevator maintained in good operating condition (Safety & Maintenance Certificate Displayed)	3			

10	Regular Servicing of /inspection and certificate of inspection displayed at the elevator	3			
11	Hot & Cold water available	3			
12	Access stair provided with slip-resistant or anti-slip materials	3			
13	Proper maintenance of air condition and air filters cleaned regularly (Maintenance schedule in place)	3			
14	Windows for ventilation and curtains provided and maintained	3			
15	Suitable air conditioning is provided and maintained	3			
16	Bed Bunks and mattresses should be in good condition and free of vermin and animal parasite (Bed bugs)	3			
17	Good illumination provided and maintained. Fused bulbs replaced immediately	3			
18	Smoke detectors provided in corridors and bedrooms, in good condition and regularly maintained. Records of inspection available for verification.	3			
	Overall Points for the Category	**54**			
16	**Recreation Facilities**	**Max**	**Awarded**	**Percent**	**Result**
1	Gymnasium facilities provided	5			
2	Common room with TV provided	5			
	Overall Points for the Category	**10**			

17	**Waste Management**	**Max**	**Awarded**	**Percent**	**Result**
1	The grounds and open areas surrounding the camps maintained in a clean and sanitary condition free from rubbish, debris, waste paper, garbage, or other refuse.	3			
2	Sufficient signed & labelled trash bins available	3			
3	Waste management signs in appropriate language for residents	3			
4	Waste collected on a regular basis	3			
5	Routine rodent and pest control for all buildings and grounds.	3			
6	Adequate provision for the handling of sewage and water discharge from the building?	3			
7	Records of waste disposal within 30 days of transportation	3			
	Overall Points for the Category	**21**			

18	Clinic / First Aid box	Max	Awarded	Percent	Result
1	Availability of health insurance during work	3			
2	Nurse available	3			
3	First aid room/clinic with adequate lighting, sufficient ventilation.	3			
4	Waste disposal bins for clinical items shall be available including sharps, used sterile supplies and general waste.	3			
5	Fully equipped First Aid boxes provided, minimum one per floor at easily accessible/visible location. All personal should have access to First Air Medicine.	3			
6	Minimum contents of First Aid boxes: Scissors, Eye pads, adhesive tape, adhesive bandages (Band-Aids), surgical gloves, biohazard bag, plastic forceps, triangular bandage, gauze pads, gauze bandage rolls, cold compress, and cotton buds contents list, inspection register.	3			
7	Personnel trained in First Aid	3			
	Overall Points for the Category	**21**			

19	*Security*	Max	Awarded	Percent	Result
1	Security personnel 24 hours, seven(7) days a week	3			
2	Security Plan in place	3			
3	Security Personnel trained in security requirements including body searches	3			
4	Vicinity surveillance/roving log.	3			
5	Visitors permitted into accommodation	3			
6	Personnel permitted to leave accommodation	3			
	Overall Points for the Category	***18***			

20	Transport	Max	Awarded	Percent	Result
1	Busses have valid registered license	***5***			
2	Bus drivers possess valid driving license	***5***			
3	Busses are surrounded by suitable lighting to identify dimension	***5***			
4	Busses display signage to indicate name of Contractor and contact details	***5***			
5	Buses transporting laborers are air-conditioned and provided with Sun Film/Lint.	***5***			
6	Busses are fitted with at least 6 hammers to break window glass in case of emergency	***5***			
7	Busses contain a First Aid kit which is suitably stocked and regularly checked	***5***			
8	Busses are fitted with 2 fire extinguishers (5kg dry powder) one at the front and one at the rear	***5***			

9	Busses are fitted with emergency windows which are indicated with appropriate signage	**5**			
10	Boarding / De-boarding:				
10a	Each Contractor / Sub-Contractor have to designate a bus Marshals to present on busses and control bus boarding / de-boarding at accommodation.	**1**			
10b	Busses are stopped at the designated parking area which is adequately designed to facilitate proper parking of buses with convenience for embarking or disembarking.	**1**			
10c	Busses are not moving, until all passengers are seated or disembarked and the doors including emergency door are closed.	**1**			
10d	Only one bus is boarded at a time.	**1**			
10e	Multiple boarding points for simultaneous boarding shall fulfill the followings: - Marked parking on road for all buses. - Shaded waiting canopy/bus stand for passengers. - Sign boards, marked boarding route/path with both side hand railing.	**1**			
	Overall Points for the Category	**50**			
21	**Fire Protection/Emergency Evacuation General**	**Max**	**Awarded**	**Percent**	**Result**
1	Written fire prevention plan, that consists of following: - Organization and responsibility for fire safety. - Means of raising the alarm in case of fire. - Procedure for calling the fire brigade. - Means of escape in case of fire. - Points of access and sources of water for the fire brigade. - Control of waste materials. - Security measures to minimize the risk of arson. - Staff training program.	5			
2	Emergency evacuation routes & muster points easily identifiable	5			
3	Written records of checks, inspections, maintenance work, fire patrols and drills available	5			
4	Adequate numbers of suitable extinguishers provided	5			
5	Sufficient personnel trained in the use of fire extinguishers	5			
6	Are carbon dioxide extinguishers in place adjacent to electrical equipment?	5			
7	Regular and routine inspection and maintenance of smoke detectors	5			
8	Smoke Alarms are tested regularly in all areas.	5			
9	Means of Egress signs conspicuously posted and well lit.	5			
10	Emergency Contact Numbers posted.	5			
11	Exit doors clear of combustible or other hazardous material.	5			
12	Corridors and exits unobstructed (no storage of files, furniture, etc.)	5			

13	Regular Fire Drills Conducted	5			
14	Occupants have been instructed on the evacuation plan	5			
15	Occupants know where the assembly point(s) are	5			
16	"No Smoking" signs posted	5			
17	Fire detection and alarm systems tested regularly	5			
18	Is there a method of counting the evacuees?	5			
19	Are all hydrants clear of obstruction?	5			
20	Assembly area to accommodate all occupants	5			
21	Are exit doors able to open from the direction of exit travel without the use of a key?	5			
22	Is the hose in cabinet properly racked and in good condition?	5			
23	Is the fire water storage tank to proper level?	5			
	Overall Points for the Category	**115**			

22	**Electrical**	**Max**	**Awarded**	**Percent**	**Result**
1	Does a competent electrician undertake all electrical work?	**5**			
2	No extensive use of cords from outlets (octopus)	**5**			
3	All electrical plugs, switches and cords in good repair	**5**			
4	Cords are not be run across doorways or under carpets or mats where they may be steeped on	**5**			
5	Electrical equipment turned off when not in use	**5**			
	Overall Points for the Category	**25**			
	Adjusted Score	720			

Lead Auditor:	
Auditee:	

PENGERANG ENERGY COMPLEX SDN BHD

Anti-Bribery and Corruption (ABC) and Anti-Money Laundry (AML) Policy

1. Introduction

The Company is committed to comply with relevant applicable laws, rules, regulations and ethical standards that reaffirm its oath to integrity and transparency.

While the Company implements activities and maintains relationships in countries where matters such as bribery and money laundering are a concern, the Company strictly rejects any form of corruption, bribery and money laundering practices. The Company recognizes that bribery is illegal for anyone in the public and private sector and extortion, abuse of office, fraud and money laundering are subject to criminal prosecution.

2. Purpose

This Anti-Bribery and Corruption and Anti-Money Laundry Policy iterates the Company's commitment to acting according to existing domestic and international law, and elaborates what is considered "acceptable" and "not acceptable" conduct from individuals and organizations associated with the Company.

3. Scope and Responsibility

This Policy applies to all individuals and organizations representing or acting on behalf of the Company. This includes Company staff, individuals represented in the Board of Directors, and other subsidiaries and agents (e.g. distributors) working on behalf of the Company – jointly referred to as "Company representatives". The Chief Executive Officer ("CEO"), and Chief Finance Officer ("CFO") are both, jointly as well as individually, responsible for the execution of this Policy.

4. Definitions

Corruption is defined as the misapplication of entrusted power for private gain and benefitting private relationships. Bribery, being an act of corruption, includes the direct or indirect giving and receiving of any personal, contractual or commercial advantage, outside the existing standard Company procedures, to improperly manipulate business outcomes with individuals and entities. Such advantages can include cash payments, facilitation payments, a favour or benefit in form of e.g. a contract/agreement or award, gift, donation/charitable contribution, sponsorship or political contribution. Money Laundering is defined as the disguise of the criminal origins of money or property within legal business transactions.

5. Guidelines

To combat corruption and avoid unlawful actions and extortions, Company is committed to not offering and accepting any bribes. The following will distinguish between what is acceptable and what is not acceptable:

Acceptable

Company permits the giving and receiving of small gift items (e.g. promotional items, chocolates, flowers), or appropriate and hosted entertainment and hospitality (e.g. at events, lunch, dinner) for the purpose of promoting good business relations, marking special occasions and maintaining a good image and reputation. This may, however, not be permitted for securing any personal advantage. As a general rule, 'small gifts' would mean gifts having an equivalent value below USD 200 whereas 'appropriate

entertainment/hospitality' would mean having an equivalent value of not more than USD 500 per occasion; both to be assessed in the context of prevailing customs and prices in the given situation.

Sponsorships are acceptable and wished for as long as those are rooted in clear, strict and transparent contracts linked to key deliverables and as long as they are not placed or received to inappropriately influence business outcomes or win business deals.

Unacceptable

Company representatives are strictly prohibited to directly or indirectly place, offer, promise to give or obtain bribes to inappropriately influence business operations or reward an achieved business or personal advantage.

No payments, valuable gifts, lavish entertainment and hospitality, or favours or advantages offered by a third party, will be accepted or requested by Company representatives for their personal use, or any other use not related directly to Company. Payments, hospitality or other services and favours accepted on behalf of Company but received outside normal Company administrative procedures shall be reported clearly to Company Management at the earliest convenient moment.

Company will not offer, provide, promise, or negotiate any payment, gift, hospitality, favour or advantage to government officials and foreign public officials aimed at improperly influencing standard procedures or business performance.

Facilitation payments in order to obtain services, decisions or agreements, other than formally approved and publicly announced fees, are illegal and shall not be provided by Company representatives.

It is forbidden for any Company representative, and especially for Company Management, to threaten or exert undue pressure on any representative who has refused to take part in bribery activities or other corrupt behaviour, or who has communicated concerns about behaviour of others.

6. Reporting

In case of detecting any bribery, corruption or money laundry act, or in the event that there is a potential conflict/exposure thereof, Company representatives are expected to immediately report the incident or potential conflict/exposure to the Company CEO or the CFO. Company partners and Company members are encouraged to follow the same approach.

The Company CEO will be responsible for ensuring that a reported incident or suspicion is adequately investigated and acted upon, if necessary in consultation with the Company Board of Directors. CEO will also ensure that the person that reported the incident or potential conflict/exposure is properly notified of action taken in response to said report. The CEO shall present all reported incidences and investigations, including those found not to require follow-up action, to the Company Board of Directors at least on a quarterly basis. Where and when required such reporting may be anonymized, e.g. to protect relationships or legitimate private interests. In case the reporting person has reason to expect that his/her report will not receive the right follow-up from neither the CEO nor the CFO, he/she may also report the incidence or suspicion directly to any member of the Company's Board of Directors, who is then responsible for ensuring that the report will be adequately investigated and acted upon.

7. Communication and Training

Company ensures that this Policy is communicated to all Company representatives as an additional attachment to the respective contract/agreement and, additionally, immediately

after amendments are made. Company also guarantees to make sure that the responsibilities are understood and the content of this Policy is acknowledged. In case of comprehension issues, the respective person may be talked through this Policy by responsible Company personnel, i.e. CEO and CFO.

Additionally, this Policy will be shared on Company website, encouraging Company members and partners to report any incidents (or conflicts thereof) to the Policy.

8. Internal Controls, Monitoring and Revisions

Company assures that its books, records and accounts are maintained correctly and accurately at all times reflecting every transaction, invoice and document, to facilitate anti-corrupt behaviour and increase transparency. The CFO reports the status of Company financial accounts to the CEO monthly and annually. The Board of Directors and the Audit and Risk Committee Meeting review the annual financial report, advise the CEO and CFO on accounting procedures, and confirm that control procedures are properly maintained.

This Policy as well as all related procedures and systems will be audited annually to assess its content and effectiveness. If applicable, this Policy may be subject to amendments at any time and in case of changes to legal texts and laws.

9. Assessment of Risk

To minimize risks, the Company management shall regularly assess and review risks of corruption, bribery and money laundering taking place within Company and with current and potential Company representatives and business partners, forming part of its overall risk management procedures. Company ensures that contracts with subcontractors and business partners will be reviewed on a yearly basis to check whether the terms are clear and remain appropriate for the business activities.

Prior to doing business with new customers and partners, as part of its due diligence procedures, Company will assess risks from bribery in the respective context by evaluating potential exposure to bribery as part of the customer onboarding, in line with the Company's Customer Due Diligence Policy. Company will also refer to the Corruption Perceptions Index to assess such risks.

10. Misconduct and Sanctions

Any violation of the terms in this Policy by any COMPANY representative may be subject to disciplinary action, and in extreme cases to immediate termination of employment and/or a claim for payment of damage. The same applies to any COMPANY representative knowing about any past or potential violations and failing to report those accordingly.

If employees and affiliates knowingly deceive and obstruct investigations, their action may be subject to disciplinary proceedings, such as termination of the contract and discharge and/or paying a penalty fine.

If third party agents violate the terms of the Policy know of any misconduct and fail to report to COMPANY and distort investigations purposefully, their contract shall be subject to termination.

Revised and effective August 01, 2020.

PENGERANG ENERGY COMPLEX SDN BHD

CONFLICT OF INTEREST POLICY

1. POLICY STATEMENT

The purpose of the conflict-of-interest policy is to protect the Company's interest when it is contemplating entering into a transaction or arrangement that might benefit the private interest of an Employee of the Company or might result in a possible excess benefit transaction. This Policy is intended to supplement but not replace any applicable laws governing conflict of interest applicable to non-profit and charitable organizations.

All employees of Pengerang Energy Complex SDN BHD (PEC) are required to perform the duties of their position with the highest level of integrity and independence, in a professional and ethical manner. They must also ensure that they avoid or eliminate any conflict of interest or situation that could reasonably be perceived as a conflict of interest and immediately report to their manager.

Although this policy details certain behaviours that may lead to a conflict of interest or the appearance of conflict of interest, it is impossible to anticipate all situations that could lead to one. Employees may also inadvertently find themselves in a situation that leads to or could be perceived as conflict of interest. These situations must also be disclosed.
Compliance with this policy is a condition of employment. Failure to comply with these provisions may result in disciplinary action, up to and including termination of employment.

2. SCOPE

This policy applies to all employees of PEC, as well as contractual third parties or partners doing business with the company. All are expected to abide by the provision of this policy that are reasonably applicable to them.

3. DETERMINING WHETHER THE CONFLICT EXIST

After disclosure of the financial interest and all material facts, and after any discussion with the Employee, he or she shall leave the governing board or committee meeting while the determination of a conflict of interest is discussed and voted upon. The remaining board or committee members shall decide if a conflict of interest exists.

3.1 ADDRESSING THE CONFLICT (IF ANY)

- The Employee may present to the governing board or committee meeting, but after the presentation, he or she shall leave the meeting during the discussion of, and the vote in relation to the transaction or arrangement involving the possible conflict of interest.
- The chair of the governing board or committee shall, if appropriate, appoint a disinterested Employee or committee to investigate alternatives to the proposed transaction or arrangement.
- After exercising due diligence, the governing board or committee shall determine whether the Company can obtain with reasonable efforts a more advantageous transaction or arrangement from a person or entity that would not give rise to a conflict of interest.
- If a more advantageous transaction or arrangement is not reasonably possible under circumstances not producing a conflict of interest, the governing board or committee shall determine by a majority vote of the disinterested directors whether the transaction or arrangement is in the Company's best interest, for its own benefit, and whether it is fair and reasonable. In conformity with the above determination, it shall make its decision as to whether to enter into the transaction or arrangement.

3.2 RECORDS OF PROCEEDINGS

The minutes of the governing board and all committees with board-delegated powers shall contain: -

- The names of the Employees who disclosed or otherwise were found to have a financial interest in connection with an actual or possible conflict of interest, the nature of the financial interest, any action taken to determine whether a conflict of interest was present, and the governing board's or committee's decision as to whether a conflict of interest in fact existed.
- The names of the Employees who were present for discussions and votes relating to the transaction or arrangement, the content of the discussion, including any alternatives to the proposed transaction or arrangement, and a record of any votes taken in connection with the proceedings

4. ACTION OR BEHAVIOURS TO AVOID

Below, you will find some situations, behaviours or events that should be avoided at all costs by employees, manager or other contractual third parties doing business with the company.

4.1 PERSONAL INTEREST

Employee must ensure that no conflict exists or could appear to exist between their personal interest and those of PEC potential competitor, customer,

partner, vendor, supplier or other business entity in which you have a direct or indirect, financial interest, or such other interest that may provide a benefit.

Employees must not:

- Take part in or attempt to influence any PEC decision or any business dealings with a current or potential competitor, customer, partner, vendor, supplier or other business entity in which you have a direct or indirect financial interest.
- Use the premises, equipment, supplies or service of other employees of PEC to promote their personal interests.
- Use confidential information for their personal benefits during or after employment with PEC.
- To be in a position where they could benefit directly or indirectly from a PEC business transaction (e.g. supplier of goods or service, contract, licence or partnership)
- Give preferential treatment to any supplier or other person doing business with PEC in order to serve their personal interest;
- Invest in, own, have an interest in or be an employee of an organization that might have an interest, direct or indirect in any PEC commercial transaction, except in the case of a widely held public company whose dealing with PEC do not represent a substantial portion of its total business.

This should not be interpreted as an exhaustive list of all circumstance that could lead to a real or perceived conflict of interest.

4.2 FAMILY, FRIENDS AND CLOSE RELATIONSHIPS

For purposes of this Policy, a “related person” of a director means: -

- the spouse of the director, or a parent or sibling thereof, or a child, grandchild, sibling, or parent of the director, or the spouse of any thereof, or an individual having the same home as the director, or a trust or estate of which an individual specified in this paragraph is a substantial beneficiary; or
- a trust, estate, incompetent, conservatee, or minor of which the director is a fiduciary.

Employees and managers must endeavour not to:

- Use their position or contacts at PEC to promote their personal interest or those of a family member or person with whom they have a close personal or professional relationships;
- Take part in or attempt to influence any PEC related decision or business dealing (including those concerning current or potential customers, partners, vendors or suppliers) that may benefit or appear to benefit a

relative, close personal friend or a business enterprise in which a relative or close friend is involved or has a direct or indirect financial interest.

- PEC generally does not permit work situations where a manager directly or indirectly manages a relative or a person with whom she / he has a close relationship with. If you are aware that PEC plans to hire your relative or a person for a position with whom you have a close relationship that directly or indirectly reports to you, you must disclose that information immediately.

If, during the course of employment, a non-collegiate relationship develops between you and another PEC employee within direct or indirect reporting chain, you both must promptly disclose that information. Although employees involved in a consensual relationship are individually responsible for disclosure, a manager's failure to report such a relationship will be grounds for appropriate disciplinary action.

4.3 RELATIONSHIP AND FAVOURITISM

Employees shall not grant or appear to grant preferential treatment to a person with whom they have a close personal or professional relationship. In some situations, past relationships may also give rise to a perceived conflict of interest and should be treated as such.

If an employee is in a situation where he or she could make a decision (e.g., hiring, evaluation, discipline, promotion, reward, any other form of discretionary control or the awarding of a contract) involving, directly or indirectly, a person with whom he or she has close personal or professional relationship, the employee must:

- Disclose the potential conflict to his / her manager
- Refer the decision to the manager or someone designated by him / her
- Refrain from making any recommendations or conveying views related to the decision.

Conflicts of interest may arise not only in the context of a transaction but also in situations where a director's personal interests, or the interests of a related person, personal friend, business associate, an entity in which an Employee holds an equity interest, employer, employee, or a significant creditor or debtor of the director, could reasonably be expected to exert an influence on the director's judgment regarding general Company matters and/or impair his or her ability to act in the Company's best interests.

It is important to note that a "conflict of interest" exists if a decision could be influenced (i.e., perceived conflict of interest) — it is not necessary that influence actually take place.
In addition, if an employee is in position of authority over a person with whom he or she has a close personal or business relationship, the manager must change the hierarchical relationship between the employee and that person. The

manager may also take other measures to reduce the appearance of conflict of interest, if necessary.

4.4 OUTSIDE BUSINESS ACTIVITIES

Employees are permitted to engage in outside employment or activities (in case of part time contract) as long as they inform their manager prior to starting or involved in such activity, and to the extent that:

- It does not compete with or reflect adversely on PEC or give rise to conflict of interest.
- It does not engage in any outside activity is likely to involve disclosure of PEC's proprietary information or that likely to divert time and attention from your responsibilities at PEC.
- It could not be reasonably perceived as compromising the integrity, independence and impartially expected from PEC or bring PEC into disrepute.
- It does not inappropriately exploit the employee's connection with PEC
- It does not restrict your availability or efficiency.
- It does not involve acting as a spokesperson for another organization.

4.5 OTHER ACTIVITIES

Employees are permitted to act as board members of an organization external to PEC, if their participation meets the criteria above, and if authorized by their manager beforehand. You cannot serve as a board member or technical advisor of a competitor or of a company that may reasonably be expected to become a competitor.

- Employee may be permitted to write books or work on other creative projects that are not in competition with PEC as long as they respect the criteria of outside activities mentioned above and obtained prior written authorization from their manager.

You are not required to seek approval for the following activities:

- Any affiliation with a trade association, professional association or other such organization related to your work or position at PEC.
- Participation in non-profit civic or charitable activities, including serving as a member of a board of directors or technical advisory board. However, you must obtain approval if the entity has a business relationship with PEC or expect to receive or seek a contribution from PEC.
- Positions with co-op boards, condominium association and similar entities where the sole purpose of such participation would be to hold title to and / or manager real property in which you can do reside.

- Position with holding companies, trust or other non-operating entities establishment solely for purposes of you or your family's investment, estate or tax planning or to hold you, your family's real estate or other investment that would not otherwise require disclosure under this policy.

If the manager considers the outside activity to be inappropriate, considering the criteria mentioned above, it must inform the employee in writing and the employees must avoid, discontinue or modify his / her participation in such activities accordingly. Disclosure and their assessment by the manager must be documented.

4.6 GIFTS, HOSPITALITY & OTHER BENEFITS

Accepting a gift, a benefit or an offer of hospitality for oneself or for a colleague, family member or friend may lead to perceived conflict of interest.

Employees may occasionally accept unsolicited gifts, hospitality, tickets or invitation to sports or entertainment event (e.g. tennis, football game, round of golf, theatre show or concert) or other benefits, but only if they have value of SGD 100 or less, subject to the conditions subject below. It is also permitted to occasionally accept working meals of reasonable value paid for by third party. Any such benefits will need to be declared to superior or senior reporting personnel, or to the HR department where a senior reporting personnel is unavailable.

However, employees must not accept gifts, cash vouchers, hospitality, free travel or invitation to sports or entertainment events or any other benefits:

- That could influence or be perceived to influence, the judgement and or their performance of duties;
- That are offered by a business partner and or supplier of goods or services involved in an active request for proposal, sole source contract procedure or contract discussion or in the six months following such process, or soon as they know such a process will begin in the near future.
- That are offered by a business partner and or supplier whose performance the employee is evaluating;
- That are cash, loan, discount or work rendered free of charge for personnel purpose.
- If the total value of what has been received from the same source within 12 months period would exceed SGD 500.

Employees must also refuse invitation to a conference or other formal gathering not mentioned above, organized or sponsored by an external party, a supplier, potential supplier or business partner, unless their manager determines that their attendance at such event would not compromise or appear to compromise the objectively, independence, impartiality or integrity of the employee of PEC.

5. VIOLATION OF THE POLICY

If the governing board or committee has reasonable cause to believe an Employee has failed to disclose actual or possible conflicts of interest, it shall inform the member of the basis for such belief and afford the member an opportunity to explain the alleged failure to disclose.

If, after hearing the Employee's response and after making further investigation as warranted by the circumstances, the governing board or committee determines the member has failed to disclose an actual or possible conflict of interest, it shall take appropriate disciplinary and corrective action.

6. COMPENSATION

- A voting member of the governing board who receives compensation, directly or indirectly, from the Company for services is precluded from voting on matters pertaining to that Employee's compensation.
- A voting member of any committee whose jurisdiction includes compensation matters and who receives compensation, directly or indirectly, from the Company for services is precluded from voting on matters pertaining to that Employee's compensation.
- No voting member of the governing board or any committee whose jurisdiction includes compensation matters and who receives compensation, directly or indirectly, from the Company, either individually or collectively, is prohibited from providing information to any committee regarding compensation.

7. EMPLOYEE AGREEMENT ON CONFLICT-OF-INTEREST POLICY

I have read, understand and agree to comply with the foregoing policy, rules and conditions governing the conflict-of-interest policy. I am aware that violation of this policy may subject me to disciplinary action, including termination from employment, legal action and criminal liability. Furthermore, I understand that this policy can be amended at any time.

Date : _____

PENGERANG ENERGY COMPLEX SDN BHD

EMPLOYEE Name

Signature

COMPANY Authorized Signatory

Signature

Revised and effective August 01, 2020.

PENGERANG ENERGY COMPLEX SDN BHD

TRADE CONTROLS AND SANCTIONS COMPLIANCE POLICY

[date]

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This Sanctions and Trade Controls Policy is designed to ensure that the Company comply with applicable sanctions laws imposed by Malaysia through relevant legislation and ministerial orders which take various forms such as embargoes which prohibit trade, transhipment or transit of strategic items or unlisted strategic items, freezing, seizure and forfeiture of funds, financial assets and other economic resources, travel bans to or through Malaysia and prohibition of the provisions of financial measures or other related services.

1. INTRODUCTION

WHAT ARE SANCTIONS?

As a member of the United Nations, Malaysia is obliged to comply with the UNSC's Resolutions. Sanctions are restrictions on activity with targeted countries, governments, entities, individuals and industries ("**targets**") that are imposed by bodies such as the United Nations (**UN**), the European Union (**EU**), individual countries or groups of countries.

The policy and commitment of Pengerang Energy Complex Sdn. Bhd. and its subsidiaries ("Company") has been and continues to be that all employees, officers, directors and agents of the Company must comply fully with all applicable laws and regulations governing economic sanctions and trade controls. These include the laws and regulations administered by the U.S. Department of the Treasury's Office of Foreign Assets Control ("**OFAC**"), the U.S. Department of Commerce's Bureau of Industry and Security and Census Bureau, the United Kingdom Export Control Organisation, the United Kingdom Office of Financial Sanctions Implementation, the Canadian Trade Controls Bureau, the Canadian Minister of Foreign Affairs, as well as similar laws and regulations in other jurisdictions. These laws and regulations are the primary requirements that affect the Company's trade. However, certain other government agencies maintain trade requirements that may also affect the Company.

You are required to carefully review and adhere to this Trade Controls and Sanctions Compliance Policy (the "**Compliance Policy**"). If you become aware of any violations of this Compliance Policy, you must report such violations in accordance with the reporting procedures outlined below.

2. SANCTIONS COMPLIANCE POLICY

The Company is committed to adhering to the economic sanctions laws and regulations administered by OFAC ("**OFAC Laws**") and the economic sanctions laws and regulations that apply to our operations in the other countries where we do business (collectively, with OFAC Laws, "**Sanctions Law**s"). While there are some similarities among countries with respect to Sanctions Laws, each country has different laws, regulations, and policies administered by different government agencies. This Sanctions Compliance Policy ("Sanctions Compliance Policy") is intended to facilitate the Company's compliance with Sanctions Laws and to reduce reputational, operational, and legal risks that could arise from a potential breach of the Sanctions Laws.

3. THE LAW

The overarching legislation is the Strategic Trade Act 2010 (the STA) which is consistent with Malaysia's national security and international obligations. In addition, the Anti-Money Laundering, Anti-Terrorism Financing and Proceeds of Unlawful Activities Act 2001 (AMLA) gives power to the Minister of Homes Affairs to make orders for the implementation of measures to give effect to resolutions adopted by the UNSC.

The Company or any of its directors, managers, secretary or officers and staff must not: -

- Deal with funds or economic resources owned, held or controlled by a target (or where we know or have reasonable grounds to suspect that a target is holding or controlling those funds or economic resources);
- Make funds, financial services or economic resources available, directly or indirectly to targets;
- Make funds, financial services or economic resources available, directly or indirectly for the benefit of targets; and
- Knowingly and intentionally participate in activities that would directly or indirectly circumvent the financial restrictions imposed by the sanctions regime or enable or facilitate the commission of any of the above

Violation of the STA and AMLA is punishable by fines, imprisonment, freezing, seizure and forfeiture of assets.

4. APPLICATION OF OFAC PROHIBITIONS TO U.S PERSONS AT THE COMPANY

OFAC's prohibitions apply to transactions involving the United States or conducted by any U.S. Person, wherever located. U.S. Person means any United States citizen, wherever in the world the person is located (including dual citizens), any permanent resident alien of the U.S. (wherever located), any person (natural or non-natural) located in the U.S., and any entity organized under the laws of a U.S. jurisdiction including its overseas branches/divisions. OFAC prohibitions thus apply to any director, officer, employee or agent of the Company who is a U.S. Person. The regulations generally prohibit a U.S. Person from "approving," "facilitating," participating in, financing or guaranteeing a transaction involving a person or entity on the SDN List, the EO 13599 List or who is otherwise the target of the OFAC Laws and regulations and from taking any action to evade or avoid OFAC Laws.

With respect to U.S. sanctions involving Cuba and in certain cases, Iran, the term "U.S. Person" also means any foreign subsidiary or affiliate owned or controlled by a U.S. Person. The Cuba and in certain cases, Iran sanctions programs applies to the Company as an entity. Thus, under the Cuba and (in certain cases) Iran sanctions programs, the Company and its U.S. directors, officers, employees and agents, would be considered U.S. Persons.

OFAC Policy prohibits U.S. Persons at the Company from entering into business relationships on behalf of the Company with any OFAC-sanctioned party, or any party owned or controlled by or acting on behalf of any OFAC-sanctioned party, and requires directors, officers, employees and agents to report the attempted transaction to a Compliance Officer.

The Company shall ensure that customer screening and customer due diligence procedures are in place to promote the identification of potential sanctions violations or other potentially impermissible transactions. Such procedures shall also provide for appropriate distributor screening and distributor due diligence to ensure the Company distributors comply with Sanctions laws applicable to the Company.

5. WITHDRAWAL BY AN EMPLOYEE WHO IS A U.S. PERSON

If a director, officer, employee or agent of the Company who is a U.S. Person, including any Company director, officer, employee or agent who is in the United States temporarily, finds that he or she has been assigned to work on a transaction or business matter that has been

[1]*Implementing regulations for many of the OFAC sanctions programs are codified in Title 31 of the Code of Federal Regulations, and both basic guidelines and details on implementation are available on the OFAC website at http://www.treasury.gov/ofac/.x*

[2]*The SDN List and the EO 13599 List are accessible at the OFAC website. The Consolidated Screening List, which includes the SDN List and other U.S. government lists of sanctioned and prohibited individuals and entities, is available at http://apps.export.gov/cslsearch#/csl-search*

identified as potentially involving OFAC sanctions, that director, officer, employee or agent must immediately recuse himself/herself from dealing with the transaction or business matter. The U.S. Person must also immediately inform his or her supervisor, as well as a Compliance Officer of such recusal.

6. BACKGROUND ON EU SANCTIONS[3]

This section provides an overview of current EU sanctions regulations. It is **NOT** intended to provide guidance on whether any specific activity or transaction is permitted under applicable laws and regulations. All services provided and all transactions conducted by or through the Company must comply with applicable EU sanctions regulations. If there is a question concerning these requirements or if you have been asked to do something which conflicts with these requirements, you should promptly contact a Compliance Officer.

Although the jurisdictional reach of EU sanctions regulations can vary depending on the targets, there are several common themes: -

- EU organized entities must comply with EU sanctions.
- Other countries outside of the EU also often follow EU sanctions such as Switzerland, Norway or UK protectorates or dependencies.
- EU citizens are subject to EU laws, even if they are living or working outside of the EU.
- Activities in, or partially in, the EU are covered. Any non-EU entity or person is subject to EU Sanctions Laws while they are acting within the territory of the EU.
- The EU devolves enforcement of sanctions to competent authorities of each EU Member State, such as HM Treasury and the Office of Financial Sanctions Implementation in the United Kingdom.

EU sanctions can take different forms, but the most common measures are asset freezes ("**EU Financial Sanctions**"), and arms embargoes, general or specific sectoral trade or export embargoes ("**EU Economic Sanctions**", collectively with EU Financial Sanctions, "**EU Sanctions**"). EU sanctions apply to: -

(i) any person within the territory of the EU;
(ii) any person inside or outside the territory of the EU who is a national of an EU Member State;
(iii) any legal person, entity or body, inside or outside the territory of the EU, which is incorporated or constituted under the law of an EU Member State;
(iv) any legal person, entity or body in respect of any business done in whole or in part within the EU; and
(v) any person on board any aircraft or any vessel under the jurisdiction of an EU Member State (collectively, "**EU Persons**").

EU Financial Sanctions are imposed on persons or entities (so called "**designated persons**") listed on the EU's Consolidated List of Persons, Groups and Entities ("**EU Consolidated List of Persons**"). EU Financial Sanctions include measures against government or ex-government officials and others suspected of human rights abuses, violations of public international law, internal repression or political instability, theft of state assets or funds, war crimes or assassination, terrorism and terrorist financing, being a member of Al Qaida, and assisting in nuclear proliferation. EU Financial Sanctions also target persons profiting from any such violations, crimes or abuses.

EU Financial Sanctions apply to conduct in and from the EU and generally also apply to EU citizens and companies outside EU territory. It is a criminal offense to breach an EU Financial Sanction, without an appropriate license or authorization.

Although each sanctions regime is implemented by each EU Member State individually, it can constitute a criminal offense for an EU national or company anywhere in the world to: -

(i) deal with the funds or economic resources belonging to or owned, held or controlled by a designated person;
(ii) make funds or economic resources available, directly or indirectly, to, or for the benefit of a designated person;
(iii) intentionally circumvent financial sanctions; or
(iv) fail to notify the regulator of possession of funds owned or controlled by a designated person. The definition of "funds" is broadly construed to include cash, all kinds of payment instruments, deposits, shares, derivatives, interest, guarantees, letters of credit and rights of set-off.

EU Economic Sanctions include embargoes with respect to certain products and services exported to a particular country. Where it is not prohibited to import or export goods, the particular good or destination or use may be restricted and subject to licensing. It can constitute a criminal offense to import or export goods without the required license.

EU Economic Sanctions are imposed on a country and typically involve prohibiting or restricting trade, prohibiting or restricting certain types of commercial and financial transactions with natural or legal persons in the respective country or other appropriate measures. Prohibitions or restrictions will apply in relation to goods and services which can be used for military purposes, internal repression or nuclear proliferation, for example, exporting or supplying arms or dual use products and associated technical assistance, training and financing or technologies. Sectoral EU Economic Sanctions include restrictions or prohibitions in various sectors including: -

- oil and gas;
- financial services;
- access to capital markets;
- luxury goods;
- certain computer software; and
- technologies.

The summary provided above is current as of the latest revision date of this Compliance Policy. It is the responsibility of all directors, officers, employees and agents to keep up to date on changes and additions made to the EU Sanctions.[3]

7. SANCTIONED INDIVIDUAL AND ENTITIES

Further information on the individuals and entities sanctioned under the AMLA is accessible at http://www.moha.gov.my/index.php/en/menu-utama

Additionally, the Malaysian Minister of International Trade and Industry has also designated certain individuals, entities, and countries as restricted or prohibited end-users. These are currently reported under the Strategic Trade (Restricted End-Users and Prohibited End-Users) Order 2010, as amended in 2011, 2014 and 2016, which includes any person or country that is subject to any proliferation of weapons of mass destruction-related sanction imposed pursuant

[3]The EU Consolidated List of Persons is accessible on the EU website at http://eeas.europa.eu/cfsp/sanctions/consol-list/index_en.htm.

to a decision of the UNSC. A list of individuals, entities and countries designated by the Malaysian Minister of International Trade and Industry as restricted end-users and prohibited end-users is accessible at https://www.miti.gov.my/index.php/pages/view/sta2010#Strategic%20Items%20List

8. PENALTIES

Violations of the Sanctions Laws carry significant civil and criminal penalties. For violations of the OFAC Laws, criminal penalties can include fines of up to $1,000,000 per violation and imprisonment for up to 20 years. Civil penalties for violations of the OFAC Laws can include fines of $250,000 per violation or twice the amount of the transaction that is the basis of the violation, whichever is greater.

The consequences of a failure to abide by EU Sanctions can be similarly severe. Although, each Member State's penalties vary, violations of EU Sanctions may lead to prosecution by EU Member States and result in serious criminal and administrative penalties for the Company and associated individuals.

9. EXPORT CONTROLS POLICY

The United States administers controls over the export, reexport, and transfer of goods, technology, and software for national security, foreign policy, nuclear non-proliferation, and other policy reasons. The U.S. Department of Commerce, Bureau of Industry and Security ("**BIS**"), has jurisdiction over most (but not all) such exports, re-exports, and transfers. Among other things, BIS controls goods and information having both civilian and military uses by including them on the Commerce Control List, 15 CFR Part 774. A license from BIS (and/or another U.S. agency), may be required prior to engaging in exports, re-exports, or transfers involving a prohibited end use, end destination, or end user. Prohibited end users include individuals and entities listed on various lists maintained by BIS, such as the Entity List (15 CFR Part 744, Supplement No. 4), and other U.S. government lists. Among the most restrictive end destinations are Cuba, Iran, North Korea, Sudan, and Syria. Prohibited end uses include (but are not limited to) terrorist-related end uses, the development, production, or use of rocket and missile systems, and weapons of mass destruction.

It is the policy of the Company to comply with all U.S. export control laws. In any case where an employee is uncertain as to its applicability to a particular matter, the employee should contact the Company's Compliance Officer to enable a further determination of the applicability of U.S. export controls.

10. ANTI-BOYCOTT POLICY

During the mid-1970's the United States adopted two laws that seek to discourage the participation of U.S. citizens in other nations' economic boycotts or embargoes that have been found to be contrary to U.S. foreign policy. These anti-boycott laws are the 1977 amendments to the Export Administration Act ("**EAA**") and the Ribicoff Amendment to the 1976 Tax Reform Act ("**TRA**"). It is the policy of the Company to comply with the U.S. antiboycott laws with respect to all operations that are subject to U.S. jurisdiction. Other countries in which the Company

does business may have similar laws. You should consult with the Compliance Officer regarding questions about whether the U.S. or other jurisdictions' laws apply to a transaction.

The Arab League boycott of Israel is the principal foreign economic boycott encountered by U.S. companies. The anti-boycott laws, however, apply to all boycotts imposed by foreign countries that are not authorized by the United States.

The anti-boycott provisions of the EAA, which are administered by BIS, apply to U.S. persons wherever located. A "**U.S. person**" is defined as any person who is a U.S. resident or national, including individuals, domestic concerns such as companies and associations, and controlled-in-fact foreign subsidiaries, affiliates, or other permanent foreign establishments of domestic concerns. A U.S. person's activities in the interstate or foreign commerce of the United States are subject to the prohibitions of the EAA. Such activities include those that relate to the sale, purchase, or transfer of goods or services (including information) between U.S. states, territories, or possessions or between the United States and a foreign country. Thus, the EAA covers U.S. exports and imports, financing, forwarding and shipping, and certain other transactions that may take place wholly offshore, including activities of controlled-in-fact foreign affiliates of a U.S. person relating to interstate and foreign commerce of the United States.

The TRA, which is administered by the Treasury Department, applies to all U.S. taxpayers and their related companies as well as U.S. shareholders of foreign companies. The TRA's reporting requirements apply to taxpayers' operations in, with, or related to boycotting countries or their nationals.

Conduct that may be penalized under the TRA and prohibited under the EAA includes: -

- participating (or agreeing to participate) in a boycott that is not sanctioned by the U.S. government;
- refusing (or agreeing to refuse) to do business with or in Israel or with blacklisted companies;
- discriminating (or agreeing to discriminate) against other persons based on race, religion, sex, national origin, or national identity;
- providing (or agreeing to provide) information about business relationships with or in Israel or with blacklisted companies;
- providing (or agreeing to provide) information about the race, religion, sex, or national origin of another person;
- implementing letters of credit containing prohibited boycott terms or conditions; and
- failing to report any of the above.

The EAA requires U.S. Persons to report on a quarterly basis to BIS any requests they have received to take certain actions to comply with, further, or support an unsanctioned foreign boycott. The TRA requires taxpayers to annually report to the Treasury Department operations in, with, or related to a boycotting country or its nationals and requests received to participate in or cooperate with an international boycott. The Treasury Department publishes a quarterly list of boycotting countries.

The criminal and civil penalties for violating the antiboycott provisions of the EAA are the same as those described above for trade control violations. Pursuant to the TRA, violations can result in the denial of the foreign tax credit, foreign subsidiary deferral benefits, and other tax benefits under U.S. law.

It is the policy of the Company to fully comply with U.S. anti-boycott laws and to refuse to participate in or agree to participate in any unsanctioned foreign boycott. If a Company director, officer, employee, or agent receives a request to take any action to comply with, participate in, or support an unsanctioned foreign boycott, he or she should immediately advise the

[4]The U.S. Department of Commerce maintains a public website summarizing the anti-boycott requirements at http://www.bis.doc.gov/index.php/enforcement/oac

Compliance Officer(s) and General Counsel to enable a determination of whether a report by the Company is required. The Compliance Officer(s) will, as necessary, submit reports required by the EAA and TRA to BIS and the Treasury Department.

11. RECORD RETENTION

The Company will comply with the retention requirements for all records compiled and maintained in accordance with the Sanctions Laws and trade control laws. All documents required to be maintained under U.S. OFAC Laws and trade control laws must be maintained for a minimum of five (5) years. Other jurisdictions may impose longer records retention periods.

12. COMPLIANCE OFFICER

The Company's Compliance Officer will be responsible for overseeing the coordination and monitoring of this Compliance Policy. The Compliance Officer will be responsible for overseeing all aspects of the Company's adherence to applicable Sanctions Laws and trade control laws and implementing regulations, including: -

- providing guidance to management and the different departments within the Company on economic sanctions and trade control compliance matters;
- monitoring legal and regulatory developments and best practices in the economic sanctions and trade control area;
- recommending changes to the Compliance Policy based on such developments;
- responding to inquiries regarding economic sanctions and trade control matters; and
- providing for economic sanctions and trade control training.

Other responsibilities of the Compliance Officer include: -

(i) carrying out the direction of the Board with respect to economic sanctions and trade control matters; and

(ii) coordinating with the Company's human resources department to communicate updates to the Compliance Policy.

13. SCREENING CLIENTS

We screen all clients either from those countries on the sanctions list or with links to them.

We conduct screening before we: -

(a) Undertake any work for or on behalf of the individual or entity;
(b) Receive or transfer any funds to, from or on behalf of the individual or entity; and/or
(c) Routinely – every 6 months and whenever we become aware that a target has been added or removed from the sanctions lists

14. SCREENING OTHERS

In addition to screening our clients, we follow the above screening procedures or: -

(a) Directors and beneficial owners of corporate clients; and
(b) Intended recipients of funds in transactional and litigation matters, where we have reason to believe that they may be subject to sanctions.

15. DUTY TO COOPERATE

The Company may at any time undertake formal or informal audits, investigations, or inquiries concerning compliance with this Compliance Policy and related procedures. The Company expects and requires that all directors, officers, employees and agents will fully cooperate with the Company, outside counsel, outside auditors, or other similar parties in all such audits, investigations, and inquiries. Failure to cooperate constitutes a breach of this Compliance Policy and, in addition to other applicable legal obligations, may result in termination, cancelation of contracts, or other appropriate action.

16. TRAINING

To promote awareness of the Company obligations under the Sanctions Laws and trade controls laws, and to help employees understand their roles and responsibilities under this Compliance Policy, Company will provide periodic training. All designated employees are required to participate in and complete the Company's general sanctions and trade controls training program. New hires will receive training during orientation as appropriate. The Company will maintain records of training materials and attendance at training sessions.

17. INDEPENDENT REVIEW

The Company's compliance department is responsible for ensuring that an independent review of this Compliance Policy and independent testing of quality assurance are conducted. These internal audits must take place at least annually. In performing this review and testing, the Company is committed to addressing adequately its systems and controls for complying with Sanctions Laws and trade controls laws and regulations and shall, at a minimum: -

(i) perform transaction testing designed to ensure reasonably that the institution is following Sanctions Laws and trade controls laws;
(ii) review processes to assess knowledge of regulations and procedures;
(iii) review written procedures and training programs for completeness and accuracy; and
(iv) report findings to the Compliance Officers. The Compliance Officer(s) will ensure the results of such independent reviews are communicated to the Audit Committee.

18. WHO TO CONTACT WITH QUESTIONS

If any of the Company's director, officer, employee or agent has any doubts or questions as to whether his or her conduct is permissible under the Sanctions Laws and trade control laws or this Compliance Policy, he or she is strongly encouraged to contact a Compliance Officer. It is

imperative when seeking advice from legal counsel that all facts be disclosed fully and promptly. Legal counsel then will be able to make recommendations that are designed to further the Company's legitimate business needs without creating undue legal risks.

19. COMPLIANCE PROCEDURES

A copy of this Compliance Policy will be furnished to employees who work in sensitive areas. These employees will be asked to sign the attached acknowledgment form or provide an electronic acknowledgement to the same effect. Human Resources shall retain records of all such acknowledgements.

Whenever you become aware of any issue or practice that involves a violation or potential violation of this Compliance Policy, Sanctions Laws or trade control laws, you must report this issue or practice as soon as possible to one of the following: -

- your supervisor;
- the Human Resources Department;
- the Legal Department;
- a Compliance Officer;
- our Compliance Helpline at [ ]; or online via [ ]; or
- Compliance Officer: [Enter name]
  Tel: [Enter phone number]
  Email: [Enter email address]

If you prefer, you may report anonymously through any one of these channels.

Any potential match identified through our screening process must be properly investigated before we can take any further steps.

You are responsible for reporting any potential matches immediately to the Compliance Officer. The Compliance Officer will investigate whether there is an actual match.

The result of that investigation may be that we: -

(a) Seek guidance from Strategic Trade Secretariat, Ministry of International Trade and Industry; and/or
(b) Ask an external party to investigate whether the person or entity we are dealing with is in fact a target.

Where there is a positive match against the sanctions lists: -

(i) Decline to act;
(ii) Cease to act
(iii) Inform the Company as necessary

It is not for you to decide whether there is a positive match and if so, whether we should act. Your responsibility is simply to complete the Sanctions Report Form and submit it to the Compliance Officer who will decide how to proceed.

20. INFORMING STRATEGIC TRADE SECRETARIST ("STS"), MITI

The STA requires us to inform STS, MITI as soon as practicable if we know, or have reasonable cause to suspect, that a person who is or has been a client or a person with whom we have had dealings in the course of our business: -

(a) Is a target;
(b) Is a person acting for or on behalf of a target; or
(c) has committed an offence under the STA

The Compliance Officer is responsible for providing information to STS, MITI

21. REPORTING CONCERNS

Where you are concerned that: -

- Your matter involves a target; or
- Someone has committed an offence under a sanctions regime.

You must raise your concern with the Compliance Officer.

If you believe the matter you are dealing with involves a sanctions issue and possible money laundering or terrorist financing issue you must raise the issue with the Compliance Officer

22. TIPPING OFF

Remember, there are no tipping-off offences in the sanctions legislation—the lists of targets maintained by STS and MITI are public documents.

We will not therefore commit an offence if we tell our client that we will not trade with them because they are on the sanctions list.

The Compliance Officer will advise you on communicating with the client in the event that a sanctions issue is raised.

Foot notes:

[1]*Implementing regulations for many of the OFAC sanctions programs are codified in Title 31 of the Code of Federal Regulations, and both basic guidelines and details on implementation are available on the OFAC website at http://www.treasury.gov/ofac/.x*

[2]*The SDN List and the EO 13599 List are accessible at the OFAC website. The Consolidated Screening List, which includes the SDN List and other U.S. government lists of sanctioned and prohibited individuals and entities, is available at http://apps..gov/cslsearch#/csl-search*

PENGERANG ENERGY COMPLEX SDN BHD

ACKNOWLEDGMENT OF RECEIPT

I acknowledge that I have received a copy of the Company's Trade Controls and Sanctions Compliance Policy. I recognize that the Compliance Policy is a statement of the Company's policy regarding full compliance with the laws and regulations governing economic sanctions and trade controls applicable to the Company's operations, a policy to which the Company is committed and to which I am expected to adhere during the term of my employment or business relationship with the Company or any of its subsidiaries and other managed companies, and that it is not, in any way, an employment contract or an assurance of continued employment. I further acknowledge and agree that I have read and understood the Compliance Policy, and will comply with the Compliance Policy, including my reporting obligations if I suspect or become aware of any violations of the Compliance Policy or the applicable laws and regulations governing economic sanctions and trade controls.

(X)

_____

Signature

_____

Name (please print)

_____

Location

_____

Date

PEC TECHNICAL STANDARDS

HEALTH, SAFETY AND ENVIRONMENT

GUIDELINE

Labour Management Plan – Construction and Operations phases

(Doc.No.: PEC-04D1)

PREFACE

PEC Technical Standards (PTS) are based on the experience acquired during the involvement with the design, construction, operation and maintenance of processing units and facilities of Aromatic Complex Project in Singapore. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good technical practice to be applied by PEC' OPUs in oil and gas production facilities, refineries, gas processing plants, chemical plants, marketing facilities or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to users for their consideration and decision to implement. This is of particular importance where PTS may not cover every requirement or diversity of condition at each locality. The system of PTS is expected to be sufficiently flexible to allow individual operating units to adapt the information set forth in PTS to their own environment and requirements.

When Contractors or Manufacturers / Suppliers use PTS they shall be solely responsible for the quality of work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, it is expected of them to follow those design and engineering practices which will achieve the same level of integrity as reflected in the PTS. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the owner.

The right to use PTS rests with three categories of users:

1. PEC and its affiliates.
2. Other parties who are authorized to use PTS subject to appropriate contractual arrangements.
3. Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) and 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

Subject to any particular terms and conditions as may be set forth in specific agreements with users, PEC disclaims any liability of whatsoever nature for any damage (including injury or death) suffered by any company or person whomsoever as a result of or in connection with the use, application or implementation of any PTS, combination of PTS or any part thereof. The benefit of this disclaimer shall inure in all respects to PEC and/or any company affiliated to PEC that may issue PTS or require the use of PTS.

Without prejudice to any specific terms in respect of confidentiality under relevant contractual arrangements, PTS shall not, without the prior written consent of PEC, be disclosed by users to any company or person whomsoever and the PTS shall be used exclusively for the purpose they have been provided to the user. They shall be returned after use, including any copies which shall only be made by users with the express prior written consent of PEC.

The copyright of PTS vests in PEC. Users shall arrange for PTS to be held in safe custody and PEC may at any time require information satisfactory to PEC in order to ascertain how users implement this requirement.

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1 INTRODUCTION

1.1 *Project Background*

The proposed Pengerang Energy Complex Sdn Bhd (PEC) is planned as a world-scale condensate splitter and aromatics complex, on a 250-acre site in the Pengerang Industrial Park (PIP) that is located within the Pengerang Integrated Petroleum Complex (PIPC), Pengerang, Kota Tinggi District, Johor (refer to *Figure 1.1*).

The production capacity of the PEC is about 5.844 million metric tonnes per annum (MMtpa), or 16.7 kilometric tonnes per day (kMtpd), of aromatic petrochemicals and oil products, which will be processed from 6.324 MMtpa of condensate feedstock using the latest generation of proven UOP technology.

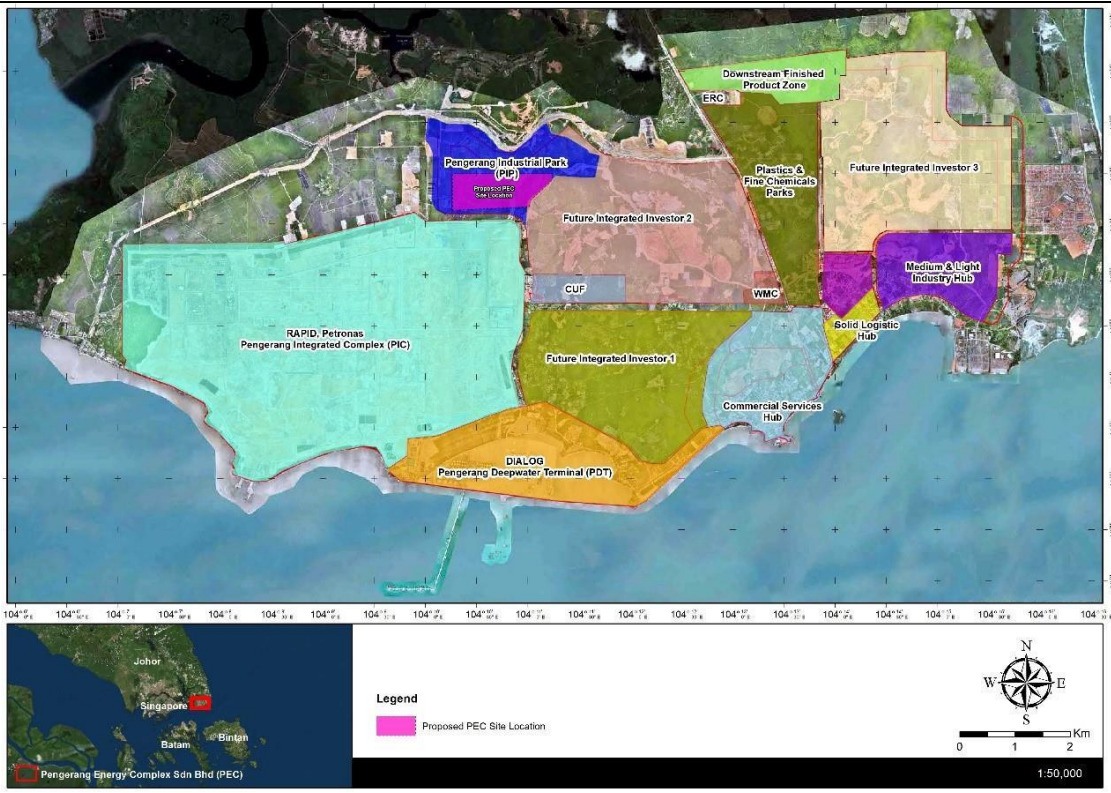


Figure 1.1 Site Location within PIPC

The PEC project is estimated to cost about RM13.0 billion (~US$ 3.4 billion) and expected to spur economic activities. The PEC project is also in-line with the Johor State Government's development policy to develop Pengerang into a major oil & gas, and petrochemical hub for Malaysia. The Pengerang Integrated Petroleum Complex (PIPC) is creating value to the downstream oil and gas value chain in Johor. Pengerang is considered a strategic location due to:

- Access to existing major international shipping lanes; Middle East –Singapore –China;
- Water depth of 24m enables Very Large Crude Carriers (VLCCs) and Ultra Large Crude Carriers (ULCCs) to berth right at the jetty;

- Safe and sheltered harbour;
- No breakwater required with sufficient seagoing passage for Very Large Crude Carriers (VLCCs) and Ultra Large Crude Carriers (ULCCs);
- Low negative socio-economic impact;
- Availability of sufficient development land;
- A single candidate plot in excess of 20,000 acres;
- Very few Environmentally Sensitive Areas (ESAs) which are easily preserved; and
- Proximity to an existing major trading hub adjacent to Singapore.

1.2 *Objective and Scope*

The main objective of this Labor Management Plan is to identify, understand, assess, and address the concerns and issues related to labour management or activities on the human rights such as workers and community members.

The Labour Management Plan is also intended to provide the guideline for manging processes and dealing with Local and Migrant workers for the project during construction and operation phase of the aromatic complex.

Construction, Commissioning, Start-up and schedule

Construction is planned to start in Q1 2022 and will stretch up to 2024, with start-up in 2025. The current schedule indicates 42 months period with the following breakdown:

- Engineering Procurement Construction (ISBL) - 36 months
- Engineering Procurement Construction (OSBL) - 32 months
- Commissioning and start-up - 6 months

Operations Phase :

- Q1 2025

Workforce Size – Construction Phase

Peak anticipated workforce size is around 7,000 workers. The peak construction period is expected to occur within 20 months of the project start and to last about 12 months.

1.3 Site & Land Setting

The site setting and land use information covers within and surrounding area of the Project of 5 km. This section of the report assesses the sensitive receptors (information of the existing physical environment) within 5 km as illustrated in *Figure 4.2* below.



Figure 4.2 – Limit of Study Area for Land Use Analysis
Source: PEC, ESC, ESRI, and Google Earth
Image Year 2016

2. Land Acquisition and Resettlement

The access to the land of the proposed location is provided by PIPC and JCorp and the potential site for development consideration has been defined in the PIPC master development plan. Based on PEC's Land Acquisition and Resettlement Framework document, PEC has selected investor Lot 2 due to the following reasons:

- Bigger land acreage is available in investor Lot 2. This provides more flexibility in project development layout alignment;
- No significant settlement is located within the site. Only several houses are located within the project site and this is expected to significantly minimise the potential social impacts in results to resettlement issues;
- No religious or cultural heritage significant site is located within the project boundary and this is expected to minimise social conflicts;
- In general, the site is less populated and with lesser commercial activities in comparison to investor Lot 3; and
- In terms of topography, environmentally sensitive land use, accessibility and infrastructure, Site A (Investor Lot 2) could be relatively easy for mitigation.

The location of investor Lot 2 (Site A) and investor Lot 3 (Site B) are referred in *Figure 4.3* below.

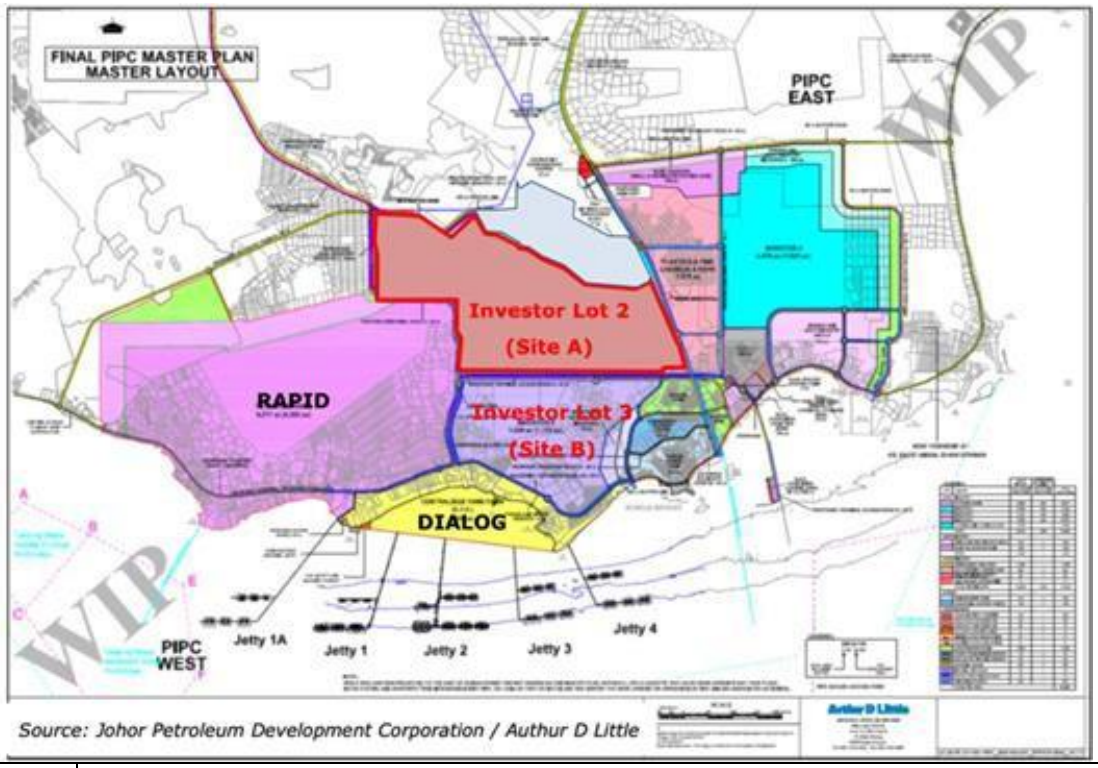


Figure 4.3 – Location of Investor Lot 2 (Site A) and Investor Lot 3 (Site B) within PIPCDevelopment Zone
Source: ChemOne with Google Earth Image, 2016

3. Purpose

This Labour Management Plan (LMP) is intended to set out responsibilities and the management practices associated with the management of labour during construction and operation of the Projects. This LMP is developed to:

- Ensure that the Projects comply with applicable environmental, health and safety, and social (E&S) requirements defined in *Section 3;*
- Ensure that all personnel involved in the construction and operation of the Project, including the contractors, and subcontractors fully comply Project Owner's obligations on labour management; and
- Implement applicable Good International Industry Practices (GIIPs) to manage labour related issues in an appropriate manner.

a. Scope

This LMP applies to the following personnel during construction and operation of PEC Projects:

- All the Projects' employees including part-time, temporary, seasonal and migrant employees;
- Contractors and its subcontractors and their employees, associated with the Projects; and
- Primary suppliers.

This LMP applies to all parties involved in labor activities during construction and operation of the Projects. Failure to comply with the requirements of this LMP may lead to disciplinary action in accordance with the Projects' Internal Labor Regulation and national regulations.

b. Malaysian Law & Regulations

Table 3-1 below summarized the relevant laws and legislations pertaining human rights in Malaysia.

Table 3-1: Laws and Legislations of Human Rights in Malaysia

No.	Legislation	Related Provisions
1	The Federal Constitution of Malaysia	• The supreme law of Malaysia which came into force in 1957 which comprises of 15 Parts containing 230 Articles and 13 Schedules. • Part II of the Constitution is on **Fundamental Liberties** which outlined in Articles 5 to 13 under the following headlines; liberty of the person, prohibition of slavery and forced labour, protection against retrospective criminal laws and repeated trials, equality, prohibition of banishment and freedom of movement, freedom of speech, assembly and association, freedom of religion, rights in respect of education and rights to property. • **Article 5 – Right to life and liberty** enshrined that no person may be deprived of life or personal liberty except in accordance with law, not to unlawfully detained a person (right of *habeas corpus*), a person's right to be informed of the reasons of his arrest and legally represented a lawyer of his choice and a person not to be arrested for more than 24 hours without magistrate's permission. • **Article 6 – No Slavery** provides that no person may be held in slavery and all forms of forced labour are prohibited, but federal law such as National Services Act 1952 may provide for compulsory services for national purposes. • **Article 7 – No retrospective criminal laws or increases in punishment and no repetition of criminal trials** provides the following protections; (i) no person to be punished for an act or omission which was not punishable by law, (ii) no person to suffer greater punishment for an offence than was prescribed by law at that time it was committed, (iii) a person who has been acquitted or convicted of an offence shall not be tried again for the same office except where a retrial is ordered by a court.

No.	Legislation	Related Provisions
		• **Article 8 – Equality** provides that all persons are equal before the law and entitled to its equal protection (Clause 1) and Clause 2 states that there is no discrimination against citizen on the ground. • **Article 9 – Prohibition of banishment and freedom of movement** stated that Malaysian citizens are protected against being banished from the country that every citizen has the right to move freely throughout the Federation. • **Article 10 – Freedom of Speech, Assembly and Association** allows the freedom to every Malaysian citizen, but the freedom and rights are not absolute; the Constitution itself, under this Article expressly permits Parliament by law to impose restrictions in the interest of the security of the Federation, friendly relations with other countries, public order, morality to protect the privileges of Parliament, to provide against contempt of court, defamation, or incitement to any offence. There are several acts of law that regulate the freedoms mentioned by Article 10 of the Constitution. • **Article 11 – Freedom of religion** expressed that every person has the right to profess and practice his own religion and has the right to propagate his religion, but the state law and in respect, the Federal Territories, may control or restrict the propagation of any religious doctrine. • **Article 12 – Rights in respect of education** provides that there shall be no discrimination against any citizen on the grounds only of religion, race, descent or place of birth (i) in the administration of any educational institution maintained by a public authority and (ii) in providing out of the funds of a public authority financial aid for the maintenance or education of students in any educational institution. Every religious group has the right to establish and maintain institutions for the education of children in its own religion. • **Article 13 – Rights to property** stated that no person may be deprived of property save in accordance with law and no law may provide for the compulsory acquisition or use of property without adequate compensation.

2	Child Act 2001 (Act 611)	• Malaysia acceded the Convention on the Rights of the Child (CRC) in 1995 which has introduced the Child Act in 2001. • This Act incorporates the core principles for the protection, care and rehabilitation of children which stated the principles of non-discrimination, best interests of the child, the right to life, survival and development as well as respects for the views of thechild. • National Council for the Protection of Children was established to advise the Government on child protection issues. • National Advisory and Consultative Council for Children acts as national focal point for children's well-being and development. Child Protection Teams and Child Activity Centres are established at both state and district levels as requires in the Act to protect children that are at risk or vulnerable to all forms ofabuse and exploitation. • This Act also provides procedures before the Court for Children to administer the juvenile justice, taking into account the mentaland emotional maturity of a child. • Among the initiatives to safeguard children from violence, abuse, neglect and exploitation, are criminalized incest under the Penal Code (Act 574) while the Domestic Violence Act 1994(Act 521) protects the child against violence within the family
3	Children and Young Persons (Employment) Act 1966 (Act 350)	• The framework of this Act is for elimination of child labour, and protection of children and young persons. • This Act defines a child as a person under 14 years of age and ayoung person as under 16 years of age. • Children may be employed in light work done within the family, specific public entertainment, apprenticeships, and work sponsored by the Government. • Night work, underground work, and sets forth hours of work are impeded under this Act. • The Minister responsible for labour may declare an employment suitable for children or young persons if he is satisfied that such employment poses no threat to the life, limb, health or morals of the employees *(Section 2(4)).* • In order to enter into a contract of services, children and young persons shall be competent, provided that no damages or indemnity under the Employment Act 1955 shall be recoverable from a child or young persons for breaching the services *(Section13)*.

No.	Legislation	Related Provisions
4.	Employment Act, 1955	• This Act sets out minimum benefits that are afforded to applicable employees where any clause in an employment contract that purports to offer less favourable benefits than those set out in the Act, shall be void and replaced with the minimum benefits in as in the Act. • The applicable employees under this Act are: - employees whose monthly salary does not exceed MYR2,000; - employees who are engaged in manual labour, regardless of salary; - employees engaged in the operation or maintenance of mechanically propelled vehicles; - employees who supervise or oversees other employees engaged in manual labour; and - employees engaged in any capacity on a vessel (subjected to certain other conditions). Under the Minimum Wages Order 2020, effective 1st February 2020, the minimum wage is MYR 1,200.00 a month (for City Council or Municipal Council areas) and MYR 1,100.00 a month (for areas other than the City Council or Municipal Council areas). The rate is based on calculations of total working hours of a maximum of 48 hours a week. • Under *Section 6*, it is a legal obligation for the employer to make the following statutory contributions: - Employees Provident Fund (EPF) - Social Security Organization (SOCSO) - Employee Insurance System (EIS) - Schedular Tax Deduction or *Potongan Cukai Berjadual* (PCB) - Trade Union Subscription Fees or PTPTN loan repayment (subjected to a request in writing by the employee must first be obtained) • Employees are also entitled for annual leave, sick leave, maternity and paternity leave as outlined in the Act. • In *Section 60A (1)* of the Act, an employee shall not be required under his contract of service to work: - - more than 5 consecutive hours without a period of leisure of not less than 30 minutes duration; - more than 8 hours in a day; - in excess of a spread over a period of 10 hours in a day; and - more than 48 hours in a week. • Every employee shall be allowed in each week a paid rest day of one whole day as may be determined from time to time by the employer *(Section 59)*. Should the employee be required to work on a rest day, he shall be paid not less than 2 times of his daily rate of pay. The same principle applies should he be

		required to work overtime on the said rest day. • Overtime work is classifying in the Act *(Section 60A (3))* as any number of hours of work carried out in excess of the normal hours of work per day. • *Section 8* of the Act prohibits any term in any contract of service that restrains the right of an employee to: - - join a trade union; - participate in trade union activities; and - to associate with any persons with regards to a trade union. • The Act also provides the law against sexual harassment which are basically applicable to all employees regardless of whether they fall under the purview of the Act. *Section 81A-81G* sets out that the employer has the duty to act by inquiring into complaint of sexual harassment. • The right of the employer to reorganize business for the purpose of the economy and convenience provided it acted bona fide. *Section 60J* of the Act provides that the Human Resource Minister may provide for the employees (i) termination benefits, (ii) lay-off benefits and (iii) retirement benefits. Employees are entitled to the termination and lay-off benefits, depending on their tenure of employment and pro- rata as respect an incomplete year, calculated to the nearest month.
5.	Persons with DisabilitiesAct 2008	• Malaysian Government has ratified the **Convention on the Rights of Persons with Disabilities** in the United Nations Headquarters in 2008. The ratification affirms broad protections for people with disabilities, including the rights to life, freedom from discrimination, equal recognition before the law, and access to justice, education, employment and health. • This Act defines "persons with disabilities" as those who have long term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society. • The main purpose of this Act is to provide for the registration, protection, rehabilitation, development and well-being ofpersons with disabilities. • *Section 25* stated that persons with disabilities with qualifying criteria under the Act shall be registered with the Registrar General for Persons with Disabilities and to be issued with an "OKU Card" or "Kad OKU". The receiver will be able to claim certain benefits such as monthly allowance, scholarships, tax rebates, and free treatment at public hospitals. • The Act also ensure that persons with disabilities have the right to equal access to public facilities, public transportation, education and employment as there are for persons without disabilities. • *Section 29* defines the right to access to employment on equal bases with persons without disabilities and the employer has to provide favourable workplace conditions and stableemployment. Any workplace discrimination can be challenged under this Act. • An employer cannot terminate a person's employment becausea person has a mental health disability if terms of the employment contract has not been violated. This includes self- paced

		workloads and flexible hours, different job responsibilities, allowing leave for treatment or during periods of hospitalization or incapacity. • The Register of Persons with Disabilities shall de-registered the persons if and when social cognitive and/or behavioural functioning is no longer impaired *(Section 21 and Section 25).*
6.	Education Act, 1996	• The aim of provisions in this Act are to further consolidate the national education system for the generation in accordance with the country's aspiration of making Malaysia the centre of excellence for education and to outline the legislation related to education. • Allows for free state education for all children or, if a parent chooses, to educate their child themselves (providing the education given is efficient). • Generally, the Act has three general legislative provisions namely; - the National Philosophy of Education 1988; - consolidation of the national education system to include all levels of schooling from pre-school to tertiary education and all categories of school e.g., government-aided and private schools; and - the National Language as main medium of instruction and as compulsory subject in all schools and institutions. • *Section 9* of the Act provides general principle that a child will be educated in accordance to their parents' wishes and parents shall request from the local authority to place their child in any schools where there is difference in costing. • *Section 19* of the Act stated that the local authority to provide a suitable education for a child who is out-of-school ill, excluded "or otherwise" which applies to all children, whether they have • special educational needs (SEN) or not.
7.	National Policy on Women, 1989	• The objective of the policy is to ensure equitable sharing of resources and development opportunities between men and women as well as to integrate women into all sectors of development in accordance with their capabilities and needs[1]. 1https://www.adb.org/sites/default/files/institutional-document/32552/women-malaysia.pdf

8.	Anti-Trafficking in Persons and Anti-Smuggling of Migrants Act 2007 (Act 670)	• The Act is enacted to prevent and combat trafficking in persons and smuggling of migrants as well as elimination of forced labour. • "Human trafficking" in this Act refers to any act that involves the acquisition or the retention of employment or services of a person through coercion and includes the act of recruiting, transporting, transferring, protecting, providing or accepting a person for the purpose of exploitation. • "Exploitation" refers to any form of sexual exploitation, forced work or services, slavery, practices similar to slavery, or any activities that contravenes the law or human organ transplants *(Section 2).* • "Smuggling of migrants" means arranging, facilitating or planning, directly or indirectly, any unauthorized entry into or through a country, or an unauthorized exit of those who are not citizens or permanent residents of that country *(Section 2).*
9.	Freedom of Association and the Right to Collective Bargaining	*Mediation Act, 2012* – An Act to encourage and promote mediation as a method of alternative dispute resolution by providing for the process of mediation, thereby facilitating the parties in disputes to settle disputes in a fair, speedy and cost-effective manner. • *Arbitration Act 2005* – An Act to reform the law relating to domestic arbitration, provide for international arbitration, the recognition and enforcement of awards and for related matters. • *Trade Union Act 1959* – The restrictions under this Act that does not allow general unions for workers. Instead, membership of any trade union is confined to only those who are employees of a particular industry, establishment, trade and occupation e.g., a bank employee could only be a memberof a banking union but not a member of an airline or teachers'union. This Act protects workers from being victimized by an employer for joining a union. • *Industrial Relations Act 1967* – This Act provides a comprehensive legislation regarding trade unions, collective bargaining, and labour disputes. Section 4 of the Act stated forthe freedom of association and prohibits discrimination basedon trade union membership. Recognition of trade unions, collective bargaining procedures, representation in case of dismissals, and conciliation procedures are also outlined in theAct.

c. International Applicable Standard

Other than the National laws and legislations relevant to human rights, in Table *3-2* below are the summary of applicable international standards and guidelines.

Table 3-2: International Standard and Guidelines

No.	Standards/Guidelines	Applicable provisions
1.	United Nations Guiding Principles on Business and Human Rights (UNGPs)	• The UNGPs contains three chapters or pillars; **protect, respect and remedy** where each defines concrete, actionable steps for governments and companies to meet their respective duties and responsibilities to prevent human rights abuses in company operations and provide remedies if such abuses take place. • General principles in these guidelines consists of the following: - States' existing obligations to respect, protect and fulfil human rights and fundamental freedoms; - the role of business enterprises as specialized organs of society performing specialized functions, required to comply with all applicable laws and to respect human rights; and - the need for rights and obligations to be matched to appropriate and effective remedies when breached. • The purpose of these guidelines is for any States or companies to prevent, address and remedy human rights abuses committed in business operations. It currently forms the framework for actions by States and companies in connection with business-related human rights impacts. However, the UNGPs are non-binding and do not create new legal obligations for either States or companies.
2.	International Labour Organization (ILO) Core Labour Standards	• The International Labour Organization has maintained and developed a system of international labour standards since year 1919. • The standards are aimed at promoting opportunities for women and men to obtain decent and productive work, in conditions of freedom, equity, security, and dignity. • International labour standards main aim is about the development of people as human beings. Supported in this statement is the Declaration of Philadelphia (1944) that recognized "labour is not a commodity", not an inanimate product, that can be negotiated for the highest profit or the lowest price. Instead, work is considered as part of everyone's daily life and crucial to a person's dignity, well-being and development as a human being. • In achieving the goal of decent work in the globalized economy requires action at the international level. The International Labour Organization (ILO) contributes to this legal framework by elaborating and promoting international labour standards aimed at making sure that economic growth and development go hand-in-hand with the creation of decent work.

No.	Standards/Guidelines	Applicable provisions
		• These standards are the result of discussions among governments, employers and workers, in consultation with experts from around the world which represent the international consensus on how a particular labour problem could be addressed at the global level and reflect knowledge and experience from all corners of the world. • Governments, employers' and workers' organizations, international institutions, multinational enterprises and non-governmental organizations can benefit from this knowledge by incorporating the standards in their policies, operational objectives and day-to-day action. • The legal nature of the standards means that they can be used in legal systems and administrations at the national level, and as part of the corpus of international law which can bring about greater integration of the international community.
3.	International Bill of Human Rights	• The International Bill of Human Rights reposed of the Universal Declaration of Human Rights, the International Covenant on Economic, Social and Cultural Rights and the International Covenant on Civil and Political Rights and its two Optional Protocols. • Universal Declaration of Human Rights was adopted and proclaimed by the General Assembly as a common standard of achievement for all peoples and all nations. It consists of a preamble and 30 Articles, setting forth the human rights and fundamental freedoms to which all men and women, everywhere in the world, are entitled, without any discrimination. • **Article 1** – All human beings are born free and equal in dignity and rights. • **Article 2 –** basic principle of equality and non-discrimination as regards the enjoyment of human rights and fundamental freedoms, forbids "distinction of any kind, such as race, color, sex, language, religion, political, or other opinion, national or social origin, property, birth or other status". **Article 3 –** proclaims the right to life, liberty and security of a person – a right essential to the enjoyment of all other rights. This Article introduces Articles 4 to 21, in which other civil and political rights are sets out including; freedom from slavery and servitude; freedom from torture and cruel, inhuman or degrading treatment or punishment; the right to recognition everywhere as a person before the law; the right to an effective judicial remedy; freedom from arbitrary arrest, detention or exile; the right to a fair trial and public hearing by an independent and impartial tribunal; the right to be presumed innocent until proved guilty; freedom from arbitrary interference with privacy, family, home or correspondence;freedom of movement and residence; the right of asylum; the right to a nationality; the right to marry and to found a family; the right to own property; freedom of thought, conscience and religion; freedom of opinion and expression; the right to peaceful assembly and association; and the right to take part in the government of one's country and to equal access to public service in one's country.

No.	Standards/Guidelines	Applicable provisions
4.	Equator Principles (EP) 4	• The Equator Principles are adopted to ensure Projects are developed in a manner that is socially responsible and reflects sound environmental practices. The ten (10) principles are in line with the objectives and outcomes of the United Nations Sustainable Development Goals (SDGs). • **Principle 4 – Environmental and Social Management System and Equator Principles Action Plan** - Projects that are under Category A and B are required to developed and/or maintain an Environmental and Social Management Plan (ESMS). - The Plan is to address issued raised in the Assessment process which incorporate actions that may require to comply with the applicable standards. • An Equator Principles Action Plan (EPAP) shall be developed when applicable standards are not met to the satisfaction.
5.	International Finance Corporation (IFC) Performance Standards (PS) **Performance Standard 2 – Labour and Working Conditions**	• Protection of the fundamental rights of workers as the workforce is a valuable asset, and a sound worker-management relationship is a key ingredient in the sustainability of a company. This PS is applicable during the environmental and social risks and impacts identification process, where the implementations are necessary to meet the expectations in the Company's Environmental and Social Management System (ESMS). It applies to the Company's direct workers, contracted workers and also supply chain workers. • Requirements under this PS are (i) working conditions and management of worker relationship, (ii) protection of the workforce, (iii) occupational health and safety, (iv) workers engaged by the third parties, and (v) supply chain.

No.	Standards/Guidelines	Applicable provisions
6.	International Finance Corporation (IFC) Performance Standards (PS) **Performance Standard 5 – Land Acquisition and Involuntary Resettlement**	• The PS5 perceived that project-related land acquisition and restrictions on land-use may have adverse impacts on communities and persons using the land. Involuntary resettlement refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood). • In order to avoid expropriation and eliminate the need to use governmental authority to enforce relocations, the Company is encouraged to use negotiated settlements meeting the requirements in this PS, even if they have the legal means to acquire land without the seller's consent. • This PS applies to physical and/or economic displacement resulting from the following types of land-related transactions: •land rights or land use rights acquired through expropriation or other compulsory procedures legally; •land rights or land use rights acquired through negotiated settlements with property owners or those with legal rights tothe land if failure to reach settlement would have resulted in expropriation or other compulsory procedures; •projects where involuntary restrictions on land use and access to natural resources cause a community or groups within a community to lose access to resources usage where they havetraditional or recognizable usage rights; •certain project situations requiring evictions of people occupying land without formal, traditional, or recognizable usage rights; or •restriction on access to land or use of other resources including communal property and natural resources such as marine and aquatic resources, timber and non-timber forest products, freshwater, medicinal plants, hunting and gatheringgrounds and grazing and cropping areas. • However, the PS5 is unapplicable for resettlement that resulting from voluntary land transactions and projects that is not changing the land use of affected groups or communities. • Generally, the requirements of this PS5 involve project designing stage, compensation and benefits for displaced persons, community engagement, grievance mechanism, resettlement and livelihood restoration planning and implementation, displacement, and private sector responsibilities.

6.	International Finance Corporation (IFC) Performance Standards (PS) **Performance Standard 7 – Indigenous Peoples**	• PS7 noted that Indigenous Peoples (IPs) as social groups with identities that are distinct from mainstream groups in national societies, whom are often among the most deprecated and vulnerable segments of the population. • Nonetheless, project proponent can create opportunities for IPs to participate in, and benefit from project-related activities that may help them fulfill their goal for economic and social development. • This PS applies to communities or group of IPs who maintain a collective attachment i.e., whose identity as a group or community is linked, to distinct habitats or ancestral territories and the natural resources therein. Besides, it also applies to communities or groups that have lost collective attachment to distinct habitats or ancestral territories in the project area. • The requirements under this PS7 including: - avoidance of adverse impacts; - participation and consent; - circumstances requiring free, prior and informed consent; - mitigation and development benefits; and • private sector responsibilities where Government is responsible for managing IPs issues.
7.	International Finance Corporation (IFC) Performance Standards (PS) **Performance Standard 8 – Cultural Heritage**	• PS8 acknowledges the importance of cultural heritage for current and future generations. This is horizontal with the Convention Concerning the Protection of the World Cultural and Natural Heritage which target to ensure that the Company protect cultural heritage in the course of their project activities. • Besides that, the requirements outlined in this PS are based on standards set by the Convention on Biological Diversity which apply to cultural heritage regardless of whether or not it has been legally protected or previously disturbed. • The requirements in this PS focused on: - protection of cultural heritage in project design and execution; and • project's use of cultural heritage.
8.	World Bank Group (WBG) Environmental Health and Safety (EHS) Guidelines	• The Environmental, Health and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). • The General EHS Guidelines are tailored into four (4) main sections/topics (i) Environmental, (ii) Occupational Safety and Health, (iii) Community Health and Safety, and (iv) Construction and Decommissioning. It shall be used together with the relevant Industry Sector EHS Guidelines. Applicable topic for human rights under the World Bank EHS Guidelines is the **Community Health and Safety**. This section of the Guidelines is addressing some aspects of projects activities are taking place outside the traditional project boundaries, but nonetheless related to the project operations, as may be applicable on a project basis. Issues may arise at any stage of project life cycle and can have an impact beyond the life of the project.

		• The topic covers the following requirements: - water quality and availability; - structural safety of project infrastructure; - life and fire safety; - traffic safety; - transportation of hazardous materials; - disease prevention; and - emergency preparedness and response.

4. DEFINITIONS

Term	Definition
Audit	Systematic, independent and documented process for obtaining audit evidenceand evaluating it objectively to determine the extent to which the audit criteria are fulfilled.
Collective bargaining agreement	A contract specifying the terms and conditions for work, negotiated between anorganization (e.g. employer) or group of employers and one or more worker organization(s).
Corrective action	Action to eliminate the cause of a detected nonconformity and to preventrecurrence.
Child labor	Means the employment of children whose age is below the host country's statutory minimum age of employment or employment of children in contraventions of International Labour Organization Convention No. 138 "Minimum Age Convention" (www.ilo.org). In the case of Malaysia, the minimum age of employment is 18 years old.
Discrimination	Means discrimination on the grounds of race, skin color, nationality, ethnicity,gender, age, pregnancy, marital status, religion, opinion, disability, family responsibility, HIV infection, establishment of or participation in trade union orinternal employee organization in a manner that affects the equality of opportunity of employment.

Forced or compulsory labor	Means all work or service not voluntarily performed, that is, extracted fromindividuals under threat of force or penalty.
Harassment	Any improper and unwelcome conduct that might reasonably be expected or be perceived to cause offence or humiliation to another person. Harassment may take the form of words, gestures, actions or omissions which tend to annoy, alarm, abuse, demean, intimidate, belittle, humiliate or embarrass another or which create an intimidating, hostile or offensive work environment. It includes harassment based on any grounds, such as race, religion, color, creed, ethnic origin, physical attributes, gender or sexual orientation.
Migrant worker	A migrant worker is a person who either migrates within their home country oroutside it to pursue work.
Non-conformity/ Non-compliance	Non-fulfilment of a requirement.
Primary supplier	Those suppliers who, on an ongoing basis, provide goods or materialsessential for the core business processes of the Projects.
Nonverbal harassment	Nonverbal harassment includes distribution, display or discussion of any written or graphic material that ridicules, denigrates, insults, belittles or showshostility, aversion or disrespect toward an individual or group because of national origin, race, color, religion, age, gender, sexual orientation, pregnancy, appearance, disability, sexual identity, marital status or other protected status.

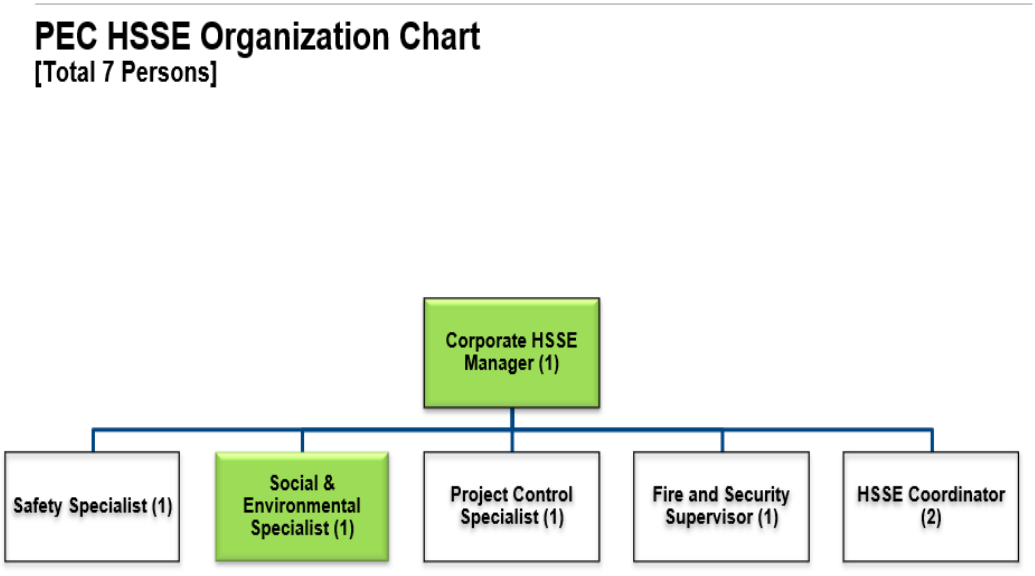
Term	Definition
Sexual harassment	Means any sexual act of a person against another person in the workplace against the latter's will. "Workplace" means the location when an employee works under agreement or as assigned by the employer
Aromatic Complex	The Project Owner's functional department that acts as an EPC Contractor.
Subcontractor and O&MContractor	An individual or company that enters into a subcontract/contract (directly or indirectly) with the PEC project to perform a specific task or provide services forthe Projects.
Supplier/subcontractor	Any entity or individual(s) in the supply chain that directly provides the organization with goods or services integral to, utilized in or for the productionof the organization's goods or services.
The Project Owner	Pengerang Energy Complex SDN BHD

Trade union	Means primary organization of Trade Union, which gathers members of TradeUnion in one or a number of agencies, organizations, enterprises and be recognized by Trade Union at their directly higher level as prescribed by law and charter of Malaysian Trade Union.
Verbal harassment	Verbal harassment includes comments that are offensive or unwelcome regarding a person's national origin, race, color, religion, age, sex, sexual orientation, pregnancy, appearance, disability, gender identity or expression,marital status or other protected status, including epithets, slurs and negative stereotyping.
Worker organization	An autonomous voluntary association of workers organized for the purpose offurthering and defending the rights and interests of workers.

5. ROLES AND RESPONSIBILITIES

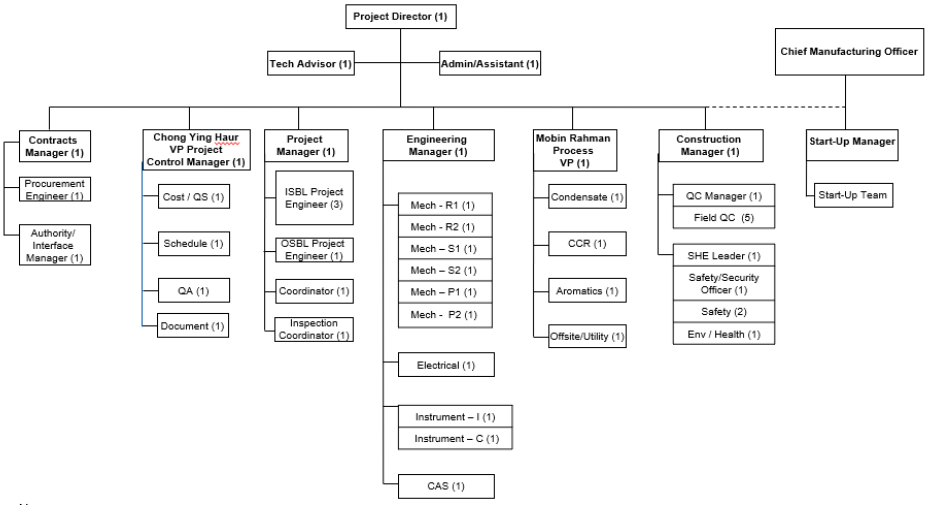
The Projects reserves the right to change the LMP according to the business needs of the Projects andto comply with any changes in the relevant regulatory requirements. The LMP will therefore be updatedon a regular basis. The Projects is responsible in disclosing the LMP to all employees, the Projects' contractors, subcontractors, and primary suppliers, and inform if any revisions made.

Employees in the Projects shall keep themselves informed of any changes made in the LMP. It is the employees' responsibility to understand and comply with all procedures stated herein, and seek clarification if needed. The rules and guidelines specified in this LMP are applicable to all employees ofthe Projects. Figure 5.1 and Figure 5.2 below presents the HR structure over the Projects.



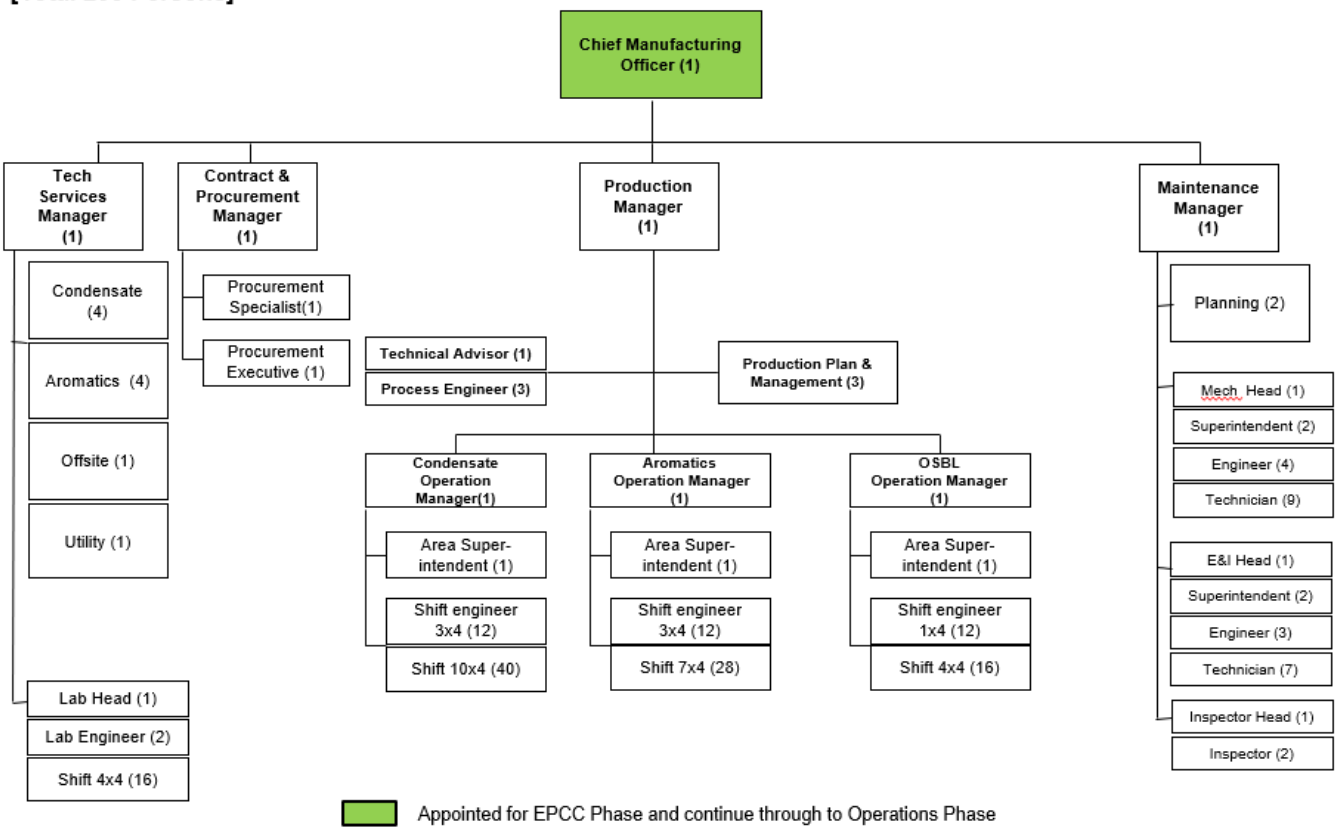
PEC Integrated Project Organization (EPCC Phase)

[Made up of PEC direct employees and members from the PMS Contractor and the O&M Advisor]
[Total 46 Persons]



PEC Integrated Operations & Maintenance Organization (Operations Phase)

[Including members from the O&M Advisor]
[Total 203 Persons]



Within this Plan, roles and responsibilities in relation to labor management are provided in Table 5.1.

Table 5.1 Roles and Responsibilities

Roles	Responsibilities
HSSE Manager at the Company level ('HSSE DeputyManager')	■ Lead the Internal Labour and Working Condition Management Audit andLabour Compliance Self-Assessment, prepare and submit report to the Site Manager/PEC Director; and ■ Review Report on Corrective Actions Implementation Status submitted byHR Specialist.
Site Manager/Project Director at the Site ('Site Manager/ Director')	■ Ensure the Projects' LMP implementation are aligned with Malaysian regulations and international practices (e.g. IFC, USEXIM) that the Projectshas committed to; ■ Review contractors' monitoring report submitted by HR Specialist; ■ Review and approve HR training plan submitted by HR Specialist; ■ Prepare annual budget to implement LMP; ■ Review and approve Disciplinary Report submitted by HR Specialist; ■ Be responsible for overall implementation of corrective actions during theinternal audits implemented by HR Specialist; ■ Ensure provision of necessary resources, including budget and competentpersonnel are provided to manage labour issues being aligned with requirements and commitments; and ■ Ensure the Projects' LMP is monitored and reviewed regularly.

HR Head / Specialist at the Site/ Deputy Head HR ('HR Specialist')	■ Ensure that all the employees, contractors, subcontractors and primary suppliers have access to the most recent LMP at all times in a languageunderstood by them; ■ Implement LMP of the Projects; ■ Review and update the LMP; ■ Prepare, disclose and inform to all employees, and implement LabourUtilization Plan (when needed); ■ Monitor the implementation of LMP of the Projects; ■ Prepare and update wage scale (when needed); ■ Check employee's profile during recruitment process; ■ Undertake diligent reference checks of candidates before hiring; ■ Prepare and update Labour contract for employees; ■ Monitor working hours and overtime hours of employees to ensurecompliance with laws; ■ Update and implement disciplinary process; ■ Coordinate with Trade Union/Workers' Organization to implement this LMP; ■ Receive grievance, ensure documented properly and that database of grievances is updated regularly including details of grievance resolution;

Roles	Responsibilities
	■ Participate in review, investigate, resolve and follow up grievances; ■ Review documents submitted by contractors/subcontractors as mentionedin Section 6.2.9.1; ■ Work closely with community People's Committee and Police related torisks and violations of the Projects' migrant employees/workers in host commune; ■ Review documents/ procedures submitted by contractors/subcontractors/suppliers during the selection process ofcontractors/subcontractors/suppliers; ■ Overall responsible for monitoring contractor's, subcontractor's, andsupplier's implementation on labor management; ■ Review monthly performance report of subcontractors and conductquarterly monitoring audit during construction phase; ■ Conduct semi-annual monitoring audit to contractors and subcontractors,prepare monitoring report and submit to the Director during operation phase; ■ Overall responsible in monitoring Subcontractor's and Contractor'simplementation of the CAP; ■ Work with the Project and its subcontractors/contractors in developinga training program for labour management; ■ Prepare and submit external report to local authorities as mentioned inSection 7.3.2; ■ Implement corrective actions for issues identified during the internal auditsand assessments of the EHSS Deputy Manager; ■ Prepare external report to Lenders (if needed); and ■ Prepare training plan for newly-hired and on-job employees and coordinate with other departments on implementation training plan.

Trade Union/Workers' Organization[1]	Trade Union/Workers' Organization in the company shall be responsible for: ■ Representing the workers' collective by: - negotiating, signing and supervising the implementation of collectivebargaining agreement (CBA) at the company; - litigating in Court upon violations of the legal and legitimate rights and interests of a workers' collective; and - participating in labour and administration lawsuits and enterprise bankruptcy cases in order to protect the legal and legitimate rightsand interests of workers' collectives and workers; ■ Cooperating with the company to formulate and monitor the implementation of wage scales and tables, and labour standards andregulations, including regulations of wage payment and bonuses;

Roles	Responsibilities
	■ Entering into dialogue with the company to settle problems related to the rights and obligations of workers, including business and production situation, implementation of the employment contract, CBA and other regulations at the workplace, working conditions, etc.; ■ Proposing issues for collective bargaining which relate to wages, bonus, allowance and wage increase, time of work and time of rest, overtime work, breaks between shifts, employment security for workers, occupational safety and health, implementation of internal work regulations, and other issues of concern to the two parties; ■ Guiding and counselling workers on their rights and obligations upon signing and implementing labour contracts with the company; ■ Taking part in the settlement of labour disputes together with the competent agencies, organizations and personnel; ■ Offering settlement proposals to competent organizations and state agencies for consideration when the legal and legitimate rights and interests of workers' collectives and workers have been breached; and ■ Participating and coordinating with competent state agencies to inspect, examine, and supervise the implementation of labour regulations at the company.

HR Manager of Subcontractorsand O&M Contractors	■ Coordinate with HR Specialist in implementation of the LMP; ■ Develop a separate grievance mechanism or adopt the Projects' WorkerGrievance Mechanism to collect and resolve grievance raised by contractor's and its subcontractor's workers; ■ Communicate contractor's grievance mechanism to all contractor's and itssubcontractor's workers and implement the mechanism accordingly; ■ Prepare and submit quarterly and annually internal report to HR Specialistduring construction and operation phases respectively; ■ Support HR Specialist to conduct Contractor/Subcontractors/SupplierManagement Audit; and ■ Implement the corrective action plan of the Contractor/Subcontractors/Supplier Management Audit and submitevidences to HR Specialist for further verification.
All employees	■ Participate in related trainings; ■ Comply with requirements in the Plan; and ■ Cooperate with the employer and others to enable them to fulfil their legalobligations.

6. LABOR MANAGEMENT

a. Labor Policy

The Projects' Labour Policy (Figure 6.1) takes into consideration its type of business processes. It is a wide-range strategic document to reflect the Projects' commitment to comply with internationally recognized standards and applicable local laws and regulations, and are complied with by all employees, contractors, subcontractors and primary suppliers of the Projects. The Labour Policy will be communicated in a language understood by the Projects' employees, contractors/subcontractors and primary suppliers for further compliance and implementation.

Labor Policy

The Projects endeavours to enhance effective human resources management practices in all its activities witha special focus on the following:

- **Working Relationship**

  The Projects provides all employees with documented information that is clear and understandable, regarding their rights under relevant laws and regulations in Malaysia and any applicable collective agreements, including their rights related to hours of work, wages, overtime, compensation, and benefits upon beginning the working relationship and when any material changes occur.

- **Working Conditions & Terms of Employment**

  The Projects provides all employees with reasonable working conditions and terms of employment. The Projects would follow the local regulatory requirements on working hours and wages, including aspects related to working hours per week, adequate days off, overtime and related compensation, minimum wages and social benefits. All employees are entitled to local holidays and annual leave.

  The Projects shall be in compliance with the local regulatory requirements and internationally recognized standards on working conditions, including the physical environment, health, and safety precautions, and access to sanitary facilities.

  The Projects commits to the implementation of fair and consistent disciplinary procedures to deal with non-compliance with The Projects' management system behaviour.

  The Projects and its employees can terminate the labour contract based on the local regulatory requirements and The Projects' policy but shall provide notification in advance. Notice period shall be referred to the employment contract.

  The Projects commits to respecting employees' personal dignity, including refraining from physical punishment or abusive language.

- **Gender Equity**

  The Projects commits to promoting and applying equal opportunity between women, men, and women and men regardless of sexual orientation individuals by providing an inclusive working, learning and social environment in which the rights and dignity of all employees are equal and respected.

  The Projects commits to fostering this through promoting and encouraging gender equity at all stages of the employment lifecycle including recruitment, retention, performance management, professional development, promotion, talent identification, succession planning, remuneration and resignations.

- **Harassment and Abuse**

  The Projects commits to provide a workplace free from harassment and abuse to all employees. Employees are encouraged to report harassment and abuse issues through The Projects' Worker Grievance Mechanism.

- **Workers' Organizations**

  The Projects commits to respect employees' rights to freely associate, organize and bargain collectively in accordance with applicable laws and regulations.

- **Non-Discrimination & Equal Opportunity**

  The Projects commits to ensure all employees are not discriminated against based on their gender, age, race, religion, physical ability, political opinion, social or ethnic origin or sexual orientation, or any other characteristics that do not pertain directly to their work performance.

- **Retrenchment**

  The Projects commits to undertake an alternative analysis prior to implementation of retrenchment. If the alternative analysis shows the retrenchment cannot be avoided, a retrenchment plan will be developed based on consultation with employees, which is in compliance with Malaysian regulations.

- **Grievance Mechanism**

  The Projects commits to provide a grievance mechanism for employees and their organization, where they exist, to raise workplace concerns. This mechanism allows for anonymous complaints to be raised and addressed, and also ensures that all information related to grievances will be treated confidentially.

  Third party (i.e. contractor, subcontractor, supplier) shall provide a grievance mechanism for their employees, which shall be as per the applicable standards for the Projects and at par with that provided by the Projects. In case where a third party is not able to provide a grievance mechanism, The Projects' Worker Grievance Mechanism will extend to serve workers engaged by the third party.

- **Child Labour and Forced Labour**

  The Projects applies strict management on prohibition of child labour and forced labour.

- **Occupational Health & Safety**

  The Projects will provide a safe and healthy work environment, taking into account inherent risks in its particular sector and specific classes of hazards in The Projects' work areas, including physical, chemical, biological, and radiological hazards, and specific threats to women.

  The Projects shall establish a program to implement, check and review health and safety status including occupational health, workplace safety, and fire safety and emergency response.

  The conditions of the workplace need to be explained to employees prior to employment and shall be documented in the employment contract.

- **Workers Engaged by Third Parties**

  The Projects shall ensure the third parties who engage these workers are reputable and legitimate enterprises and have an appropriate labour policies and procedures that will allow them to operate in accordance with the requirements of applicable national laws and regulations and international recognizedstandards.

- **Supply Chain**

  The Projects applies management procedure over its primary suppliers, to identify child labour, forced labour and significant safety issues related to supply chain workers. For these identified risks, The Projects will take appropriate steps to remedy them. Where remedy is not possible, The Projects will shift the certain primary supply chain over time to suppliers that can demonstrate that they are complying with the requirements of prohibition of child labour and forced labour, and prevention of significant safety issues.

b. Labor Procedures/Requirements

i. Working Conditions and Terms of Employment

1. Probation

- The probation period shall be negotiated by the Projects and candidates based on the candidates' job. Only one probation period is applied for a job, and the probation shall not exceed:
  - 180 days for the position of the Projects executive prescribed by the Law on Enterprises;
  - 60 days for positions that require a junior college degree or above;
  - 30 days for positions that require a secondary vocational certificate, professional secondary school; technicians, and skilled employees; and
  - Six (6) working days for other jobs.
- A copy of probation contract will be provided to candidate which outlines working conditions and term of employment of the candidate during probation period;
- Upon expiry of the probation period, the Projects shall notify the candidate of the probation result. If the result is satisfactory, the Projects will sign a labour contract with the candidate. If the result is not satisfactory, the Projects may terminate the probation contract;
- During probation period, either party have the right to terminate the probation contract without prior notice and compensation obligation; and
- The salary during probation period shall be agreed upon by the two parties but shall be at least equal to 85% of the offered salary and shall be above the regional minimum wage.

2. Labor Contract

General Principles

- The labour contract is an agreement between the Projects and an employee on a paid job, salary, working conditions, rights and obligations of each party in the labour relations. The labour contract is also a legal binding agreement between the Projects and an employee, which is the first basis to resolve conflicts and disputes arising in labour relations;

- All individuals recruited to work for the Projects shall enter into a labour contract with the Projects without making any employment fees;
- A labour contract shall be concluded in writing and made into two copies, one of which will be retained by the employee, the other by the Projects. A labour contract shall be provided in Malay and the employee's language;
- A labour contract is mutually agreed by both the Projects and an employee on the basis of respect, voluntariness, equality, good faith, cooperation and honesty;
- A labour contract is effective from the signing date stated in the contract, unless otherwise agreed by both parties or prescribed by relevant laws and regulations;
- In all cases, the Projects will not retain any original copies of personal documents, passport, qualifications, diplomas, certificates of employees; request the employee to make a deposit in cash or property as security for his/her performance of the labour contract with the Projects; or force the employeeto keep performing the labour contract to pay debt to the Projects;
- The following principles are adopted by the Projects with regards to protection of worker's right to privacy:
  - Notification: notification to workers on the personal data collection process, the type of personal data collected, and the purpose of collecting the personal data;
  - Consent: personnel data shall not be disclosed without the worker's consent;
  - Security: personal data shall be kept secured and confidential;
  - Disclosure: workers shall be informed as to who is collecting their data;
  - Access: workers shall be allowed to access their data and make corrections to any inaccurate data; and
  - Accountability: workers shall have a method available to them to hold data collectors accountable for not following the above principles.
- Implementation of the labour contract shall adhere to the employment act 1955 and itsunder-law regulations.

Conclusion of Labor Contract

The Projects will sign a labour contract with the candidate who satisfies the probation period. A labour contract shall be concluded in one of the following types:

- A fixed-term labour contract is a contract in which the two parties fix the term of the contract for a duration of up to 36 months from the date of its signing. If the employee keeps working upon expiration of this second fixed-term labour contract, the third labour contract shall be of indefinite-term; and
- An indefinite-term labour contract is a contract in which the two parties neither fix the term nor the time of termination of the contract.

The content of labour contract shall follow the Malaysia Labour Code.

Termination of Labor Contract

An employee and the Projects shall have the right to unilaterally terminate the labour contract, however, notification shall be given to each other in advance:

- at least 45 days in case of an indefinite-term labour contract;
- at least 30 days in case of a labour contract with a fixed term of 12 – 36 months; and
- at least three (3) working days in case of a labour contract with a fixed term of under 12 months.

An employee is shall have the right to unilaterally terminate the labor contract without prior notice if he/she:

- is not assigned to the work or workplace or not provided with the working conditions as agreed in the labor contract,;
- is not paid adequately or on schedule
- is maltreated, assaulted, physically or verbally insulted by the employer in a manner that affects the employee's health, dignity or honor; is forced to work against his/her will;
- is sexually harassed in the workplace;
- reaches the retirement age, unless otherwiseagreed by the parties; or

The Projects shall have the right to unilaterally terminate an employment contract without prior notice in one of the following circumstances:

- The employee is not present at the workplace after the time limit specified
- The employee is not present at work without acceptable excuses for at least 05 consecutive working days.

The Projects shall have the right to unilaterally terminate an employment contract but have to notice in advance in one of the following circumstances:

- The employee repeatedly fails up to three (3) times to perform his/her work according to the criteria for assessment of employees' fulfillment of duties established by the employer. The criteria for assessment of employees' fulfillment of duties shall be established by the employer with consideration taken of opinions offered by the representative organization of employees (if any);
- The employee is sick or has an accident and remains unable to work after having received treatment for a period of 12 consecutive months in the case of an indefinite-term labor contract, for 06 consecutive months in the case of a labor contract with a fixed term of 12 – 36 months, or more than half the duration of the contract in case of a labor contract with a fixed term of less than 12 months. Upon recovery, the Projects may consider concluding another labor contract with the employee;
- In the event of a natural disaster, fire, major epidemic, hostility, relocation or downsizing requested by a competent authority, the employer has to lay off employees after all possibilities have been exhausted;
- The employee reaches the retirement age, unless otherwise agreed by the parties;
- The employee fails to provide truthful information during the conclusion of the employment contract in accordance in a manner that affects the recruitment.

3. Wage and Benefits

Wage

- Employees will be paid based on their performance and skills regardless of employees' characteristic such as gender, age, race, religion, disability, nationality, political beliefs, membership of unions, ethnic origin, religious beliefs, as well as sexual orientation. The base monthly salary shall be determined according to wage scale and shall not be lower than the regional minimum wage.
- The wage will be paid monthly in MYR. If payment date coincides with the weekly rest day (Saturday or Sunday) or public holiday, the wage will be paid on the following day. Payslip willalso

be provided to each employee confidentially at the time of the payment and will be understandable for all employees, which includes without limitation of: basis salary, actual working hours/days of the period of the payment, number of hours working on night time and amount of payment, number of overtime hours and amount of payment, number of leave hours/days, allowances, amount and type of each deduction (e.g. statutory , fees etc.), net salary.

- HR Specialist shall prepare a wage scale with consideration of the regional minimum wage and consultation with Trade Union/Workers' Organizations. The wage scale will be developed in accordance with the Malaysian Labour Code and will be updated when necessary.

Adjustment of Wage

- The Projects will conduct performance assessments transparently following the established wage scale and adjustments of wage for all employees accordingly. The wage will be adjusted based on the assessment result. Employees will not be considered in adjustment of wage if their performance is assessed as unsatisfactory.

- Annual budget and the inflation rate of the previous year as announced by the Malaysian government will be considered during the adjustment of wage.
- The basic wage will be adjusted with the change of local minimum wage standard (if applicable).

Benefits

The statutory benefits include medical examination, social security and childcare assistant:

- Medical examination benefits: employees who work in hazardous working conditions will be provided medical examination for every six (06) months, others will be provided annually; and
- Social security: provide social security (i.e. social, health) foremployees, who sign labour contract with the company from one month or more, according to local regulatory requirements, the payment shall be paid by the company that has labour relationship with the employee, the specific proportion is determined in Table 6.1;

Table 6.1 Specific proportion of SOCSO

	Employment Injury insurance and Pension (%)		Pension (%)		Employment Injury(%)	
	Employee	PEC	Employee	PEC	Employee	PEC
Local employees	0.75	1.75	0.2	0.2	0	1.25

7. Compensation for Damage

An employee who causes damage to equipment or otherwise damages the employer's assets shall have to pay compensation in accordance with laws.

In case the damage caused by an employee is not serious, not deliberate and is worth less than 10 months of regional minimum wage announced by the Government, the employee shall have to pay a compensation of not more than his/her three (3) months salary. The Projects has the right to conduct wage deduction from the employee's salary every month to make up for the loss. The one-time wage

deduction is no more than 30% of monthly salary. If the amount of wage deduction is more than 30% of monthly salary (after paying compulsory social, health and unemployment insurance, and income tax), it will be deducted monthly.

An investigation shall be conducted when an employee causes damage to the company equipment or assets. The Projects shall assign resources to set up an Investigation Committee, members typically include the HR Specialist, workers' organization representative, supervisor of employee and other related managers (as needed). Investigation Committee shall review, investigate and consult with employee as well as relevant personnel and/or contractor to understand clearly and fully about the situation of the damage. If required, a meeting can be organized for collection of detailed information, clarification, discussion, consultation and advice. Minutes of the meeting shall be recorded in the Investigation Form (Appendix A) for further monitoring and audit.

8. Hours of Work and Breaks

Regular working hours of all employees at the Projects is 8 hours per day and/or 48 hours per week. Employees are entitled to have at least four (4) days off per month. Female employees who are on their 7th-month of pregnancy and who are nursing a child under 12 months of age will only work 7 hours per day but will be compensated for 8 hours.

Employees who perform shift work are entitled to have:

- At least 30 minutes paid break when working on day shift (any time between 6:00 – 22:00);
- At least 45 minutes paid break when working on at least 6 hours per day, including at least 3 hours of night shift (any time between 22:00 – 6:00);
- Additional amount at least equal to 30% of the salary calculated according to the salary unit or the salary for a job performed during normal workdays when working on night shift any time between 22:00 – 6:00); and
- A break of at least 12 hours before beginning another shift.

1. Overtime Arrangements and Overtime Compensation

The legal requirement on maximum overtime allowed shall be followed as not to exceed 4 hours per day, 40 hours per month, and 300 hours per year. The overtime premium shall be paid in accordance with local regulatory requirements of Malaysia as presented in Table 6.2. In case Collective Bargaining Agreement has different requirements on overtime premium, more stringent requirement shall be applied.

Table 6.2 Overtime Premium Applied for the Projects' Employees

	Working day	Weekly rest day	Statutory holiday
Overtime during day time (any time between 6:00 – 22:00)	150 %	200%	300 %
Overtime during night time (any time between 22:00 – 6:00) and does not work overtime during day time on that day	200 %	270%	390 %

Overtime during night time (any time between 22:00 – 6:00)and works overtime consecutively from day time to night time on that day	210 %	290%	450 %

2. Leave

The breaks and leave include statutory holiday, public leave, marriage leave, maternity leave, sick leave, work injuries leave, personal leave, bereavement leave and annual leave.

Statutory holiday

The statutory holiday is implemented in accordance with local relevant laws and regulations, including:

- Chinese New Year Holidays: 02 days;
- International Labour Day: 01 day (the 1st of May of the Gregorian calendar);
- Hari Raya : 02 days
- Vesak Day : 1 day
- Hari Raya Haji : 1 day
- Hijri New Year : 1 Day
- National Day : 1 Day.
- Maulidur Rasul : 1 day
- Christmas Day : 1 Day

Marriage leave

Employees are provided three (3) paid days for their marriage leave and one (1) paid day for their child's marriage. Employees shall take the marriage leave within one year after obtaining the marriage certificate. Employees who are eligible for marriage leave shall submit the application with the copy of marriage certificate at least one week in advance.

Maternity leave

- During an employee's pregnancy, the employee is entitled five (5) days for pregnancy check-ups. According to the pregnancy check-up results, the employee is entitled to apply for pre-maternity leave for no more than 1 months, which is included in the total days of maternity leave.
- Female employees are entitled to have a total of 3 months of maternity leave and are paid in according to social insurance law. In case of a multiple birth, the leave shall be extended by one
  a. month for each child, counting from the second child.
- Female employee may return to work after she has taken at least four (4) months of maternity leave if she obtained a confirmation from a competent health facility that the early resumption of work does not adversely affect her health. In this case, besides the salary of the working days, which is paid by the company, the female employee shall continue to receive the maternity allowance in accordance with social insurance law.
- An employee shall be reinstated to her previous work after finishing her maternity leave without any reduction in her salary, rights and benefits before the leave. In case the previous work is no longer available, the company shall assign another work to the employee with a salary not lower than the salary she received prior to the maternity leave.

- A male employee whose wife dies in childbirth, an employee who adopts a child under 06 months of age, a female employee who becomes a surrogate mother shall be entitled to maternity leave in accordance with social insurance laws.

Paternity leave

The male employees are entitled to have paternity leave in accordance with local regulations, as below:

- Two (2) working days;
- Five (5) working days, in case their wives undergo a surgical birth or give birth to children before 32 weeks of pregnancy;

Sick leave

Employees are entitled to have sick leave due to illness or non-work-related injury, employees are treated according to his/her social security payment. The salary will be paid in accordance with local regulatory requirements during sick leave.

Work injuries leave

Employees who sustained injuries that are recognized as work injuries according to local laws and regulations will be entitled to work injuries leave. The days of work injuries leave are determined by local relevant government authorities according to the severity of work injuries. During the work injuries period, employees' wage and benefits are implemented in accordance with local regulatory requirements.

Bereavement leave

Employees are entitled to have paid bereavement leave for: three days on death of employees' parent or adoptive parent, parent or adoptive parent of employees' spouse, employees' spouse, and employees' child or adopted child. Employees who are eligible for bereavement leave shall submit the application latest on the first day after returning to work.

Annual leave

- (a) eight days for every twelve months of continuous service with the same employer if he has been employed by that employer for a period of less than two years;
- (b) twelve days for every twelve months of continuous service with the same employer if he has been employed by that employer for a period of two years or more but less than five years; and
- (c) sixteen days for every twelve months of continuous service with the same employer if he has been employed by that employer for a period of five years or more,
- Vocational training, apprenticeship period, and probation period will be included in working time for calculation of annual leave; and
- The employee who, due to employment termination, job loss or for other reasons, has not taken, or fully not taken annual leave is entitled to 100% of the salary for the untaken leave days.

Unpaid leave

- Employees are entitled to have unpaid bereavement leave for: one day on the death of employee's grandparent or sibling;
- Employees are entitled to have unpaid marriage leave for: one day on marriage of employees' parent or sibling.

- Employees who want to take unpaid leave have to discuss and obtain approval from respective managers.

3. Labor Disciplinary Practice

Principles and procedures for taking disciplinary measures

- Disciplinary measures against an employee shall be taken in accordance with the following regulations:
  - The employer is able to prove the employee's fault;
  - The process is participated in by the representative organization of employees to which the employee is a member;
  - The employee is physically present and has the right to defend him/herself, request a lawyer or the representative organization of employees to defend him/her; if the employee is under 15 years of age, his/her parent or a legal representative must be present;
  - The disciplinary process is recorded in writing.
- It is prohibited to impose more than one disciplinary measure for one violation of internal labor regulations.
- Where an employee commits multiple violations of internal labor regulations, he/she shall be subjected to the heaviest disciplinary measure for the most serious violation.
- No disciplinary measure shall be taken against an employee during the period when:
  - The employee is taking sick leave or convalescence; or on other types of leave with the employer's consent;
  - The employee is being held under temporary custody or detention;
  - The employee is pregnant, on maternal leave or raising a child under 12 months of age.
- No disciplinary measure shall be taken against an employee who commits a violation of internal labor regulations while suffering from the mental illness or another disease which causes the loss of consciousness ability or the loss of his/her behavior control.

Timeframe for taking disciplinary measures

- The timeframe for taking disciplinary measures against a violation is 06 months from the date of the occurrence of the violation. The timeframe for dealing with violations directly relating to finance, assets and disclosure of technological or business secrets shall be 12 months.

Disciplinary measures

The following disciplinary practices will be applied at the Projects site:

- Written warning;
- Delay wage increment for up to 6 months;
- Demotion; and
- Dismissal.

Dismissal for disciplinary reasons

An employee may be dismissed in the following circumstances:

- The employee commits an act of theft, embezzlement, gambling, deliberate infliction of injuries or uses drug at the workplace;
- The employee discloses technological or business secrets or infringing the intellectual property rights of the employer, or commits acts which are seriously detrimental or posing seriously detrimental threat to the assets or interests of the Projects, or commits sexual harassment in the workplace against the Labor Management Plan;
- The employee repeats a violation which was disciplined by delay wage increment or demotion and has not been absolved. A repeated violation means a violation which was disciplined and is repeated before it is absolved;
- The employee fails to go to work for a total period of five (5) days in 30 days, or for a total period of 20 days in 365 days from the first day he/she fails to go to work without acceptable excuses.

Justified reasons include natural disasters, fires; the employee or his/her family member suffers from illness with a certification by a competent health facility; and other reasons as stipulated in the Internal Labor Regulation.

Removal and reduction in the duration of disciplinary measures

An employee who commits a violation that is disciplined by reprimand, delay wage increment for up to six (6) months, or demotion will be removed the disciplinary measures after three (3) years from the starting date of the disciplinary measure if he/she does not commit any violation against internal labor regulations.

Where an employee who is disciplined by delay wage increment for up to 6 months has completed half of the duration of the disciplinary measure and has demonstrated improvement, the employer may consider on reduction in the duration of disciplinary measures.

Prohibited actions when imposing disciplinary measures

- Harming the employee's health, life, honor or dignity;
- Applying monetary fines or deducting the employee’s salary wage;
- Imposing a disciplinary measure against an employee for a violation which is not stipulated in the internal labor regulations or employment contract.

Disciplinary process

The Disciplinary Process will be updated by the HR Specialist, implemented accordingly (Figure 6.2), and discussed further in the following paragraphs:



Figure 6.2 Disciplinary Process

Step 1: Report violation

When an employee's violation is discovered, the HR Specialist shall gather evidence of such violation and prepare a violation record. The HR Specialist shall inform the Trade Union/Workers' organization representative about such violation.

Step 2: Establish Disciplinary Committee

A Disciplinary Committee, members typically include the HR Specialist, the Trade Union/Workers' organization representative, other related managers (as needed) shall be established when a violation is detected. The Disciplinary Committee shall investigate and consult with relevant personnel and/or local authority (i.e. a lawyer, Provincial Department of Labor, War Invalids and Social Affairs) to understand clearly and fully the situation of the violation.

Step 3: Disciplinary meeting

Within the timeframe of disciplinary measures, the HR Specialist shall send a written invitation of the disciplinary meeting to relevant people (i.e. relevant employees, Trade Union/Workers' organization representative, a lawyer (if necessary) before at least five (5) days of the meeting.

The invited people shall response to the invitation of the disciplinary meeting to the HR Specialist for the arrangement. In case any of the mandatory participants cannot participate in the meeting, the HR Specialist shall reach an agreement on the change of time and/or location of the meeting. In case such agreement cannot be reached, the HR Specialist shall make the final decision.

Minutes of the meeting shall be recorded in writing. All participants shall sign on the meeting record, in case a person refuses to sign on the meeting record, he/she shall write his/her justification. The HR Specialist shall complete the Disciplinary Report, prepare a Disciplinary Decision and submit it to the Site Manager/Project Director for approval.

Step 4: Communication and Recordkeeping

Within five (5) working days from the disciplinary meeting, the HR Specialist shall send the Disciplinary Decision to all participants in the disciplinary meeting.

Disciplinary records shall be kept until the disciplined employees left the company.

ii. Gender Equity

The PEC provides equitable opportunities for male and female employees and maintains an organisational culture which supports gender equity. The Projects provides adequate break rooms and toilets for both male and female employees with consideration of their privacy. Where security management requires body check of employees, the Projects shall ensure gender sensitivity is respected by providing security guards with the same gender.

During recruitment, utilization, development, promotion and retrenchment process, the Projects provides equal opportunity for both male employees, female employees, and male and female employees regardless of sexual orientation, including:

- Recruitment process: The Projects ensures the formulation of job descriptions and the composition of shortlists and selection panels will be taken into account of gender equity;

- Utilization: The Projects ensures salary, rewarding, remuneration payment, social insurance, health insurance, unemployment insurance, working conditions, labour safety, working hours, rest periods, sick leave, maternal leave, other material and spiritual benefits will be provided to male and female employees in consideration of gender equity;
- Performance assessment process: The Projects provides a fair working conditions and benefits for all employees such as remuneration and working arrangements;
- Promotion: The Projects ensures requirements for promotion are fair, equitable and transparent and take account of the impact of caring responsibilities on working arrangements; and
- Retrenchment: The Projects undertakes an analysis of alternatives to retrenchment with consideration of gender equity and where retrenchment cannot be avoided, the Projects shall conduct the retrenchment based on the principle of gender equity.

The Projects shall consult with female employees or their representatives when taking decisions which affect their rights and interests.

The Projects shall not require a female employee to work at night, work overtime or go on a long-distance working trip in the following circumstances:

- The employee reaches her seventh month of pregnancy; or her sixth month of pregnancy when working in upland, remote, border, and island areas; and
- The employee is raising a child under 12 months of age, unless otherwise agreed by her.

An employee who is working at a toxic or dangerous work, a highly toxic or dangerous work or any work that might negatively affect her maternity shall be moved to safer work, or reduce the working hours by one (1) hour per day without reducing her salary, rights or benefits until her child reaches 12 months of age.

The Projects shall not dismiss an employee or unilaterally terminate the labor contract with an employee due to his/her marriage, pregnancy, maternity leave, or nursing a child under 12 months of age.

Upon expiration of the labor contract with a female employee who is pregnant or nursing a child under 12 months of age, the conclusion of a new labor contract shall be given priority.

During a female employee's menstruation period, a female employee shall be entitled to 30 minutes break per day for three (3) days per month; a female employee nursing a child under 12 months of age shall be entitled to 60 minutes breaks in every working day with full salary.

Where a female employee is pregnant and obtains a confirmation from a competent health facility which states that if she continues to work, it may adversely affect her pregnancy, she shall have the right to unilaterally terminate or suspend the labor contract. In case of unilateral termination or suspension of the employment contract, the employees shall submit a notification enclosed with the aforementioned confirmation from the competent health facility to the Projects. In case of suspension of the labor contract, the suspension period shall be agreed upon by the Projects and the employee and must not be shorter than the period specified by the competent health facility. If the rest period is not specified by the competent health facility, both parties shall negotiate the suspension period.

When an employee takes leave to take care of a sick child aged under seven (7), have prenatal care check-up, due to miscarriage, abortion, stillbirth, therapeutic abortion, implementation of contraceptive methods or sterilization, the employee shall receive an allowance for the leave period in accordance with social insurance laws.

The Projects shall provide adequate information to their employees on the hazards and requirements of the works before the employees make their decisions; ensure occupational safety and health of the employees when assigning them any of the works on the jobs and works that are harmful to child-bearing and parenting functions[6].

iii. Harassment

The Projects prohibits harassment of any kind, including sexual harassment, and will take all appropriate measures to promote a harmonious work environment, and to protect personnel from exposure to any form of prohibited conduct through preventive measures and the provision of effective remedies when prevention has failed.

During the recruitment process, the HR Specialist has to undertake diligent reference checks of candidates to ensure that individuals who have a documented history of prohibited conduct are not hired.

Managers and supervisors shall:

- Monitor the implementation of harassment policy in the workplace;
- Act as role models by upholding the highest standards of conduct without regard to the power their position holds; and
- Promote a harmonious working environment and create an atmosphere in which personnel feel free to express concerns about inappropriate behaviours and to use, without fear of reprisal, all recourse mechanisms and services available to them.

All employees shall:

- Strictly implement regulations on preventing and combating harassment in the workplace;
- Treat all people in the workplace with courtesy and respect and demonstrate their commitment to the prevention of and response to prohibited conduct; and
- Report concerns/complaints as soon as possible after an incident has occurred through the Grievance Mechanism.

iv. Non-Discrimination and Equal Opportunity

Employees must be treated equally with regard to gender, age, race, religion, disability, nationality, political beliefs, membership of unions, ethnic origin, religious beliefs, as well as sexual orientation. Equality in employment shall mean the absence of any form of discrimination, direct or indirect, for reasons specified as mentioned above.

The Projects build its equal opportunity policy to ensure fairness in all aspects of employment, including hiring, training, evaluation performance, compensation and benefits, as well as termination of employment.

To ensure that the Projects implements non-discrimination and equal opportunity, the Projects:

- Use inclusive language in job advertisement;
- Set formal job-related criteria to hire, promote and reward team members;
- Offer compensation and benefits according to position, seniority, qualifications and performance, not protected characteristics;
- Require managers to keep detailed records of their decisions concerning their team members and job candidates; and

- Organizing trainings on diversity, communication and conflict management to improve collaboration among employees of different backgrounds.

The HR Specialist is responsible for receiving claims regarding discriminatory behaviour, investigating these issues, as well as determining punishment.

Regarding leased workers (i.e. workers hired by a third parties under a contract with the Projects), the Projects shall ensure non-discrimination between the Projects employees and leased workers in respect of the working conditions.

The Projects shall ensure that the employee be treated with the respect, not apply any form of physical punishment (by using force); abuse of the speech, power or any form of sexual harassment or sexual provocation.

v. Retrenchment

Retrenchment means the elimination of a number of positions or the dismissal or layoff of a number of workers by an employer, generally by reason of plant closing or for cost savings. In the Projects, retrenchment refers to a consequence of adverse economic circumstances or as a result of a reorganization or restructuring, it does not cover isolated cases of termination of employment for cause or voluntary departure.

Prior to formally implement any retrenchment, the Projects will undertake an analysis of alternatives to retrenchment. The alternatives may include:

- Temporarily suspending recruitment;
- The working of short time at correspondingly reduced salary levels;
- Temporary lay-offs with or without employment benefits or remuneration;
- Employee capacity building;
- Internal transfers to suitable vacancies, not necessarily at the same job/salary level; and
- Reasonable time off work will be permitted in the notice period to seek alternative employment.

If the analysis does not identify viable alternatives to retrenchment, a Labour Utilization Plan (LUP) in accordance with Malaysian Labour Code will be developed and implemented to reduce the adverse impacts of retrenchment on employees. The LUP will be based on the principle of non-discrimination and will reflect the Projects' consultation with employees/ Trade Union/Workers' Organizations. The following steps will be implemented when developing the LUP:

- **Step 1:** Review and compile a list and number of employees (i.e. employees working under employment contracts; employees currently on leave receiving social insurance, occupational accident or occupational disease benefits in accordance with regulations of laws on social insurance and occupational safety and hygiene; employees currently taking unpaid leave; employees currently subject to a suspension of employment contracts, others);
- **Step 2:** According to the number of employees of the enterprise, business and production plan in the next 3-5 years, the Projects shall classify all employees into:
  - Keep using;
  - Re-training for use;
  - Retirement;
  - Working on part-time basis; and
  - Terminating labour contract.

- **Step 3:** Based on the list of classified employees and labour laws, the Projects will propose measures and arrange a budget for implementation of the LUP:
  - Budget for re-training employees;
  - Budget for severance pay and redundancy pay.
- **Step 4:** Consultation with workers' organization and employees on the LUP.
- **Step 5:** The LUP will be completed and submitted to local authorities for approval. The LUP shall have the following contents:
  - The names and number of employees to be retained;
  - The names and number of employees to be retrained for further employment;
  - The names and number of employees to be working on part-time basis;
  - The names and number of employees to retire;
  - The names and number of employees whose employment contracts have to be terminated;
  - Rights and obligations of the employer, employee and relevant parties regarding implementation of the LUP; and
  - The measure and financial sources to implement the LUP.
- **Step 6:** Implement the LUP. Notice are given to employees who are to be retrenched once the consultation process has been completed, which shall include:
  - The reasons for the proposed retrenchment.
  - The alternative analysis results.
  - The number of employees likely to be affected.
  - The time when, or the period during which, the retrenchment are likely to take effect.
  - The proposed severance payment
  - Any assistance that the Projects proposes to provide to the employees are to be dismissed.
  - The possibility of the future re-employment of the employees who are dismissed.
- **Step 7:** The LUP shall be made available to the employees (e.g. post on bulletin boards) within 15 days after it was approved.

vi. Child Labour

In keeping with internationally recognized standards, the Projects make a distinction between child labour and young worker. The Projects will not tolerate child labour under any circumstances. The employment of young workers, i.e. minors aged from full 15 years to under 18 years who have reached the minimum age of employment and completed compulsory schooling, is also not allowed in any conditions.

The Projects commitments to follow the requirements that are emphasized in the ILO conventions, IFC PS2, Social Protection Strategy, and local relevant laws in terms of prohibition of child labour. In addition, the Projects require its contractors, subcontractors, partners and primary suppliers to follow applicable laws and recognize children's rights.

In order to eliminate child labour, the Projects will:

- Require the recruitment process to avoid hiring minor under the legal age of working;

- Keep and validate documentation verifying the Projects employees' age after they are hired;
- Work with responsible government authorities to end child labour;
- Educate all employees on prohibition of child labour and let them know how to report child labour if any form of child labour are identified in the Projects; and
- Undertake contractors, subcontractors, and primary supplier audits, especially those in industries with high child labour risk, periodically to ensure they are not involved in child labour.

If any form of child labour is identified in the Projects, the following measures will be conducted:

- This child must cease work immediately;
- The Projects shall provide this child and his/her immediate family with appropriate compensation for the loss of employment; and
- The Projects shall safeguard and promote the welfare of this child, including, for instance, verification of continuation of compulsory schooling and financial assistance for the family of the respective child.

vii. Forced Labour

The Projects defines forced labour in line with ILO Convention as any work or service extracted from a person under threat or penalty, which includes penal sanctions and the loss of rights and privileges, where the person has not offered him or herself voluntarily. It includes slavery and abduction, misuses of public and prison works, forced recruitment, debt bondage and domestic workers under forced labour situations, and internal or international human trafficking.

The Projects commitments to follow the requirements are emphasized in the ILO conventions, IFC PS 2, Environmental and Social Policy, and local relevant laws in terms of prohibition of forced labour in any form, including slavery and human trafficking. The Projectstakes a firm stand against all forms of forced labour and expects the same of its primary suppliers, partners, contractors and subcontractors.

The freedom of employees may not be restricted and must be ensured at all times, including:

- The Projects shall ensure that employees are doing voluntarily and does not engage in or support the use of forced labour;
- Employees shall have the right to leave the workplace premises after completing the standards workday, and be free to terminate their employment provided that they give reasonable notice to their employer;
- Neither the Projects nor any entity provides labour to the Projects shall withhold or delay providing any part of any personnel's salary, benefits, property, or documents in order to force such personnel to continue working for the Projects;
- Neither the Projects nor any entity provides labour to the Projects shall engage in or support trafficking in human beings;
- All employees shall be informed of the terms of employment clearly; and
- The Projects does not keep any original qualification documents of employees.

The Projects educates all employees on prohibition of forced labour and enables them to recognize and report forced labour if any form of forced labour are identified in the Projects.

For the Projects' primary suppliers, partners and contractors/subcontractors, acceptance of the prohibition of forced labour is a basic prerequisite for establishing a business relationship with the Projects. In the case of any business entity that do business directly with the Projects, the Projects will undertake labour audit periodically to ensure they are not involved in forced labour.

viii. Migrant Workers

The Projects commits to employ at least 80% of workforce from local during operations phase and 20% during construction phase, therefore, about 80% of workforce will be filled by people from elsewhere in Malaysia. A number of expats is expected, who are mostly managers and technical engineers.

Normally, risks relating to influx of construction workforce and Project-induced immigrants to the Project area have been major social concerns in many industrial projects. The risks might include potential conflict in cultural practice and living style between the migrant worker and the local people, include littering and noise surrounding the worker accommodation facilities, fighting due to heavy drinking, and gambling, transmission of communicable diseases, criminality issue and increase pressure on the local infrastructure and public services.

On the other hand, migrant employees/workers can be particularly vulnerable to certain E&S risks including working long hours with lower payment, limited rest, exposure to chemicals, lifting heavy weights, specific psychosocial risks, sexual abuse and violence, social and cultural barriers, discrimination, forced (including pay recruitment fee for recruitment agency, bond money) and human trafficking.

1. Require Contractors to Submit Documents

Prior to commence work at the Projects site, contractors/subcontractors shall submit the following documents to HR Specialist (Table 6.3):

Table 6.3 Migrant Workers' Document

No.	Documents	Details
1	Rented accommodations	Contractor to provide the Projects a list of rented accommodations with its address. A map indicated geographical correlation between the Projects site and rented accommodations shall also be provided.
2	List of migrant employees/workers	Contractors to provide the Projects a list of migrant employees/workers livein each rented accommodations with their copy of ID, health check, registerof temporary residence and certificate of completion Covid-19 isolation period (for foreign employees/workers). In addition to that, list of migrant employees/workers who do NOT live in rented accommodations with their copy of ID, health check, and register oftemporary residence shall also be provided to the Projects (if applicable).

3	Training records	As part of the newly hired migrant employees/workers induction training, contractor shall provide the following training to newly hired migrant employees/workers and submit the training material and training records tothe Projects: ■ Code of conduct between workforce and to local community; ■ Typical communicable infectious diseases and prevention methodology,including without limitation of: influenzas, SARS, malaria, dengue, cholera, HIV/AIDS, syphilis, gonorrhoea, and Covid-19; and ■ Waste management plan.

When there is any update of the above documents, these updated documents shall be submitted together with the periodic performance report of contractor quarterly/annually performance report of contractor.

2. Programs to Migrant Workers

Contractors shall collaborate with the Projects in developing and implementation of the following programs to migrant workers prior to commence working at the Projects site:

- Conduct Covid-19 screening, including without limitation of: temperature check and health declaration;
- Provide induction training on the Projects' Labour Policy, Worker Grievance Mechanism, food safety and waste classification;
- Communicate of typical communicable infectious diseases and prevention methodology, including without limitation of: influenzas, SARS, malaria, dengue, cholera, HIV/AIDS, syphilis, gonorrhoea, and Covid-19;
- Support full or part of the cost of vaccination for migrant employees/workers before the epidemic season; and
- Spray disinfectants to rented accommodations before the epidemic seasons.

3. Programs to Community

Contractors shall collaborate with the Projects and local health facilities (e.g. department of preventive medicine, clinic, hospital, etc.) in developing and implementation of the following programs in communication to host community where rented accommodations are located:

- Communication of typical communicable infectious diseases and prevention methodology, including without limitation of: influenzas, SARS, malaria, dengue, cholera, HIV/AIDS, syphilis, gonorrhoea, and Covid-19;
- Promotion of vaccination before the epidemic seasons;
- Guidance on waste classification and protection of water resource; and
- Education on sexual and reproductive health for women, including prevention of gender-based violence and harassment.

4. Managing Relations with Local Authority

Contractors and HR Specialist shall work closely with community People's Committee and Police related to risks and violations of the Projects' migrant employees/workers in host commune in order to timely prevent and provide corrective actions. Contractors shall immediately report to HR Specialist in event of violation occur related to the Projects' migrant employees/workers.

ix. Workers Engaged by Third Parties/ Supply Chain

Contractors/subcontractors/primary suppliers maybe involved in the Projects' during construction and operation phases, as such, contractors/subcontractors/primary suppliers have to follow the Projects requirements on labour and working conditions throughout the contract period with the Projects.

1. Contract Terms

Together with other terms and conditions stated in the contract with a contractor/subcontractor/primary suppliers, the following terms shall also be included and agreed with contractors/subcontractors/primary suppliers, with regards to labour management aspects:

- Contractor/subcontractor/primary supplier shall commit to adhere to the valid Labour Code and relevant under-law regulations;
- Contractor/subcontractor/primary supplier shall commit to adhere to or adopt and implement the Projects' requirements in terms of labour management, including but not limited to working conditions, working hours, labour contract, minimum wage, compulsory insurance payment, rest time, gender equity, no use of child labour, forced labour, non-discrimination, and worker grievance;
- Contractor/subcontractor/primary supplier is required to monitor and report to the Projects its labour management performance, according to the Projects required template;
- Contractor/subcontractor/primary supplier shall be responsible for taking appropriate corrective actions to address any non-conformance identified either by the Projects, local authorities or other relevant parties.

2. Require Contractors to Submit Documents/Procedures

Contractors/primary suppliers shall submit documents/procedures to the Projects during the selection process of contractors/suppliers in order to demonstrate that their competencies meet the selection criteria. An inspection by HR Specialist shall be conducted to verify the information provided in the questionnaire and assess the compliance level of the contractors/suppliers prior to selection. A list is provided which shall be updated as necessary (Table 6.4).

Table 6.4 Labour Documents and/or Procedures

No.	Documents/ Procedures	Details
For contractors only		
1.	Internal Labor Regulation	Contractors to maintain their own Internal Labor Regulation (ILR) appropriate with their operation, and in accordance with *Labor Code of Malaysia*. The ILR shall be approved by the local authority and a copy shall be submitted to the Projects. The Contractors shall communicate the ILR to its employees/workers.
2.	Collective Bargaining Agreement	Contractors to establish and maintain a Trade Union/Workers' organization at their organization and develop and implement a Collective Bargaining Agreement (CBA) in accordance with regulatory requirements. The CBA shall be easy to access by contractors' employees and be updated periodically according to laws.
3.	Wage Scale	Contractors to develop and implement a Wage Scale in accordance with the applicable regional minimum wage, in compliance with regulatory requirements.
4.	Compensation and Benefit Procedure	Contractors to develop, communicate and implement a Compensation and Benefit (C&B) Procedure appropriate to their operations. The procedure shall follow regulatory requirements on regional minimum wage, overtime premiums, compulsory benefits, and terms and method of payment to employees/workers. The procedure shall be communicated to all employees/workers for implementation and compliance.
5.	Recruitment and Termination Procedure	Contractor to develop and implement a Recruitment and Termination (R&T) Procedure in accordance with regulatory requirements and IFC PS2. This will cover child labor, forced labor, non-discrimination, sexual harassment and abuse, and terms of employment. Termination procedure shall include a requirement of carrying out an analysis of alternatives in case of retrenchment. If retrenchment is unavoidable, Contractor shall develop a Retrenchment Plan in line with regulatory requirements in terms of non-discrimination, consultation and participation with workers and their organization, severance payment, security benefits, pension contributions and other benefits.

6.	Work permit	Contractors to provide the Projects a list of foreign employees/ workers, who willwork at the Projects' facilities/ the Projects' with their valid work permit.
7.	Social security andIncident insurance	Contractor to ensure that all contractor and subcontractor's workers working onsite are provided social security and incident insurance according to legalrequirement.

- **For both contractors, subcontractors, and primary suppliers**

8.	Labor Contract	Contractors/Subcontractors/Primary Suppliers to ensure that Labor Contract will be signed with all its employees/workers and the Contractor's/Subcontractors/Primary Supplier's authorized representatives; and one (1) copy of the Labor Contract will be given to the Contractor's/Primary Supplier's employee/workers for retention. Terms and contents of Labor Contract and implementation of Labor Contract shall follow regulatory requirements.
9.	Grievance Mechanis m	Contractors/Subcontractors/Primary Suppliers shall develop and implement a Grievance Mechanism for its employees/workers to raise concerns, complaints and/or feedbacks and provide transparency on how Contractor/Primary Supplier will process the grievance. Where there is absence of a Grievance Mechanism, the Worker Grievance Mechanism of the Projects will be adopted and shall beclearly communicated to Contractor/Primary Supplier employees and workers.
10.	List of employees/ workers	Contractors/Subcontractors/Primary Suppliers to provide the Projects a list of employees/ workers, who will work at the Projects' facilities/ the Projects' with details of their name, date of birth, date of hired, positions, genders, types of labour contract.

When there is any update of the above documents, these updated documents shall be submitted together with the periodic performance report of contractor quarterly/annually performance report of contractor (see Checklist of Contractor's/Primary Supplier's Employees/Workers Profile in Appendix B).

3. Monitor Performance of Contractors/Primary Suppliers

Regular monitoring program will be undertaken by the HR Specialist during construction and operation phases to confirm contractor's, subcontractor's, and primary supplier's compliance with the Projects' Labor Management Plan and regulatory requirements.

The monitoring program will be comprised of both desktop and field-based inspection programs to confirm if specified mitigation measures are being implemented effectively and intended outcomes are achieved. The monitoring program will be conducted quarterly (construction phase) and semiannually (operation phase), covering the following but not limited to (see Contractor/Subcontractor/Supplier Management Audit Checklist in Appendix C:

- Child labour;
- Forced labour;

- Working condition and term of employment;
- Wages and benefits;
- Working hours and overtime hours; and
- Grievance mechanism.

As an outcome of the audit, a corrective action plan (CAP) will be developed and implemented by the Contractors to address all identified issues. Template of the Corrective Actions Implementation Status Report is presented in Appendix G. The HR Specialist will be overall responsible in monitoring Contractor's implementation of the CAP during construction and operation phases, respectively.

4. Monitoring and Report of Contractor on Performance

- Internal Reporting:
  - Construction phase – Subcontractor and primary supplier are responsible for conducting self-audit of their performance. In addition, subcontractor shall audit the labor management performance of its primary supplier. Gaps, if any, discovered from the audit findings shall need to be rectified by the auditee and ensured by the subcontractor. It was noted that when performing self-audit, subcontractor shall ensure that its performance is in line with the Applicable Standards. The audit checklist in Appendix C can be used by the subcontractor also. Results of the audit shall be submitted to the HR Specialist together with the monthly performance reports (see Subcontractor's/Primary Supplier's Monthly Performance Report in *Appendix D*); and
  - Operation phase – HR Specialist shall be for conducting this audit on semi-annual basis for the Projects' contractors and primary suppliers only to evaluate the compliance with the Projects' requirements, as well as the Applicable Standard, as well as identify areas for further improvement. Template of the audit checklist is presented in Appendix C).
- External Reporting:
  - External reports on labour and working condition management of contractors, subcontractors, and primary suppliers will be part of Safeguards and Social Monitoring Report, will be prepared by the HR Specialist and submit to Lender on a quarterly basis during construction and semi-annual basis during operations. Content and template will be dependent on Lenders and regulatory requirements.

x. Local Recuitment

1. Policy for Local Employment

Based on Initial Environmental and Social Examinations (IESE), it was noted that "the Project Owner would endeavour to source at least 20% of labour force from the local during construction and 80% during operation (e.g. the Project area and other nearby communes in Kota Tingi District) with subject to the availability of candidates with the required skills and experience". The preference for Project employment will be given to local people, in particular those have been directly affected by Project-related displacement and/ or those have successfully completed specific skills training under various programmes offered and managed through the Community Development Plan (CDP), Livelihood Restoration and Ethnic Minority Development Plan (LREMDPs) and Ethnic Minority Development Plan (EMDP). The preferential treatment shall be managed with the PEC and its subcontractors.

It is important to note that while preferential treatment is given to local residents, all employment applicants will need to subject themselves to typical interview and aptitude testing requirements. This policy does not immediately entitle local residents to employment without due assessment of their

capacity to safely and effectively undertake a specific role.

2. Local Recruitment Process

In order to implement local recruitment policy, a local recruitment process will be developed by the PEC including the following activities:

- Collect and finalize the information for recruitment from the PEC and its subcontractors (e.g.type of position, number of position, job description) during construction and operation phases;
- Conduct public disclosure of summary of upcoming recruitment (both skilled and unskilled positions) and the process for application at the Project area and nearby communes;
- Collect the data of candidates those have applied or registered in seeking employment including personal background, contact information, expected position, training, update of involvement in CDP
- Share the data of candidates to subcontractors for recruitment and update the status of local recruitment from subcontractors

It was noted that following items shall be taken into consideration while promoting local recruitment:

- Communication with the Projects' stakeholders and beneficiary shall be clear to manage expectations;
- Local recruitment of the Projects may be collaborated with other similar programs in the Commune/area, which has the same purpose to support the effectiveness. the shall collaborate with any neighbouring businesses, non-government organizations to amplify the number of beneficiaries.

9. MONITORING AND REPORTING

a. Monitoring

Monitoring and implementation follows the requirements are critical component to prevent issues from becoming problems in the first place, and to ensure that action plans are implemented and procedures are being followed. Monitoring program related to the LMP is presented in Table 7.1.

Any major non-compliance (e.g. issues that could lead to a significant failure of structures, fatal accident, major injuries, authorities' notice/prosecution or delay in project schedule) shall be corrected within one working day. Minor non-compliance issues (e.g. issues that do not lead to breach of statutory requirements, bodily injuries/damage to properties, the environment and surrounding communities) shall be corrected within one week.

Table 7.1 Monitoring Program

Action	Performance Indicators	Monitoring Protocol	Responsibilities	Monitoring Records

Internal monitoring	■ Number of child labour; ■ Number of forced labour; ■ Number of Trade Union/Workers' Organization members and activities; ■ Number of Trade Union/Workers' Organization dialogues and no. of issues raised; ■ Number of employees who sign the labour contract; ■ Number of employees paid under regional minimum wage; ■ Number of employees registered with social, health and unemployment insurance; ■ Type, number, and compensation ofoccupational accidents and diseases; ■ Type and number of grievance; and Type and number of instances of disciplinary actions.	■ Quarterly during construction phase ■ Semi-annual during operation phase	■ EHSS Deputy Manager; and ■ HR Specialist.	■ Employees' information (refer to*Appendix E*); ■ Internal Labour Regulation; ■ CBA and other Trade Union/Workers' Organization's documents (minutes ofLabour Conference, Social Dialogues, Trade Union/ Workers' Organization's Fund, records of Trade Union/ Workers' Organization's activities); ■ Labour Contracts; ■ Wage scale andpayslip; ■ Documents on social,health and unemployment insurance payment; ■ Documents on occupational accidentsand diseases; ■ Grievance documents;and ■ Discipline documents.

■ Number of local people (separated by gender) working at the Projects	■ Quarterly	■ EHSS Deputy Manager; and ■ HR Specialist.	■ List of local people (separated by gender)working at the Projectfrom the / subcontractors
■ Performance indicators listedabove; and ■ Labor Audit Report ■ Other indicators upon request byLender.	■ Quarterly during constructio n phase ■ Semi-annual during operatio n phase	■ HR Specialist	■ Upon request byLender.

1.1 *Audit*

1.1.1 *Internal Audit*

Apart from daily inspection, internal audits at planned intervals will be scheduled to ensure appropriate preventive actions being taken as planned, and corrective actions being carried out on a timely basis. Internal auditing program is shown in Table 7.2.

The HSSE Manager shall conduct Internal Labour and Working Condition Management Audit quarterly during construction phase and semi-annually during operation phase to ensure the performance of the Projects complies with Applicable Standard. Template of the audit checklist is presented in Appendix F.

Table 7.2 Internal Auditing Program

No.	Audit/Inspection	Responsibilities	
		The Project Owner	Contractor/subcontractor/primary supplier
1	Monthly inspection		x
2	Quarterly self-audit		x
3	Quarterly audit of Subontractor/Supplier Management (during construction phase)	x	

No.	Audit/Inspection	Responsibilities	
		The Project Owner	Contractor/subcontractor/primary supplier
4	Semi-annual audit of Contractor/Subcontractor/Supplier Management (during operation phase)	x	
5	Semi-annual Labor Compliance Self- Assessment (during construction and operation phases)	x	
6	Quarterly/Semi-Annual audit of the Projects' Labour and Working Condition Management (during construction and operation phases)	x	

i. External Audit

In addition to internal audits, the Project is also subject to external audits conducted by relevant stakeholders. These audits may include but not limited to:

- Planned and unplanned audits or inspections undertaken by local authorities;
- Routine audits requested by Lenders or their agents.

b. Reporting

i. Internal Reporting

Internal reporting is defined as a communication between the Project Owner, contractors, subcontractors and primary suppliers. The internal reporting during construction and operation shall include, but not limited to:

- Quarterly self-audit report of contractor and primary supplier performance, including subcontractors' performance;
- Annual report of Contractor/Primary Supplier Management; and
- Annual report of the Projects' Labour and Working Conditions Management.

HR Specialist/Contractors and Primary Suppliers shall be responsible for implementation of corrective actions for issued identified during the audits and assessments. Report on Corrective Actions Implementation Status shall be prepared and submitted to EHSS Deputy Manager/HR Specialist in the next audits. Template of the Corrective Actions Implementation Status Report is presented in Appendix G.

ii. External Reporting

HR Specialist shall be responsible for preparing and submitting the following labour reports to Provincial Labour, War Invalids and Social Affairs Department:

- Semi-annual Reports on Change of Labour Utilization: Submit before 5th June and 5th December each year). Template of the reports is provided in Appendix I – Decree 145/2020/ND-CP;
- Quarterly Reports on Utilization of Foreign Workers: Submit by 5th January, 5th April, 5th July, and 5th October each year. Template of the reports is provided in Form No. 14
- Annual Labour Compliance Self-Assessment Report: Template of the report shall be compliance with Appendix I and
- Extraordinary labour reports (when requested by the local authorities).

Labour and working condition management of the Projects will be a part of Safeguards and Social Monitoring Report, will be prepared by the HR Specialist and submit to Lender quarterly during construction period and semi-annual basis during operation. Content and template will be dependent on Lenders and regulatory requirements.

10. TRAINING AND DISCLOSURE

a. Training and Communication

i. Training

The Project Owner is committed to providing appropriate training to all personnel and ensures that the PEC and subcontractors are also providing the same level of training to their personnel (including Managers, Supervisors and Workers) so that these people have the skills and knowledge necessary to implement and fulfil their obligations required by this LMP during construction and operation.

In addition to environmental and social trainings, the PEC and subcontractors shall work with HR Specialist to develop a training program for labour management. This training/communication on labour management can be combined as part of other trainings on environmental and social management. Training contents shall be tailored to trainees' scope of work.

Table 8.1 Labour Training Matrix

Trainee	Training content	Training form	Training frequency		Training record
			Initial training	Refresher training	

All employees, including contractors', subcontractors'and primary suppliers' workers	■ Labour Management;and ■ Worker Grievance Mechanism.	■ In-house training	Prior to working atthe Projects	Bi-annual during constructionand annual during operation	■ Training materials;and ■ List of participants (including the participants' signatures).

ii. Communication

This LMP and Worker Grievance Mechanism shall be disclosed to the subcontractors and O&M contractors.

Any grievances raised by workers shall be logged and followed up in accordance with the Projects' Worker Grievance Mechanism.

The subcontractors, and O&M contractors shall keep workers informed about the Projects' response to their concerns or complaints.

1. Internal Communication

Table 8.2 lists types of information shall be communicated by HR Office or Trade Union/Workers' Organization (when applicable) to employees to ensure employees' awareness and implementation.

Table 8.2 Types of Information, Timing and Method for Internal Communication

No.	Types of information	When to communicate	Method of communication
1	Labour ManagementPlan	■ When Labour Management Plan isofficially issued; ■ During new employee induction; and ■ When Labour Management Plan isrevised.	As part of the new employeeinduction training; and any other internal announcement method.
2	Internal Labour Regulation	■ When Internal Labour Regulation isofficially issued; ■ During new employee induction; and ■ When the Internal Labour Regulation isrevised.	As part of the new employeeinduction training; and any other internal announcement method.
3	Regulation on Workplace Democracy	■ Prior to the implementation.	Any internal announcementmethod.

4	Trade Union/Workers' Organization Operation Regulations	■ When Trade Union/Workers' Organization Operation Regulations isestablished; ■ Before employee joins Trade Union/Workers' Organization; and ■ When Trade Union/Workers' Organization Operation Regulations isrevised.	Any internal announcementmethod.
5	Results of the LabourConference	■ As specified in Regulation onWorkplace Democracy.	As per Regulation on Workplace Democracy.
6	Collective Bargaining Agreement	■ Before the Collective BargainingAgreement is signed; or ■ The revised version is signed.	Any internal announcementmethod.
7	Worker Grievance Mechanism	■ When the Worker Grievance Mechanism is officially issued; ■ During new employee induction; and ■ When Worker Grievance Mechanism isrevised.	As part of the new employeeinduction training; and any other internal announcement method.
8	Labour Utilization Plan	■ Within 15 days from the date ofapproval.	Posted on visible locations ininformation boards of the Project site.

2. External Communication

Table 8.3 lists types of information that shall be communicated to contractors/subcontractors and primary supplier by HR Specialist for their awareness and implementation:

Table 8.3 Types of Information, Timing and Method for External Communication

No.	Types of information	When to communicate	Method of communication
1	Labour Management Plan	■ Before signing contracts; and ■ When Labour ManagementPlan is revised.	Written documentation.

2	The Projects' requirements on contractors' labour management	■ Before signing contracts.	Written documentation.
3	Worker Grievance Mechanism (for contractors/subcontractors and primary suppliers' implementation in case they are not able to provide a grievance mechanism)	■ Before signing contracts; and ■ When Worker GrievanceMechanism is revised.	Written documentation.

Community Disclosure

The Project Owner shall work with the subcontractors and O&M contractors to disclose External Grievance Mechanism to surrounding communities of the Projects and/or other interested parties (e.g. Commune People's Committee, Commune Police, host communities of rented accommodations). The disclosure process shall be in line with the Projects' Stakeholder Engagement Plan.

In addition, the subcontractors and O&M contractors shall consult with surrounding communities about any concerns or issues related to labour management.

Any grievances lodged by the communities shall be logged and followed up in accordance with the Projects' Stakeholder Engagement Plan.

Affected communities shall be kept informed about actions taken to address their concerns through the most suitable ways, which can be in the form of:

- Town hall meetings at the local municipality or civic centre;
- Meetings with representatives of the affected stakeholders;
- Letters to representatives of the affected stakeholders and complainants; and
- Phone calls.

11. MANAGEMENT REVIEW

This LMP is a living document and shall be continually updated and improved. The Project Owner shall review and, if necessary, revise the LMP at least semi-annually (construction), annually (operation), or:

- When there is any change(s) in organisational structure;
- When there is any change in applicable requirements and standards;
- When there is any significant change in work process or activity; or
- When new information on E&S risks is made known.

The review shall consider the following, but not limited to:

- Internal and external audit findings;
- Monitoring records;
- Grievances records; and
- Incident reports.

12. RECORDS AND DOCUMENTATION

The control of documents and records related to labour management shall be conducted in accordance with the document control procedure of the Project Owner.

The Project Owner, subcontractors, and O&M contractors shall retain the followingdocuments and records:

- Employees' information (refer to Appendix E);
- Internal Labour Regulation;
- CBA and other Trade Union/Workers' Organization's documents (minutes of Labour Conference, Social Dialogues, Trade Union/ Workers' Organization's Fund, records of Trade Union/ Workers' Organization's activities);
- Labour Contracts;
- Wage scale and payslip;
- Documents on Statutory payment;
- Documents on occupational accidents and diseases (Refer to Appendix C and D of the Projects' Occupational Health and Safety Management Plan);
- Grievance documents (Refer to the Project's Worker Grievance Management Plan);
- Training records (Appendix H);
- Discipline records (type and number).
- Monthly self-audit report of subcontractors, O&M contractors and its subcontractors, and primary suppliers performance (Appendix C);
- Monthly performance report of subcontractors/ primary supplier during construction phase (Appendix D);
- Quarterly/Semi-Annual report of Contractor/Subcontractor/Primary Supplier Management Audit (Appendix C);
- Quarterly/Semi-Annual report of the Projects' Labour and Working Conditions Management (Appendix F);
- Semi-annual Reports on Change of Labour Utilization (Appendix I);
- Quarterly Reports on Utilization of Foreign Workers (Form No. 14); and
- Annual Labour Compliance Self-Assessment Report (Appendix I).

All documents and records are required to be filed for at least five years or as per regulatory requirements, whichever is more stringent, and kept in safe storage accessible only to authorised personnel.

Records shall be made available for inspection and audit by the Project Owner or its agents upon request.

APPENDIX A INVESTIGATION FORM

INVESTIGATION FORM			Code: …….. Issued date: ……... Version: ……...
Date of investigation			
Reference Number			
Employee Full Name (who causes the damage)			
Damage Investigation andconsultation	Description of damage		
	Employee Opinion		
	Proposed Resolution		
Statement to accept the resolution and close out thecase	The investigation and consultation undertaken involved the employee, other affected people, and relevant parties. The following resolution is proposed: _____ _____ _____ This record is made with the related parties to demonstrate investigation and consultation have beenundertaken. And that the employee has agreed with the resolution stated above.		

Agreed	Acknowledged	Acknowledged	Acknowledged	Others
_____ (Employee)	_____ (Investigation team)	_____ (Related Unit/ Department)	_____ (Related External Parties)	_____ (Name)

Appendix B CHECKLIST OF CONTRACTOR'S/SUBCONTRACTOR'S/PRIMARY SUPPLIER'S EMPLOYEES/WORKERS PROFILE

Name of Contractor: Date of Submission: *****Note: Please tick as "√" if document is provided and check "X" if document is NOT provided	Code: …….. Issued date: ……... Version: ……...

No.	Name of Employee	Position	Gender	Dateof Birth	Date Hired	Nationality	If the personnelhas been hired locally	Copy oflabor contract	Copy of IdentityCard	Copy of Health Certificate	Copy of Insurance Certificate	Copy of relevant Health and Safety (H&S) Training Certificate (Please specify what kind of H&S training certificates are provided)
1												
2												
3												
4												
5												
6												

Appendix C - CONTRACTOR/SUBCONTRACTOR/SUPPLIER MANAGEMENT AUDIT CHECKLIST

	Name of Contractor: Date of Audit: Auditor:	Code: …….. Issued date: ……... Version: ……...	
No.	**Findings**	**Compliance** (Yes/No)	**Description**
1.	Are employees provided with the term of labor contract in compliance with legal requirement? Note: In-defined term-labor contract shall be provide after two (02) defined term-labor contracts.		
2.	Are employees provided with copy of labor contract in a language the employee understands?		
3.	Do/does the contractor and its subcontractors/supplier maintain sufficient employees' profiles, including copy of age document?		
4.	Do/does the contractor and its subcontractors/supplier's practices on child labor are in line with the Projects' Labor Management Plan and Applicable Standards?		
5.	Do/does the contractor and its subcontractors/supplier's practices on prison labor or slave labor are in line with the Projects' Labor Management Plan and Applicable Standards?		
6.	Do/does the contractor and its subcontractors/supplier's practices on human trafficking are in line with the Projects' Labor Management Plan and Applicable Standards?		
7.	Do/does the contractor and its subcontractors/supplier not retain original document of employees?		
8.	Do employees not pay deposit during recruitment process?		

9.	Do/does the contractor and its subcontractors/supplier not withhold any part of worker's salary, benefits, properties or documents?		
10.	Do employees have the right to leave the workplace premises after completing the standard working hours?		
11.	Do employees free to terminate their employment that they inform to the contractor in a timely manner in line withlegal requirements?		
12.	Do/does the contractor and its subcontractors/supplier's practices on non-discrimination are in line with the Projects' Labor Management Plan and Applicable Standards?		
13.	Do/does the contractor and its subcontractors/supplier's practices on gender equity are in line with the Projects' Labor Management Plan and Applicable Standards?		
14.	Do/does the contractor and its subcontractors/supplier provide employees with equal opportunities?		
15.	Do/does the contractor and its subcontractors/supplier's practices on harassment and abuse are in line with the Projects' Labor Management Plan and Applicable Standards?		
16.	Do/does the contractor and its subcontractors/supplier's practices on freedom of association and workers'organization are in line with the Projects' Labor Management Plan and Applicable Standards		

CONTRACTOR/SUBCONTRACTOR/SUPPLIER MANAGEMENT AUDIT CHECKLIST			
17.	Does employees free to join their union or workers' organization?		
18.	Are employees paid at least meet regional minimum wage?		
19.	Are employees provided with sufficient compulsory benefits? Confirm insurance coverage of all employees/workers.		
20.	Are employees paid on-time?		
21.	Are overtime payment sufficiently?		
22.	Does the contractor maintain adequate timesheets and payrolls for the past 05 years?		
23.	Are employees' working hours recorded sufficiently?		
24.	Are employees provided with adequate break?		

25.	Are employees' overtime hours in compliance with legal requirement? Note: Not excess 4 hours/day, 40 hours/month, 300 hours/ year.		
26.	Are employees provided with adequate monthly rest day? (at least 4 days/month)		
27.	Do/does the contractor and its subcontractors/supplier develop a worker grievance mechanism in line with the Projects' Labor Management Plan and Applicable Standards		
28.	Do/does the contractor and its subcontractors/supplier record all employees' grievances adequately?		
29.	Are all employees' grievances resolved in a timely manner?		
30.	Are all labor related incidents/issues (including employee relations and occupational health and safety) resolved?		
31.	Do the termination practices of the contractor and its subcontractors/supplier follow legal requirement and the Project's Applicable Standards?		
32.	Have/has the contractor and its subcontractors/supplier not been involved in retrenchment practices during thepast 05 years? If yes, does the contractor follow legal requirement and the Project's Labor Management Plan and Applicable Standards of doing of retrenchment?		
33.	Do/does the contractor and its subcontractors/supplier use safety equipment to separate around project sites toprotect the public from major hazards associated with hazardous materials incidents or process failure, as well as nuisance issues related to noise, odors, or other emissions?		
34.	Do/does the contractor and its subcontractors/supplier apply locally regulated or internationally recognized buildingcodes to ensure structures are constructed in accordance with sound architectural and engineering practice, including aspects of fire prevention and response?		
35.	Are the contractor and its subcontractors/supplier's engineers and architects responsible for constructing facilities, building, plants and other structures certified the applicability and appropriateness of the structural criteriaemployed		

CONTRACTOR/SUBCONTRACTOR/SUPPLIER MANAGEMENT AUDIT CHECKLIST			
36.	Do/does the contractor and its subcontractors/supplier use hazardous material? If yes, does the contractor theirprocedure for handling hazardous material properly?		
37.	Do/does the contractor and its subcontractors/supplier have pre-employment screening process to check healthof workers prior to recruit?		
38.	Do the contractor and its subcontractors use worker's camp? If yes, do the contractor develop and implement aworker's camp management procedure in place?		
39.	Do/does the contractor and its subcontractors/supplier prepare an EPRP corresponding to their risks and impactsand in line with the Projects' EPRP and Applicable Standards? Is the EPRP's drill conducted in a timely manner?		

Appendix D SUBCONTRACTOR'S/PRIMARY SUPPLIER'S MOTHLY PERFORMANCE REPORT

(Construction Phase)

Name of Contractor/Primary Supplier:Date of Submission:	Code: …….. Issued date: ……... Version: ……...
Prepared by:	Position:
Approved by:	Position:

CONTRACTOR'S/PRIMARY SUPPLIER'S LABOR AND WORKING CONDITION PERFORMANCE

Number of workers working for the Projects in reported period:	Total: No. of male: No. of female:
Number of workers working for the Projects in reported period are local people:	Total: No. of male: No. of female:
Number of workers working for the Projects in reported period are members of ethnic minority groups:	Total:
	Name of ethnic minority group 1: No. of male: No. of female:
	Name of ethnic minority group 2: No. of male: No. of female:
	(Please add more row when needed)

Number of workers working for the Projects who haveconducted health check-up in reported period:	Total: No. of male: No. of female:
Number of workers working for the Projects who havebeen vaccinated against diseases:	Total: No. of male: No. of female:
Type of diseases that workers have been vaccinated:	
Number of workers working for the Projects in reported period who are under 18 years old[1]:	Total:

	No. of male: No. of female:
Number of workers working for the Projects in reported period are member of Trade Union/Workers'Organization:	Total: No. of male: No. of female:
Number of workers working for the Projects in reported period who have signed labor contract:	Total: No. of male: No. of female:
Number of workers working for the Projects in reported period are under probation period:	Total: No. of male: No. of female:
Number of workers working for the Projects in reported period have provided with compulsory insurances:	No. of workers provided with Social, Health, and Unemployed Insurance: No. of workers provided with Accident Insurance:

Number of workers working for the Projects in reported period working excess legal monthly overtime hours and what department:	Total: No. of male: No. of female:
Number of workers working for the Projects in reported period are paid under regional minimumwage:	Total: No. of male: No. of female:
Number of grievance in reported period[1]:	Total number of grievance: Number of resolved grievance: Number of pending grievance:
Number of workers working for the Projects providedwith accommodation:	Total: No. of male: No. of female:
Number of security guards working for the Projects:	Total: Please specify location of monitoring:
Hazardous material being used for the Projects:	Please specify name of hazardous material, location of using (which area) and provide full safety data sheet in both English and local language.

What kind of disease identified related to the contractor's operation in relation to the Projects? Please list all activities taken by the contractor during the report period to prevent disease expose to community.	
Date and type of emergency drills taken. Please attach drill minutes and photo evidence.	
CORRECTIVE ACTIONS TAKEN AND TIMELINE	

Appendix – E – Employee Information

No.	Full Name	Gender	Year of Birth	Nationality	Address	Identity Card (Passport) Number	Qualification	Job Title	Labour Contract			Date of Hiring	SHUI number	Gross Salary	Number of annual leave	Historical of instances of disciplinary actions	Occupational Health and Disease[10]	Type of diseases has been vaccinated against
									Type	Starting Date	Termination Date							

Appendix F – Internal Labor and working conditions management audit checklist

INTERNAL LABOR AND WORKING CONDITIONS MANAGEMENT AUDIT CHECKLIST			
Name of the Projects: Date of Audit: Auditor**:**		Code: …….. Issued date: ……... Version: ……...	
No.	**Findings**	**Compliance** (Yes/No)	**Description**
1	Do the Projects have an updated ILR which approved by local authority?		
2	Do the Projects have an updated wage scale which approved by local authority?		
3	Do the Projects has valid C&B Procedure in compliance with legal requirement?		
4	Do the Projects has valid R&T Procedure in compliance with legal requirement?		
5	Do the Projects has valid CBA in compliance with legal requirement?		
6	Are employees provided with the term of labor contract in compliance with legal requirement? Note: In-defined term-labor contract shall be provide after two (02) defined term-labor contracts.		
7	Are employees provided with copy of labor contract?		
8	Do the Projects maintain sufficient employees' profiles, including copy of age document?		
9	Do the Projects not employ child labor?		
10	Do the Projects not employ prison labor or slave labor?		
11	Do the Projects not involve in human trafficking?		
12	Do the Projects not retain original document of employees?		
13	Do employees not pay deposit during recruitment process?		
14	Do the Projects not withhold any part of worker's salary, benefits, properties or documents?		
15	Do employees have the right to leave the workplace premises after completing the standard working hours?		
16	Are employees free to terminate their employment that they inform to VAPCO in a timely manner in line with legal requirements?		

17	Do the Projects recruit employees with no discrimination?		
18	Do the Projects provide employees with equal opportunities?		
19	Do the Projects free from harassment and abuse?		
20	Do employees free to join their union or workers' organizations?		
21	Are employees paid at least legal minimum wage?		
22	Are employees provided with sufficient compulsory benefits?		
23	Are employees paid on-time?		
24	Are overtime payment sufficiently?		
25	Do the Projects maintain adequate timesheets and payrolls for the past 05 years?		
26	Are employees' working hours recorded sufficiently?		
27	Are employees provided with adequate breaks?		
28	Are employees' overtime hours in compliance with legal requirement? Note: Not in excess of 4 hours/day, 40 hours/month, 300 hours/ year.		
29	Are employees provided with adequate monthly rest day? (at least 4 days/month)		
30	Do the Projects monitor their contractor in term of labor and working condition management and maintain the records?		
31	How many percentage of female employees working for the subcontractors?		
32	How many percentage of local people working for the subcontractors? In which, how many percentageof female employees?		
33	How many percentage of members of ethnic minority working for the subcontractors? In which, howmany percentage of female employees?		
34	Are all labor related incidents/issues (including employee relations and occupational health and safety) resolved?		

Appendix G – Template of Corrective Actions implementations

Name of the Projects/Contractor/Subcontractor/Primary Suppliers: Date of Audit: Auditor name:								Code: …….. Issued date: ……... Version: ……...
No.	Audit/ Assessment	Identified Issue	Root causes	Corrective actions				Status (In process/ Closed[11])
				Action	Person In charge	Starting Date	Completion Date	

Appendix - H Training Attendance Template

Subject:

Date:

Duration:
Type of training delivery:

Location

#	Name	IdentificationNumber	Job Position/Company	Signature

Training given by: Trainer's Signature:

PEC

Emergency Response Plan – Construction phase

(Doc.No.: PEC-02A1)

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i. Construction Manager (Affected Area) 15

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iii. Team Leader Fire 15

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1. Introduction

As the facilities of PEC project will start the construction work soon, this plan will only cover the period of construction stage (CS). Another plan will be issued in the future when all facilities come into operation.

Abbreviations	
CEO	Chief Executive Officer
CFO	Chief Fire Officer
CMC	Crisis Management Centre
CMT	Crisis Management Team
CMTL	Crisis Management Team Leader
cs	Construction Stage
cso	Chief Security Officer
DCEO	Deputy Chief Executive Officer
EIA	Environmental Impact Assessment
EOC	Emergency Operations Centre
EPC	Engineering, Procurement & Construction
HSE	Health Safety & Environment
HSE,S&F	Health Safety & Environment, Security & Fire
HSEMS	HSE Management System
PEC	Pengerang Energy Complex
PMC	Project Management Consultant
PMT	Project Management Team
SSERP	Site Specific Emergency Response Plan
TL	Team Leader

2. Scope

This plan applies to emergencies within PEC/EPCC controlled areas, emergency response resources, and site emergency evacuation plan for areas under construction and which includes the prefabrication laydown areas and worker camps.

This plan deals with various types of incidents that could occur during the construction period, such as but not limited to:

- Flood due to adverse weather
- Environmental incidents/accidents
- Energy release
- Confine space incidents
- Vehicle accidents
- Fire, explosion
- Flammable/toxic gas release
- Oil spills
- Industrial Accidents including medical emergency
- Severe weather condition and Natural Disaster
- Security incidents Including Bomb Treat and Violence / Riots

- Public commotion and/or riots
- Threats

3. Objectives

- To minimize the consequences of an emergency affecting people, the environment, PEC property and its business.
- Minimizing lost time that can delay the construction and schedule delays
- Restore normalcy as soon as possible and ability to handle the emergency in shortest possible time
- Establish an effective incident management system for the control of an emergency, with clearly defined roles and responsibilities.
- Secure business sites and facilities and ensure no/minimal disruption to neighboring facilities and public
- Reduce the risk of an emergency caused by human error, deliberate destruction, and building or equipment failures
- Be better prepared to recover from any emergency situation.
- Ensure the organization's ability to continue operating after a major incident
- Establish the well-defined communication protocol on emergency as well as the public announcements

4. Priority of Response (PEARL Principle)

- Protection of Human life (People)
- Environment
- Protection of Assets .
- Business Continuity, Reputation and Recovery.
- Liabilities – Protect the PEC legal responsibilities

5. Review and Update of Document

This plan shall be reviewed and updated every 6 months by the author/team since most of the facilities will be under construction and change will be dynamic in nature.

However, the following changes shall require an immediate update of the plan:

- Any organizational changes in the Company that affects the Emergency Response Plan.
- Significant deficiencies identified within the Emergency Response Plan as a result of exercises, drills or response to real events (i.e. Major Incidents.)

Emergency exercises will be conducted to:

- Verify that the scenario plans provide adequate coverage across the range of incident categories and are appropriate, taking heed of the geographic distribution of sites
- Review the effectiveness of the Emergency Response Plan, evaluating areas for improvement on the emergency response team and the site team

- Validate the competency and response times of key emergency response personnel, including knowledge of individual roles and responsibilities
- Assess the capability of HQC to respond to an emergency
- Test the competency of emergency control assets and procedures
- Reinforce prior training
- Provide confidence to participants around incident decision-making
- Verify adequacy of communication channels, both internally and externally
- Develop further recognition of interface processes between PEC and EPCC

The Emergency Response Plan will also be deemed to be exercised if an actual emergency occurs and components of the Emergency Response Plan are activated. There should be a minimum of one simulated evacuation drill every 6 months and an annual exercise that should incorporate all aspects of the Emergency Response Plan (including environmental) involving the activation of the EMT on a hypothetical basis.

6. Classification of Emergencies

Emergencies are classified according to one of the following four categories:

Classification of Emergencies (as per the response level)		Activation
Minor	An incident that can be effectively dealt with by personnel on site. The PEC project engineer will attend and confirm that the incident is over and the site is safe.	--
Category-1	Incidents that requires the support and are resolved by the assistance of one or more of first responder resources (Fire, Ambulance, HSE, Security). (This is a Serious Incident)	--
Category-2	An incident requiring additional organizational support of senior management, incorporating Emergency Operations Centre, PEC Crisis Management Team and use of appropriate resources. (This is a Major Incident)	Activate EOC & CMC
Category-3	As per category 2 above, with additional requested support from PEC and National Authorities. (This is a very high scale response to crisis)	Activate EOC & CMC & PEC CMC

Note : These emergency levels and responses are preliminary and will be finalized as the project develops

7. General Concept

Response will depend on initial report delivered to the Engineering, Procurement and Construction (EPC) Hotline and/or the onsite dynamic risk assessment resulting in theappropriate classification of the incident, ensuring that the response and resources are adequate for the emergency.

If the reported incident requires a response of Emergency Responders (Category-1/Serious), then generally the response starts by the affected EPC facility staff calling the:

- Security procedures are instigated
- PEC Fire Team will assess the risks and coordinate firefighting with State Fire
- Paramedic crew will respond to medical issues
- HSE members will advise on health, safety, and environmental protection measures.

If the classification level increases to (Category-2/Category-3), PEC management will be notified and deployment of the Crisis Management Team and Emergency Operations Centre.

8. Incident Management Structure

To bring an incident under control, an effective organization structure is required to deal with major incidents. PEC Emergency Structure shall be based on the Incident Command System. This structure shall be used as a framework for the command and control of major incidents and disasters. The three levels in the structure are as follows:

- Strategic: Represented by the Crisis Management Team. The Crisis Management Centre will be located at the main Office. Main role is to formulate the strategy for dealing with the incident and issue press releases related to the incident.

- Tactical: Represented by the Emergency Operational Members. The Emergency Operations Centre is located at Plant Location. Main role oversees all the available resources. They decide how to use these resources to achieve the strategic aims of the Crisis Management Team.

- Operational: Represented by the First Responders. They will be located at scene of the incident and will in continuous contact with the Emergency Operations Centre. Main role is to control the incident and bring the situation back to normal.

a. Crisis Management Team

Designation	Role in CMT
Deputy CEO {Area Concerned)	Head of CMT
Manager (HSE, Security & Fire)	Deputy Head of CMT and first relief to DCEO if no other DCEO is available
Manager (General Council & Legal)	CMT Member

Manager (General Services)	CMT Member
Manager (Commercial)	CMT Member
Manager {Information Technology)	CMT Member
Manager (Human resources & Social Relation)	CMT Member
Log Keeper (Assigned by Manager General Services)	Maintains Logs and resources

b. Emergency Operations Centre

Task or designation	Role
PEC Construction Manager	Incident Commander
PEC Construction Superintendent	Deputy Incident Commander
TL Fire	Manage Fire response and coordinates with Pengerang Fire Services Department
TL Safety	Manage Safety Resources and providesmeasures to prevent injuries
TL Security	Manage Security resources and coordinateswith State Police Departments
PMC Project Director	Advisor
EPC Project Director	Logistic Supports
PMC HSE	Advisor
Security	Advisor and Access Coordination
Log Keeper & Planner (Assigned by TL Major Projects)	Managing logs and resources

c. Incident Response Team

Task or designation	Role
Snr. Engineer Project Management	On scene Commander
Chief Fire Officer	Manages Fire Fighting & Rescue activities
Chief Security Officer	Manages Security Activities
Snr. Safety Engineer	Provide measures to prevent injuries
Ambulance Liaison Officer	Coordinate Ambulances and Triage area

9. EPC Emergency Hotlines

PEC Project Hotlines (Emergency)		
Project	**Description**	**Hotline**
PMC (Worley)	Project Management	XXX
EPC (TCM)	Process Units	XXX
EPC (TCM)	Utilities, Buildings & Water treatment	XXX
EPC (Dailog)	Tankage	XXX
EPC (Dailog)	Marine	XXX

10. Response

a. Staging Area Guidelines:

- The initial staging area for all incidents shall be the responsibility of the senior facility staff.
- On attendance of first responders, communication is established between attending responders and facility staff to initiate an effective and safe staging area.
- Muster Points will be established to provide safe havens for personnel to evacuate to in the event of an emergency developing. The muster point will be station at mass toolbox talk area.

Muster point locations will be marked, sign posted and be subject to change as the project activities develop. Generally, the location of Muster Points will be upwind of the emergency site at a safe vantage point at a minimum distance of 100 meters. This will be a minimum of 200 meters if there is a risk of fire and/or explosion. When establishing muster points, consideration will be given to the following:

- Type of emergencies expected
- Wind direction (current and future)
- Likelihood of explosion/fire and the impact of fire/explosion, which would determine how far is a safe distance
- Number of personnel expected to muster
- Location of access road for emergency response equipment
- Egress routes for further potential evacuations
- Additional temporary muster points may be declared on an as needs basis dependent on the nature of the emergency and the risks involved. These temporary muster points may not be sign posted. The authority for declaring a temporary muster point will be the Construction Manager.

b. Declaring the Classification of an Emergency

i. Minor

Due to their nature, minor incidents are not "declared". They are simply treated and recorded as such based on the information provided by the caller reporting the incident.

ii. Category 1 - Serious

A serious incident is declared by the on-scene commander (normally the Snr. Facility Staff or Fire Officer) at the site of the incident.

Note:

Since the main Emergency Responders (e.g. Fire, Ambulance...etc.) have been dispatched, the category of the incident will automatically align with category-1 (Serious incident) and will not necessarily needs to be declared.

Generally, these incidents may be treated and recorded as such, based on the response required

which depends on the dynamic risk assessment of the on-scene commander.

iii. Category 2 - Major

A major incident must be declared by Team Leader Fire or his deputy (Chief Fire Officer). If none of them has arrived at the incident location, then one of the following will immediately declare the major incident by calling Team Leader Fire or Manager HSE, Security & Fire:

Designation	Department
Team Leader Project Management (Area)	PEC Project Management
Project Director	EPC & PMC
HSE Manager	EPC & PMC
Security Manager	PEC

However, Team Leader Fire have the authority to supersede the decision of declaring or not a Major Incident. The decision for activating the external support shall be by the incident commander.

iv. Category 3 - Crisis/Disaster

A disaster incident can be declared by the Head of Crisis Management Team (DCEO of affected area) following the declaration of a Category 2 incident or it can be called immediately by Team Leader Fire or Manager HSE, Security & Fire.

However, the Head of Crisis Management Team has the authority to supersede the decision of declaring or reducing the classification of a Disaster Incident. The activation of external support and authorities according to the requirement of law.

c. On Site Emergency Communication

The flow and collation of timely information during an emergency is vital to the EMT in order to effectively support the On-Scene Commander/Field Response Team and assist in managing resources that may be required.

As the ERT also acts as a Communication Hub during any emergency it is paramount that information received from the emergency site be accurate so as to enable appropriate decisions to be made by the Incident Management Team. Communication mediums between the emergency site and EMT can include:

- Radio, landline telephone, mobile phone, satellite phone
- Email, fax, SMS messages

An emergency occurring at any part construction areas, camps or facilities will be coordinated and supported by the EMT which will be located at the relevant site administration office.

The Construction Manager (assisted by the Area HSE Manager) will be responsible for subsequent communications with the Incident Controller and is responsible for supervising the on-scene response effort being undertaken by the field teams.

The Incident Controller will keep the Emergency Controller briefed on the incident status. The Emergency Controller will advise the PEC / IPMT Emergency Management Representative of incident status.

d. Emergency Services and Support

When the emergency cannot be managed with internal resources, PEC/EPCC will mobilize the most appropriate means of emergency management and assistance as determined by the nature of the emergency.

e. Emergency Alarm during Construction

An alarm system will be established at the site/office for notification of all employees in case of an emergency. The alarm system may include lights, horns, sirens, or other appropriate devices to make every effort to notify every employee of site/office emergency.

If there is a need to evacuate, an alarm will sound. There will be two (2) components to the alarm system:

- ALERT ALARM - Wardens should respond; all other personnel should stand by for instructions from Wardens.
- EVACUATION ALARM - All employees should assemble on direction of Wardens and go to the designated assembly areas.

11. Declaring the End of a Major Emergency

The Head of Crisis Management Team in liaison with Head of Incident Management Team and the on-scene Commander shall be responsible for declaring the end of the activities controlling the incident.

12. Post Incident

Following the end of any Category-2 or category-3 incidents, there shall be a full investigation into the cause of the incident according to HSE Management System

(HSEMS) Incident Reporting and Investigation Procedure. A full review of the procedure to eliminate gaps from lessons learned.

After the emergency has ended and the EMERGENCY RESPONS TEAM and affected site response personnel are no longer required, the Incident Commander must consider several key issues before standing down any emergency personnel. These issues relate to ongoing emergency control, investigation processes and recovery actions including appropriate resources for key responsibilities.

In consultation with, and by approval from the PEC final non media / landholder information releases must be considered for parties and key stakeholder groups including:

- External Contractors and Services
- Government Authorities
- Employees/Employee Relatives

The Incident Commander will advise all internal and external non landholder and non-media parties that the emergency is over when:

- Emergency Services have formerly declared the emergency is over and returned control of the affected site back to EPCC
- The ERT declares the emergency has been terminated and the site facilities have been returned to a safe condition
- All people have been accounted for
- Injured persons have been stabilized and/or evacuated
- Effective environmental controls are in place

The termination of an emergency will be the responsibility of the:

- The On-Scene Commander or Area Manager for incidents contained on a specific worksite or location
- The Incident Commander for incidents where the ERT was activated

NOTE: An emergency will only be terminated and communicated, when it is safe to do so (i.e. when all personnel are accounted for and operations are deemed to be operating at a safe level).

A debriefing session is to be held after each emergency to discuss problems and necessary improvements for incorporation into the emergency procedures. This discussion should include:

- Recognition of success and what was accomplished exceedingly well
- Equipment or procedure deficiencies
- Unsafe practices/near miss incidents
- The cause of any injuries sustained
- Unforeseen problems and relevant resolution steps
- Communication/supervision problems
- Environmental considerations
- External problems, i.e. media, landowners, local authority, producers or customers
- Cause of emergency itself and how to prevent it happening again

13. External and Media Communication

Depending on the location and severity of the emergency, a significant amount of media attention may occur at the affected site. To ensure response teams, incident controller and the Crisis Management Team are permitted to regain control of the situation and are not impeded in their response actions by

the media, EPCC shall take steps to inform the PEC representative of any likely media involvement and gain direction regarding the same and will convey any impending or likely issues associated with any media impediment to the PEC, as soon as is practicable upon becoming aware of the same.

EPCC shall not maintain a media profile about the Project and understand that the PEC will remain the 'face' of the project. However EPCC shall assist the PEC to draft, prepare and distribute media releases relating to project activities and will assist with the preparation of up to date project messages.

14. Duties and Responsibilities

a. Crisis Management Team

i. Chief Executive Officer (CEO)

- Keep PEC Management and Shareholders posted with all current activities and situation updates.
- Provide information and advice to PEC Crisis Management Team on current situation with PEC and all the associated facilities.
- Notify the Minister and Department of Environment

ii. Deputy Chief Executive Officer (DCEO)

- Shall be the Head of PEC Crisis Management Team
- Carry out duties of CEO in his absence.
- Shall ensure that the Crisis Management activities are carried out accordingly
- Pronounce closure on the Crisis for PEC
- Keeps CEO, and Head of the Department of Environment informed on the emergency progress.
- Coordinates with CMT to identify key strategic issues facing PEC
- Coordinates support for the EOC.
- Minimize the incident consequences to PEC business.
- Oversees the effectiveness of the company's overall response to the incident.
- Implement appropriate communication strategy to gain media and public support for PEC response and handling of the incident.
- Callout another DCEO to be his relief.
- Forms a directorate headquarter to provide technical support

iii. Manager HSE, Security & Fire Team Leader

- Assists the Head of the CMT in preforming his duties as required.
- Will take charge of all CMC activities during the absence of the Head of CMT.
- Serves as principal Fire advisor and oversees implementation of the onsite operational response.
- Provide regular updates to the Head of CMT on all Fire activities and issues.
- Serves as principal Security advisor and oversees implementation of Security plans.

- Provide regular updates to the Head of CMT on all security activities and issues.
- Co-ordinate any other activities requested from his Group.

iv. Manager General Council & Legal

- Advises on legal implications and liabilities arising from the crisis for PEC.
- Provide legal review of press statements and other media communications.
- Advises on the implications of current and potential insurance liability.

v. Manager General Services

- Ensures catering services are provided for the CMC, EOC and first responders.
- Provides additional transportation as requested by CMC
- Provides stationary for CMC & EOC
- Co-ordinates liaison activities between Management and State authorities other than Pengarang Fire Services Department.
- Develops communication strategy to gain media and public support for PEC response/ handling of the incident.
- Co-ordinate's release of information.
- Advise on the current or likely effects on the crisis on company image and reputation regarding the public and government.
- Ensure the consistency of messages being promulgated across PEC
- Shall act as the Company's mediator to the Company Official Spokesman; either DCEO Administration and Finance or Manager General Services.
- Arrange for press conference as requested by the CEO
- Assigns a Log Keeper from his group

vi. Manager Commercial

- Coordinates with contractors as requested
- Issue urgent contracts required to handle the emergency Ensures sufficient quantities of material in stock
- Carry out procurement as required to handle the emergency.

vii. Manager Information Technology

- Acts as Principal Information Technology (IT) advisor to the CMT.
- Manages communications, computer systems, data centers and any related services during the emergency
- Initiates IT Support team for the emergency.
- Co-ordinates any other activities requested from his Group.

viii. Manager Human Resources & Social Relations

- Ensures that the arrangements in place are adequate for handling employees & contractors affected by the incident.
- Advises on the effects or future implications of the crisis on policy to employees & contractors.

- Coordinate any other activities requested from his group.

b. Emergency Operations Center (EOC)

i. Construction Manager (Affected Area)

- Assumes general control over incident site operations the Incident Commander.
- Coordinates incident control operations with other projects in the area.
- Responsible to the Head of Crisis Management Team (DCEO) and maintains communications with the CMC.

ii. Construction Superintendent (Affected Area)

- Coordinates shutdown of construction works, re-routing of contract workers.
- Coordinates with TL Fire to move resources from staging area to incident site.
- Nominates experienced and trained company personnel to keep records (Log Keeper) at the EOC on a 24-hour basis.
- Assists in catering distribution at site.
- First relief for the Head of EOC.

iii. Team Leader Fire

- Liaise with Chief Fire Officer (CFO) and HSE members on Hot & Warm Zones.
- Coordinates support with the Pengerang Fire Services for firefighting & rescue operations.
- Coordinate with other Oil Companies Fire Teams.
- Coordinates with Fire Services Station, Military Fire, Civil Defense, National Guards.
- Second relief for the Head of EOC.

iv. Team Leader Safety

- Supports & advise the EOC on HSE issues, including the Emergency Action Zones.
- Communicates with Manager HSE, Security & Fire at the CMC for HSE issues and reports.
- Determines the safe location of the staging area in the Cold Zone.
- Authorizes access and movement into the Cold and Warm Zones.
- Maintains a record of personnel in the zones.
- Obtains the identity and statements from witnesses, and injured personnel in liaison with first aider or medical staff.

v. Team Leader Security

- Assumes control of security operations.
- Coordinates access of emergency response vehicles and personnel through gates controlled by Contractor Security
- Directs Contractor security personnel to control access to the incident area, or requests re- enforcement from state to provide security support at site as requested by EOC and the CMC.
- Liaise with the EOC leader for any requirements on security issues of the incident.
- Advise Manager HSE, Security & Fire on all security matters.

vi. Project Management Consultant (PMC) Project Director

- Arrange to suspend all activities of the Contractors / Subcontractors working in or close to the vicinity of the Incident.
- Establish a Security Command Centre and liaise with PEC Team Leader Security and EPC
- Activate PMC Emergency Response Plan
- Provide technical support as requested
- Coordinate any other activities requested from his company

vii. EPC Project Director

- Evacuate all unnecessary workers to a safe area
- Activate EPC Emergency Response Plan
- Establish HSE Support Center and Liaise with PEC Team Leader Safety
- Coordinate any other activities requested from his company

c. Incident Response Team

i. Snr. Engineer Project Management

- Will act as the On-Scene Commander
- Directs available resources to control the incident
- Communicates with EOC with status report
- Assigns a competent person to coordinate all incoming supports at staging area

ii. Chief Fire Officer (CFO)

- Coordinates with Pengarang Fire Services all firefighting and rescue operations
- Reports status to EOC

iii. Chief Security Officer

- Coordinate with EPC Security Manager to secure clear access to the incident location.

- Shall liaise with State officials on site for security issues at the incident as required.

iv. Snr. Safety Engineer

- Provides technical assistance to Snr. Project Engineer on strategies to prevent further injury or damage
- Take witness statements regarding the incident
- Directs EPC HSE Engineers/Supervisors to carry out incident site hazard analysis.

v. Paramedics Liaison Officer

- Keeps a log of all casualties
- Prepares a triage area in the event of multiple/mass casualties
- Coordinates response of Ambulances and paramedics
- Assesses the situation and advises the EOC of present and future requirements for medical assistance.

15. Evacuation Guidelines for PEC & Contractors

a. Purpose

The purpose of this section is to provide a general guide to PEC Facilities / Project sites for evacuation. Each PMC & EPC are required to have its own Site-Specific plan providing details for an evacuation dealing with a natural disaster, hostile attack within Kota Tinggi, or any other reasons that may threaten the safety of people throughout one or more buildings/facilities.

Apart from the guidance provided in this Section, it is expected that state authorities will provide additional direction for the implementation of evacuation within the State of Johor.

b. Levels of Evacuation

Either a partial or a full evacuation may be ordered as described below;

i. Partial Evacuation

1. Initiated:

When a directive or order is given of a warning on a possible threat within an area of Pengarang.

2. Declaration:

By CEO or in his absence the acting CEO, in consultation with facility DCEO

3. Applies to:

All non-essential personnel that are not required for either essential CMC or EOC, emergency services (fire, ambulance & security staff).

As a guide, minimum manning will be defined by the facility / Project Manager or Team Leader according to their plans and will normally be limited to:

- Essential EOC staff.
- Emergency Services. (Fire, ambulance, Security)
- Key Staff required to maintain support.

ii. Full Evacuation

1. Initiation:

When a directive or order is given, a warning on an imminent threat and/or a pulsed tone (warning) Civil Defense Alarm Siren is initiated within an area of Pengarang.

Note: In the event a continuous ascending and descending tone (danger) Civil Defense Siren is initiated, personnel are to seek the nearest safe place.

2. Declaration:

If time permits: By CEO or in his absence the acting CEO, in consultation with facility DCEO

If situation demands an immediate evacuation: declaration can be issued by the following personnel.

i. Construction Manager
ii. Manager HSE, Security & Fire
iii. Area Manager.
iv. Area Team Leader.

3. Applies to:

All personnel in the Facility/Project. Evacuation will be conducted in order of priority as follows:

b) Contract workers and non-essential PEC personnel.
c) Essential staff for PEC.
d) EOC essential staff.
e) Fire, Ambulance & Security.

Note:

Essential Staff: Those who are required to deal with the event and memberof CMC, EOC, Incident Command or Support Services. Non- Essential Staff: Those who are not part of any response team or theemergency organization.

c. General Evacuation Responsibilities

Responsibility	Procedure
Crisis Management Team(CMT)	- In the event of a full evacuation, report to theCrisis Management Centre - Provide situational awareness to head office and national authorities as required. - Coordinate evacuation support to EOC. - In conjunction with Police, Civil Defense and/or PEC, identify evacuation routes (public roads) and safe areas for evacuees. - Establish if there is a need to evacuate byconvoy (protection or control purposes).
Directorate HQ	- Formed by the DCEO (Head of CMC) - Provide situational awareness to the CMT. - Account for all personnel, includingcontractor personnel. - Coordinate evacuation of all personnel from the offices including projects, to either a safe area or as directed by theCMT.
Project Management Team (PMT}	- In charge of evacuation of PMC & EPC(s)under the team - Coordinates between PMC & EPC with EOC

Project Management Consultant (PMC)	- Assists PMT in the evacuation process - Issue the final figure of evacuates to the PMT - Reports any missing persons to the PMT EOC
EPC	- In coordination with PMC & PMT, providetransport for the movement of contract personnel out of the areas.
Ambulance Team	Maintain two ambulances in the area, untildismissed by the EOC.
Area Security	- Maintain one shift in the area. - Be prepared to provide evacuation assistance, including; - Making sure evacuation routes are clear. Guiding transportation (evacuation byconvoy).

d. Offshore Evacuation

To evacuate the Sea Island, EOC shall carry out the following:

- Request help from State Emergency to dispatch Coast Guards, Marine Department,.
- EOC request from CMC coordinate with PEC to request Ministry of Defense Airforce to assist in the evacuation if necessary

16. Emergency Preparedness

a. Directorate Responsibility

Each PEC Directorate is responsible for ensuring that Site Specific Emergency Response Plans are developed and exercised for each of its facilities including new projects (worksites) under development.

Contractors/Subcontractors are to adhere to the terms of their contracts, regarding site specific emergency plans, with the concerned PEC representative(s).

Site Specific Emergency Response Plans must be consistent with this document, and should be updated regularly

Each employee on site should be made aware and adequately trained on their Roles and Responsibilities in an emergency, and should incorporate their respective facility/project instructions within this plan.

Note: The developed Site-Specific Emergency Response Plans should be submitted to HSE, Security & Fire Group for review and approval, to ensure compliance and quality assurance in accordance with the Corporate Emergency Response Plan.

b. Readiness

- As part of any plans developed on and off site, all operating, and services providers teams must establish procedures to ensure a quick and effective response in the event of an emergency.
- Each Group Team is responsible for ensuring that all Site-Specific Emergency Response are communicated to all levels of employees.
- Each team leader shall maintain lists of personnel and their alternates that will be available on-call to cover all times (24/7).
- Team leaders are responsible for ensuring that their own call-out lists are up-to-date at all times and copied to HSE, Security & Fire Group.
- All concerned teams shall maintain a list of equipment and resources, which will requiredeployment in an emergency.
- Persons nominated for the Emergency Operations Center (EOC), Crisis Management Team(CMT), and Support Services will designate alternate personnel in the event of their non- availability and notify HSE, Security & Fire Group.

c. Exercises

Plans must be exercised in advance on a regular basis to ensure there is a clear understanding of everyone's roles and responsibilities. Consequently, exercises have thefollowing objectives:

- Reveal resource gaps & weaknesses
- Improve coordination
- Clarify roles and responsibilities
- Improve individual performance
- Build confidence of emergency professionals and support services
- Test procedures and systems in "simulated live" situations
- Enhance company capabilities for emergency responders

d. Emergency Exercise Types

i. Minor (Evacuation) Exercise

- Confirm roles and actions of facility/Worksite personnel, including Fire Wardens.
- Planned in coordination with Fire Team
- Involves a single Facility/project location.

- Exercise duration could take up to one hour.
- The Fire Alarm System, of the Facility/Project, is to be activated by the team who isresponsible for maintaining the system, to ensure its readiness after the exercise.
- The assigned Exercise Coordinator and team of observers will assess the evacuation progress and deliver an onsite debrief to the concerned personnel (i.e. Fire Wardens).

ii. Serious (Category-1) Exercise

- Confirm roles and actions, of both facilities/project personnel and emergency responders.
- The exercise is planned by the Facility/project owners in coordination with PEC FireTeam.
- The exercise is observed and assessed by a team of competent observers.
- Exercise requires one to two hours.
- Immediate debrief is delivered after the exercise, by the Exercise Coordinator to identify gaps and areas for improvements.
- A written assessment report is prepared by the Fire Team to be delivered to all concerned for further actions and feedback.

iii. Major Tabletop Exercise

- A category-2 simulated exercise will include the participation of the Facility/Project management personnel (EOC); optionally, to include the affected Facility/Project DCEO at the Crisis Management Centre. The exercise is carried out with the understanding and implementations of emergency plans and other relevant documents.
- Planned by the Facility/Project owners in coordination with the Fire Team.
- Conducted and guided by Fire Team Emergency management personnel.
- Exercise requires one to two hours.
- Immediate feedback discussion, facilitated by Fire Team personnel, to identify areas for improvements.

iv. Major/Disaster (Category-2/Category-3} Exercise

- Confirm roles and actions, of facilities, onsite emergency responders, EOC, and CMC personnel.
- Involves comprehensive, internal and external, coordination and integration of resources and capabilities.
- Planned, coordinated, and conducted by the Fire Team.
- Could involve different facilities/Project in multiple locations.
- Exercise requires two to five hours.
- Observed and assessed by the Fire Team representatives.
- After the exercise, to identify areas for improvements, an organized post-incident debrief takes place at all responding levels; conducted by designated observers and Fire Team personnel.

- A written assessment report is prepared by Fire Team to be delivered to all involved in the exercise for further actions and feedback.
- Involved exercise participants are required to action the recommendations, from the assessment report.

17. Training And Awareness

Once emergency mechanisms and resources for the project have been established, connected and located, this Emergency Response Plan will be reviewed, and further training regarding the outcomes of this review will be provided to the relevant HQC and Contractor personnel.

Project personnel will be provided with training regarding this Emergency Response Plan. Depending on responsibilities held under this Emergency Response Plan, this training may include participating in simulated emergencies, practical drills, desktop exercises, resources and equipment checks, or other exercises designed to systematically include all personnel likely to be involved.

Basic requirements of the plan will be communicated via the following media:

- Site HSSE Induction
- Weekly Safety Meetings process
- Daily Toolbox Meetings
- Awareness Sessions
- Posters and Banners

PEC TECHNICAL STANDARDS

HEALTH, SAFETY AND ENVIRONMENT

GUIDELINE

Project Security Management Plan

(Doc.No.: PEC-06F1)

Executive Synopsis

This document presents the Project Security Management Plan for PEC (Pengerang Energy Complex) project in Pengerang, Johor, Malaysia. The plan is used to document the processes for the systematic planning and implementation of all aspect of Pengerang Energy Complex Project works scope relating to security management at site and offsite of project. It is not intended to be an exhaustive, detailed document but is designed to identify the processes, procedures and documentation that is required to execute the project. This project level security management plan is supplemented by site specific security management plans for all major work sites and fabrication shops/sites. The project management plan provides the guidance template and basic requirements for site specific plans that shall be develop by the project EPCC contractor(s). Site specific plans may differ from this document based on the Security Risk Assessment or other site-specific agreed arrangement.

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1. Introduction

The purpose of this plan is to define the minimum level of security standard for all project personnel, including contractors conducting activities on the project. This plan, among other things, will address specific risks and hazards that the contractor's Security Plan are to address. This plan will be in place for the duration of construction activities. The purpose of this SMP is to ensure that personnel, assets, and operations are protected against the risks of:

- Unauthorized access,
- personnel injury,
- entry of contraband to work sites, and
- theft, pilfering or unlawful damage of Project or personal property.

The intent of this SMP is to ensure that effective preventative controls are established commensurate with identified security risk issues to enhance the creation of a safe, secure, and productive workplace that assures business continuity and resilience.

1.1. Scope

This plan applies to all Project employees, Contractors, sub-contractors and visitors at all project-controlled sites.

This plan provides requirements related to:

- operation of the plan.
- asset protection management; and
- preventative controls and procedures.

The plan has been developed and will be implemented under the authority of the Safety, Health and Security Manager. This plan is a guideline for the development or review of

Site-Specific Security Plans for all worksites and must include site-specific details for the physical protection of people, assets, information, and each location.

1.2. Document Protection

This document shall be protected against unauthorized access, amendment, and disclosure. This SMP is classified “CONFIDENTIAL” and is only releasable to personnel possessing a business reason for accessing the information contained within it. Except for purposes directly connected with the execution or performance of the SMP, no part of this plan may be reproduced or transmitted, in any form or by any means, without the written consent of the plan owner. This document will be controlled, revised, and updated in accordance with PEC/Project document control procedures.

1.3. DEFINITIONS

In this SMP the following terms shall have the meanings set forth below. The definitions cover the singular as well as the plural.

Term	**Definition**
Access control	A system of security controls intended to ensure that only authorized people are able to gain access to all controlled sites, contraband is prevented from entering sites, and that property is not removed from sites without authorization.
ALARP	As Low As Reasonably Practicable
Asset	A specific business entity owned, or partially owned by project entities.
Asset Protection	Functional integration of security management, crisis management and business continuity management, to include safe travel planning, in order to protect human and physical assets, and nearby communities, from security threats, emergencies and crises.
Awareness	A level of knowledge necessary to conduct activities in accordance with the project management systems, and applicable legal and other requirements.
Breach	Any behavior by a person that leads to disciplinary action resulting in a

Term	Definition
	record of the outcome in his or her personal file. Business conduct breaches include (but are not limited to) concerns over fraud, theft, dishonest business activities, misappropriation of group resources, conflict of interest, corruption, harassment or bullying or any other unethical behavior in the workplace.
Bribery	Giving or receiving an undue reward to influence the behaviors of someone in government or business to obtain commercial advantage.
Business Continuity Management (BCM)	A management discipline that establishes and maintains a set of arrangements, plans, procedures and supporting infrastructure in a state of readiness, through testing and review to minimize the impacts of an unplanned interruption to business to a manageable level and facilitate a return to normal business as soon as possible.
Contraband	Anything prohibited by policy, regulation or law from entering any controlled sites under the jurisdiction of this plan.
Contractor	An individual, company or other legal entity that carries out work or performs services under a contract of services. This includes sub-contractors.
Corruption	The abuse of a position of employment and/or trust to gain an advantage. It includes offering, giving, soliciting or accepting of an inducement or reward for improper actions and any improper approach or solicitation, either directly or through a nominee.
Crisis	Loss of management control resulting in an actual or potential threat to PEC long-term ability to do business due to impact on the operability, image, reputation, and liabilities of PEC
Crisis and Emergency Management (CEM)	A tiered response based on the severity of an actual or potential event. Enables appropriate resources to be brought to bear on an incident in a timely manner so that strategy can be defined, and actions undertaken to contain an incident, maintain or regain management control. Aims include safety of personnel, protection of environment, corporate image, reputation, and long-term business objectives.
Cyber Security and Drone Monitoring	Cyber Security provision for security measures to help mitigate cyber security risk. This applies to all employees, contractors and anyone who has regular and temp access to the company system and hardware. Also, the Drone monitoring control system, restricting any unknown flying object in the project premises.
EAC	Electronic Access Card
Emergency	An abnormal occurrence that can pose a threat to the safety or health of employees, customers, or local communities, or which can cause damage

Term	Definition
	to assets or the environment.
Emergency Management/Response Plan (EMP/ERP)	A project plan that contains all relevant information to support an effective emergency response and identifies all safety, health and security hazards.
ERT	Emergency Response Team
Extortion	A demand by a person or group for a financial payment or other concession against a threat to carry out a criminal act such as kidnapping or violent acts against personnel, or damage to property or equipment, or the release of sensitive or privileged information.
Fraud	An intentional deception for improper gain. Any unlawful act or omission by which a misrepresentation is made with the intention to defraud which causes actual prejudice or which is potentially prejudicial to another, whether or not there is a personal benefit to the perpetrator.
Incident	Any occurrence that has resulted in, or has the potential to result in (that is, a near miss), adverse consequences to people, the environment, property, reputation or a combination of these. A significant deviation from standard operating procedures is also classified as an 'incident'. On-going conditions that have potential to result in adverse consequences are considered incidents.
Kidnap	The abduction of a person (or persons) with the intention of detaining them at an unknown location until a demand for cash or concessions is met.
KRE	Kidnap, Ransom or Extortion
Local dispute resolution process	Process designed to resolve disputes at a local level, and may be facilitative, advisory or determinative in nature.
Maximum Foreseeable Loss (MFL)	The aggregate financial loss sustained by PEC in the plausible worst case scenario for that risk issue. In a plausible worst-case scenario all active risk controls – including insurance and hedging contracts – are assumed to be ineffective. In a health, security and safety context – the MFL is the credible maximum number of fatalities that could occur in the event being considered. The MFL must also consider and include the potential for loss of life.
PEC	Pengerang Energy Complex
PMC	Project Management Consultant (Part of IPMT)
Protect	Actions taken to defend or guard against a security threat or event.

Term	Definition
Ransom	A concession, usually a sum of money, paid to a kidnapper or hostage taker for the release of a hostage or hostages.
Reputation Impacts	Adverse public comment or speculation concerning or impugning the activities or behaviors of PEC, whether directly or by inference.
Response controls	Predetermined actions taken following a security threat or incident, emergency, or crisis to minimize continuing risks and mitigate impacts of the event while regaining management control of the situation. It may include imposition of temporary, enhanced risk management controls.
Risk	The chance of something happening that will have an impact on objectives.
Risk management	The culture, processes and structures that are directed towards realizing potential opportunities while managing adverse effects
Security management	Organized management function that identifies and assesses security threats, classifies assets, rates system vulnerabilities determines the resulting material risk, identifies and implements effective security controls to protect against those risks.
Security Threat	Intention or determination to inflict harm, an indication or warning of a possible security event. Unlike a hazard, a security threat is based upon a human intent to harm
SMP	Security Management Plan
SHS Manager	Safety, Health and Security Manager
SSSP	Site Specific Security Plan
Unauthorized weapons	Firearms, swords, chemical sprays, knives with blades exceeding three inches, clubs and other items primarily intended for causing injury or harm to property or another person.
Unlawful detention	To confine a person or persons, usually in a known location, without apparent legal authority to justify the act.
Violations	Deliberate deviations from safe operating practices, procedures, standards or rules. Can be further categorized as routine, exceptional or acts of sabotage.

2. Operation of the Plan

2.1. Monitoring Compliance with the plan

Managers, superintendents, supervisors, and team leaders are responsible to ensure compliance with this plan in their areas of responsibility. Task observations, and inspections are to be undertaken and results reviewed on a periodic basis by senior managers to ensure that the measures stipulated in the plan are being applied to the protection of personnel and assets at Project locations.

2.2. Procedure Review

An SMP review is to be conducted annually unless specifically requested by PEC. The review shall be initiated by the Safety, Health and Security Manager. Notification of the intended review activity will be communicated to relevant managers, superintendents, supervisors, and team leaders responsible for construction operations and will then be requested to forward to the Safety, Health and Security Manager any proposed amendments to the current plan. When conducting a review or amending the existing plan consideration should be given to the following significant deviations:

- previous audit and review results,
- changes in legislation or regulations or amendments in policy,
- incident statistics,
- areas for improvement,
- training needs and records,
- exercise/drill schedules and
- Lessons learnt from incidents.

After the initial consultation and subsequent compiling of any proposed amendments, the Safety, Health and Security Manager will facilitate a meeting of the key stakeholders to discuss any modification to the plan. All records shall be in the form of minutes, with copies given to all members of the review panel. The Safety, Health and Security Manager is responsible for monitoring and reporting the outcomes of such action(s) to the PEC SHS Manager, and PMC Project Managers.

2.3. Internal and External Audits

The purpose of audits is to identify opportunities for the improvement of plans, procedures and implemented security risk controls to streamline the efficient utilization of PEC resources in pursuing the intent of this SMP. The Safety, Health and Security Manager is responsible for ensuring the auditing function is maintained. Internal audits should be conducted on a regular basis with a maximum of 6 months between each internal audit. The internal auditor will be independent of the process, procedure or plan being audited. External audits should be conducted every 12 months. The format of these audits will be as agreed with the auditor. The Safety, Health and Security Manager will nominate an appropriately qualified external auditor who will not be an employee of and independent of all matters being audited. The audits will consist of a review of the SMP, and the measures established to ensure its operation within the Site. Terms of Reference (TOR) will be developed prior to the audit and the audit will be conducted in accordance with project established Auditing Protocols. Upon the completion of the audits the Safety, Health and Security Manager will be required to present the findings to the PEC SHS Manager and discuss arrangements that need to be put in place to deal with deficiencies that have been identified. All audit records are to be maintained and will be kept for a minimum of Five (5) years.

2.4. Updating the Plan

Modification or updating of the plan is the responsibility of the Safety, Health and Security Manager who is responsible for the issue of subsequent revisions of the plan as necessary in consultation with the PEC SHS Manager. Revisions or amendment of the plan should be undertaken only following a review or audit where deficiencies have been formally identified or when there is a clear business requirement to do so.

2.5. Drills and Exercise

In order to ensure the control measures described for implementation within this SMP are effective and to identify further opportunities for the improvement of security measures and procedures regular drills and exercises should be conducted.

Drills relating to this plan should be conducted at a minimum of one every six (6) months and shall involve relevant response personnel and management at each site. It is acceptable to utilize toolbox and pre-work meetings and other forms of internal communications media to communicate security awareness information to staff when operational schedules do not allow for a dedicated drill to be undertaken. Drills conducted to exercise site Emergency Response Teams (ERT) may also be scripted to include a security component which would create opportunity to test and enhance this SMP and SSSP.

Exercises are conducted every 6 months for the Emergency Operations Centre capability and may take the form of:

- theoretical or desktop activities; and
- simulated incidents to practice response arrangements.

These exercises may also be scripted to include a security component to the scenarios being practiced that would effectively test this SMP and SSSP.

The focus of drills and exercises will be to ensure that Site personnel and contractors are familiar with key security processes & procedures. The object of these activities is to not only test response arrangements to a simulated act of unlawful interference but to also:

- practice call out of all involved staff and associated elements.
- test the adequacy of facilities.
- exercise members of the various supporting government agencies; and
- test the adequacy of appropriate contingency plans and procedures.
- test SMP and SSSP

Each activity will be planned with specific objectives in mind with the view to assess the current proficiency level and to identify areas for improvement. Upon completion of the drill or exercise the Safety, Health and Security Manager should present the findings to the PEC SHS Manager and management team and discuss any arrangements that need to be put in place to deal with any deficiencies that may have been identified. The SHS Manager is to ensure that all results and findings that emanate from drills and exercises are properly recorded and reported to PEC SHS Manager for review.

2.6. Securities Responsibilities

The SHS Manager or nominated designate is responsible to ensure that all employees, contractors, and visitors on project sites are provided adequate safety and security systems.

The Senior Security Advisor or nominated designate is responsible to ensure that sites implement and maintains preventative security controls as described in this SSSP for each site.

The Security Supervisor is directly accountable to the Senior Security Advisor and is responsible for the implementation and maintenance of preventive security controls as described in the SSSP for each site.

2.7. Team Responsibilities

The following are the requirements for responsibilities of the SHS Manager and other personnel with security responsibilities. These duties are specifically related to security at all project worksites and may be in addition to other assigned duties and are illustrated below in Table 2-1.

Table 2.1 Security Responsibilities

Position	Responsibilities
Safety, Health and Security Manager	• The SHS Manager will designate, a Senior Security Advisor for the facilities. A Senior Security Advisor may be designated by name or by reference to a position. Where the location is not managed by PEC the Senior Security Advisor will be the incumbent at that location. • A person appointed as Senior Security Advisor shall have the following: o knowledge and ability to perform the duties of a Senior Security Advisor. o Training appropriate to the performance the responsibilities. o Suitable person to access and handle security information. o Has the authority to act to ensure that protections of assets. o Provided with the resources to effectively undertake the responsibilities as listed below.
Senior Security Advisor (and Supts)	• Facilitating the development, implementation, revision and maintenance of the SMP and the Sites Specific Security Plans for all sites. • The Security Superintendent will take over all duties of the Senior Security Advisor in his/her absence. • Liaising with stakeholders, Local Law Enforcement and Emergency Services and performing the following: (a) ensuring the development and maintenance of this SMP and SSSPs; (b) management of the Contract Guard Force; (c) implementing and exercising the SMP and SSSPs; (d) undertaking regular security inspections of Site(s) to ensure the continuation of appropriate security measures; (e) recommending and incorporating, as appropriate, modifications to

Position	Responsibilities
	this SMP and/or Site Specific Security plan and any security procedure or control implemented in order to correct deficiencies and to update the plan. (f) enhancing awareness and vigilance of Site Security personnel; (g) ensuring adequate training has been provided to personnel responsible for the security of Site; (h) reporting to the relevant authorities and maintaining records of occurrences which threaten the security of the Site operations; (i) coordinating implementation of the SMP and SSSPs with the appropriate managers, superintendents, supervisors and team leaders; (j) ensuring that standards for personnel responsible for security of assets are met; (k) ensuring that security equipment is properly operated, tested, calibrated and maintained, if any; and (l) reporting to management any deficiencies and non-conformities identified during internal audits, periodic reviews, security inspections and verifications of compliance and implementing any corrective actions.
Location or Contracted Security Supervisor and Officers	• Facilitate the implementation revision and maintenance of the SSSP. • Work under the guidance of the Senior Security Advisor. • Perform the responsibilities and duties set out in the Gatehouse Security Operations Procedure. • Undertake all legal requests and orders issued by the Senior Security

2.8. Knowledge and Training

The Safety, Health and Security Manager is to ensure that all personnel with responsibility for security within facilities have adequate knowledge or have received the necessary training to be able to carry out their duties. The specific training requirements are as follows:

- the knowledge, skills and other requirements for the security aspects of their position.
- the training or qualifications that satisfy those requirements; and
- Where applicable specific training and experience for contracted security personnel is included in the ITT packages and verified by the Senior Security Advisor before being accepted to provide services at designated sites.

Table 2-2 sets out the details of the level of knowledge that employees and contractors assigned with the responsibility for the security assets should possess.

Table 2.2 Knowledge and Skill Requirement for Security Positions

Position	**Knowledge and Skills**
Safety, Health and Security Manager	The SHS Manager should have a good level of knowledge of the areas listed below so as to ensure that the mandatory corporate governance and regulatory requirements are met. Specific areas of knowledge are: • Security administration; • Relevant international conventions, codes and Recommendations and relevant Provincial and Federal Legislation and regulations; • Responsibilities and functions of other security organizations; • Possess a detailed knowledge of the project SMP and an Understanding of the corporate security standard; • Emergency preparedness and response and contingency planning; • Understanding of current security threats; • Handling procedures for sensitive security related information and security related communications; and • Recognition on a non-discriminatory basis, of characteristics and behavioural patterns of persons who may represent a security risk. • Methodology of security risk assessments;

Position	Knowledge and Skills
	• Techniques used to circumvent security measures; • Methods of conducting audits, inspection, control and monitoring; and • Security drills and exercises, including drills and assessment techniques for these.
Senior Security Advisor, Security Supts (or as nominated)	The Senior Security Advisor should have knowledge and receive training, in some or all of the following, as appropriate: • security administration; • formal training in conducting incident investigations; • relevant international conventions, codes and recommendations; • relevant legislation and regulations; • responsibilities and functions of other security organizations; • methodology of security risk assessments; • facility security measures; • emergency preparedness and response and contingency planning; • instruction techniques for security training and education, including security measures and procedures; • handling procedures for sensitive security related information and security related communications; • knowledge of current security threats; • recognition and detection of weapons, dangerous substances and devices; • recognition, on a non-discriminatory basis, of characteristics and behavioural patterns of persons who may represent a security risk;

Position	Knowledge and Skills
	• techniques used to circumvent security measures; • security equipment and systems, and their operational limitations; • methods of conducting audits, inspection, control and monitoring; • methods of physical searches and non-intrusive inspections; • security drills and exercises; • assessment techniques for security drills and exercises; • possess a detailed working knowledge of this SMP; and • possess a detailed knowledge of the corporate security standard, security policy and procedures and any specific Gatehouse Security Operations Manual. The Senior Security Advisor and Superintendents will have a minimum of ten years' experience in Security, Policing or Military background. Experience and knowledge of security programs
Contract Security Supervisors and Officers	To have completed the Site induction training. Specific areas of knowledge are: • knowledge of current security threats and patterns; • recognition and detection of weapons, dangerous substances and devices, plus characteristics and behavioural patterns of persons who are likely to threaten security; • techniques used to circumvent security measures; • crowd management and control techniques; • security related communications; • operations of security equipment and systems; • testing, calibration and maintenance of security equipment and systems;

Position	Knowledge and Skills
	• inspection, control, and monitoring techniques; • methods of physical inspections of persons, personal effects, baggage, and delivered packages; • ability to conduct foot and vehicle security patrols; • maintain access control points for pedestrians and vehicles; • self-defence and restraint skills; and • possess a detailed knowledge of the relevant portions of the security policy and procedures, and any specific Gatehouse Security Operations Procedures. Security Supervisors to have a minimum of five years security related experience in Security/Policing/Military. Guard to have training and experience as per the security contract. Expectation is to have 1-2 years' experience as Security Personnel
All employees and personnel who work within project facilities	All employees, subcontractors and visitors to the Project site area are to undertake the appropriate level of induction prior to entering Site. The induction includes information relating to security emergency response and evacuation procedures and muster points relevant to the areas they are attending.

2.9. Training Records

To enable effective management and auditing the Senior Security Advisor is to ensure that a training register is maintained to record details of all employees and contractors who have received appropriate training or have sufficient knowledge to perform their security duties. Details of any security or driving licenses required and current details of those licenses are to be recorded and regularly checked for continued compliance.

2.10. Security Concepts and Security Contractor Expectations

The security concept adopted within the organization involves the joint application of security intelligence, physical security measures, personnel movement and control systems, and personal preparedness. Correctly applied and policed by management, these measures provide holistic security as well as planned and reasoned responses to incidents.

Preparedness in the form of information gathering rehearsals and information sharing remain critical to the overall effectiveness of this SMP. PEC expects that contract security providers or on-site security will observe policies regarding ethical conduct and human rights in the delivery of security services.

Wherever relevant, PEC/EPCC Contarctor is to include the principles outlined in the above-mentioned concept as contractual provisions in agreements/contracts with contract security providers. Additionally, agreements should include a provision for measuring the performance of contract or onsite security providers and stipulate the ability by PEC/EPCC Contractor to issue notices of non-compliance to the provider where service provision does not meet the requirements specified.

All agreements are to include provision to terminate agreements and/or contracts where there is consistent non-compliance with the provisions laid out in the agreement or when there is credible evidence of unlawful behaviour by a contract security provider's personnel. Security provider contracts are to be reviewed and evaluated on an annual basis to ensure requirements are met. Contract security personnel are to have received approved security training and possess the appropriate certificate(s) to undertake all assigned duties.

All contract security personnel are to act in accordance with the relevant state and Federal legislation governing the lawful use of force and exercise restraint and caution in a manner consistent with those laws in the performance of their duties. The security provider organization is to have established and documented standard operating procedures for:

- internal investigation of individual employees (Security Officers) in cases of alleged unlawful acts,
- disciplinary action against employees (Security Officers) sufficient to prevent and deter unlawful behaviour; and

- Procedures for reporting allegations to relevant local law enforcement authorities and the SHS Manager when appropriate.
- All allegations must be reported to the SHS Manager

Security providers and their employees are to maintain the confidentiality of information obtained as a consequence of the trusted access to information systems at all times including on termination of services.

2.11. Health and Safety

This SMP complements, to the fullest extent possible, the Occupational Health and Safety requirements under the laws of Malaysia.

2.12. Compliance with other plans

This SMP complements the Project Emergency Management systems and relevant plans pertaining to the management of emergency incidents.

3. Asset Protection Management

The aim of asset protection is to protect people, assets, business continuity and reputation. The asset protection management system is represented within this SMP, which prescribes security arrangements that facilitate, and are fully integrated into, normal daily project operations. Effective security management relies on the use of information to predict any imminent changes to the security environment so that an appropriate protective response may be applied. However, security threats may occur with little or no warning, so security arrangements must be flexible and able to respond rapidly to changes in the security environment.

Even with the best preventive security controls in place, incidents can still occur. This residual risk is managed through the maintenance and continual improvement of this SMP, SSSP and associated procedures and practices. Any organization that has devoted effort

and resources to protecting assets and operations in order to ensure business continuity must:

- assess the risks it faces in line with business priorities.
- mitigate or control those risks; and
- ensure that controls are relevant, appropriate and effective.

3.1. Security Risk Assessment (SRA)

The intent of future Security Risk Assessments (SRA) of sites controlled by, or have oversight from PEC and PMC, will ensure that a systematic and analytical process is undertaken to identify preventative security controls that reduce the vulnerability of Company, PMC and Contract personnel, property and information to levels that are As Low As Reasonably Practicable (ALARP) in order to protect life, operations and reputation from identified material risks.

The purpose of these assessments is to determine the security risk profile of the facilities throughout the Project in order to provide a baseline from which to develop Site Specific Security Plans (SSSPs).

The aim of an SRA is to identify and assess credible security risk scenarios which could impact on controlled or oversight sites and where applicable table recommendations for system improvements and the development of SSSPs for all Project worksites.

3.2. Information Resources

The continual monitoring of the security environment within Project construction or technical operations is an essential activity in the effective management of security threats to assets and operations. Local information resources such as Police and Security Forces shall be identified and referred to on a regular basis to support analysis of the security environment and ensure that PEC is positioned to meet any emerging threat.

Regular liaison with PEC and other security resources that may be involved in incident management should occur. The Senior Security Advisor is the person responsible to ensure this liaison takes place and for ensuring that location emergency services have access to the latest version of the SMP, SSSP and any documentation that is relevant and pertains to the management of security incidents at Site.

Involvement with other subcontractor companies as part of the Project is encouraged wherever possible. This regular interface is the means by which the SHS Manager or delegate can seek information relating to current and emerging security threats that may impact on the PEC assets and operations. Such information gained is to be communicated to the security management teams within the COMPANY, PMC, Contactors, and security providers.

3.3. Security Communication

All security specific communication requirements at work locations will be achieved via radios. All location security personnel will carry handheld radios and are able to communicate during incidents in order to coordinate an appropriate response to breaches of security at respective sites.

Normal operational communications resources can also be utilized to assist in any incident response effort with landline, mobile and satellite communications links available.

3.4. Contact Directories

Contact directories at Project work locations are to be maintained and regularly updated at all security control points. Information in contact directories should include, but not be limited to:

- PEC and PMC Internal telephone directories
- Local Police and Emergency and Medical Services contact numbers.

The Senior Security Advisor will routinely confirm and update contact directories at relevant locations to ensure it remains current and accessible at all times.

3.5. Investigating Incidents.

All incident investigations shall be carried in accordance with the approved Incident Reporting and Investigation Plan for the Project location at which the incident occurs. It is the responsibility of the Senior Security Advisor to ensure that such a plan is in place and appropriate for the level of security risk assessed.

Effective investigation and reporting of security incidents is a critical component of this PROJECT NAME site Security Plan. For the purpose of system reporting, a security incident may comprise a suspected, attempted, or executed act. It may directly involve PEC/contractor personnel and assets, or it may have occurred in or near to the project's area of construction activities.

As a guide, security incidents may include:

- Attack (successful or near miss).
- Threats.
- Protests and other civil disobedience events.
- Surveillance.
- Harassment.
- Interference with company assets (tampering with).
- Theft.
- Any information that may indicate a new or changed threat to company/project interests.
- Any suspicious activity.
- Non-compliance with security procedures.
- Failure of security hardware or systems.

3.6. Crime Scene Management

In the event that a crime is suspected to have been committed at an incident site then the following procedure describes the actions that are required to be followed when preserving the evidence at a crime scene. No one is allowed entrance to a crime scene unless it's to preserve life. Any time it's necessary to enter a crime scene, anyone entering the scene must be conscious not to disturb any evidence that may be used by authorities' forensic teams:

- Touch nothing and move nothing unless there is a life-threatening emergency.
- Make the area safe by turning off or stopping any plant or equipment. If a firearm was involved, it should only be handled by a qualified person and only if absolutely necessary.
- Restrict access into the vicinity of the crime scene area and establish a cordon (this can be achieved with reflective tape or similar). Consideration should be given to secondary crime scenes such as vehicles or other rooms that may have been used before or after the incident.
- Ensure that access to the area is monitored by a responsible person and take precise notations of time and events as they occur including who accessed the site. Ensure handover notes are given to ensure continuity of the crime scene.
- Witnesses are to record their observations and avoid discussing the incident.
- Advise Police authorities and be prepared to carry out other crime scene preservation procedures as requested.

  Note: The preservation of life and the protection of property take precedence. However, as soon as possible after an incident has been brought under control these procedures are required to be put in place.

3.7. Incident Investigation reporting

A report must be written detailing the findings of the incident investigation and include information on the causes of the events and the actions that will be taken to prevent recurrence.

Area Managers are to communicate all incident reports and progress on incident follow-ups. This is to be circulated to their management and crew leaders and review as appropriate, e.g. monthly report to include information on safety and security statistics. These should be discussed in departmental safety/toolbox meetings. There should be a uniform approach to tracking the status of actions arising from incidents.

3.8. Reporting requirements to external parties

Contractor(s) or its sub-contractor(s) may be responsible to report to various Government and Industry authorities on occurrence of certain types of security incidents. The SHS Manager is responsible to determine what reporting is required in local and international jurisdictions and assure that the appropriate reporting is carried out.

3.9. Incidents involving explosives

Incidents involving explosives are to be reported to the appropriate authorities in the jurisdiction in which the work is taking place. The SHS Manager is responsible to determine what reporting is required in local and international jurisdictions and assure that the reporting is carried out.

3.10. Terrorist threats or incidents

The SHS Manager is responsible for ensuring that security measures are introduced at the applicable alert level. Reference should be made to the Threat Escalation Procedures which details the security measures that should be implemented at the corresponding national alert level.

3.11. Site Suspensions

The security contractor will maintain and enforce an “access denied list”. This is a listing of persons that are not permitted on the project site.

The decisions on site access list can be made by PEC Construction Manager or the contractor. Reasons for site bans may include, but are not limited to the following:

- Non-compliance to alcohol and drug policies, including failing drug tests, on-site intoxication, drug possession, drug trafficking, bootlegging, drinking and driving.
- Workplace violence, assaults, and/or making threats.
- A person with a criminal record.
- Illegal or illegitimate work stoppages.
- Harassment.
- Theft or fraud.
- Serious safety-based violations.
- Other discretionary decisions made by any of the decision makers listed above.

4. Preventive Controls and Procedures

4.1. Security In-Depth Application

Potential security threats to work locations may include a wide range of acts carried out by individuals acting alone, or by groups, whose level of organization and coordination may vary from poor to excellent. Whether the motivation is individual anger, criminal intent or terrorism, acts can be deterred or delayed through the maintenance of an appropriate security posture. All security measures and procedures should be commensurate with the identified security threats and based on the recommendations of a detailed security risk assessment (SRA).

Security best practice now relies on the application of Security-in-Depth principles. This is the layering of controls concentrically around a valuable object or site (critical person, equipment and or information) in a series of overlapping barriers. This forms a protective security framework in which each successive barrier (physical, procedural or behavioural) must be defeated by an intruder or adversary.

Security-in-Depth principles prescribe the establishment of security controls that deter, detect, delay, respond and recover from unauthorized or unlawful access, removal of assets and or damage of assets. Figure 4.1 below illustrates the methodology of Security-in-Depth.

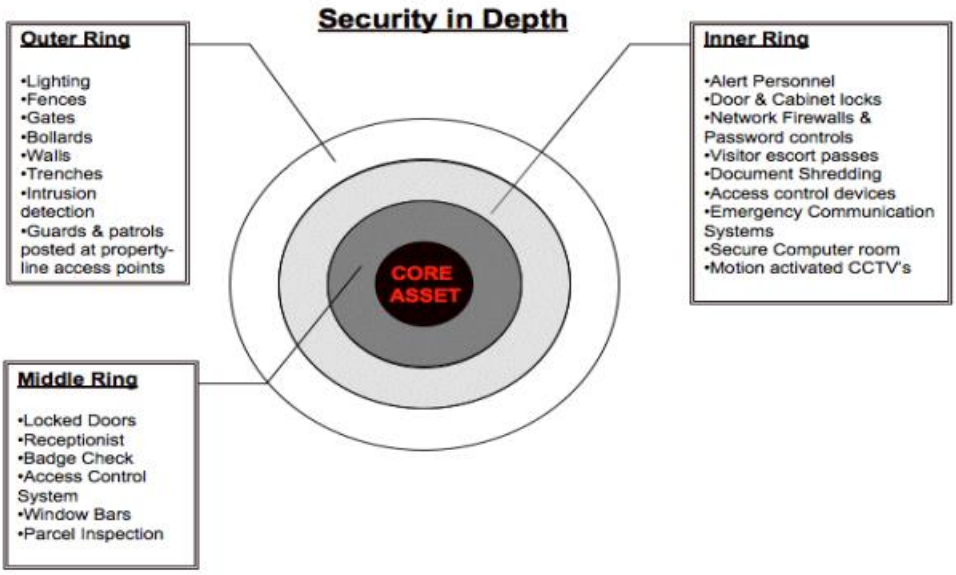


Figure 4.1 Security in Depth

4.2. Access control

Access by both vehicle and pedestrian means is to be controlled and appropriate to the threats identified in the SRA. Systems are to be enhanced to ensure that only authorized persons are able to enter the site and that restricted areas such as critical plant and equipment are only accessed by authorized personnel.

Electronic Access Cards (EAC) shall be provided to employees and contractors to ensure a record is maintained of their attendance at sites. This is an important safety and security measure and all persons entering and exiting from project work locations are to be visually or electronically identified using their EAC. Security Officers are to monitor the entry and exit of vehicles to ensure that this occurs. Breaches of this procedure are to be reported in accordance with the Gatehouse Security Operations Procedures.

All personnel entering site in an authorized vehicle are to park in the designated parking areas or at specific jobs sites as required. The driver of the vehicle will be responsible for ensuring that the vehicle does not contain any unauthorized weapons or prohibited substances and is responsible for the security of the vehicle for the duration of time it remains on site.

A Contraband Procedure will be developed to provide guidance on the list of contraband materials and actions to be followed should contraband be discovered. Furthermore, employee personal vehicles will be secured in a designated area and security provided.

4.3. Access Card System

Each Project location or office location shall utilize a photo-identification system to identify employees, contractors, clients/vendors, locally employed staff and visitors. The identification badge may be colour coded to identify specific access rights to sites throughout the Project. The Access Card Issuing Procedure will further detail how these cards are to be produced and issued. The procedure will also describe the process for accounting of all lost or un-returned identification badges and for recovering ID badges from leaving employees. Any lost or stolen identification badges are to be reported to Supervisors and the Senior Security Advisor.

All persons entering Project locations are to have their identity verified prior to being allowed access to the site. Regular checks and audits are to be conducted to ensure that only authorized persons hold identification badges.

4.4. Perimeter Control

Effective perimeter control is to be established using a Security-in-Depth approach whereby critical areas containing sensitive or hazardous equipment or operations are to be contained within fenced boundaries wherever practicable. This will effectively result in a series of fenced and locked areas within a broader outer layer of perimeter controls to be defined using a combination of gates, jersey barriers, signage, lighting, and fencing.

Where operational requirements govern that an area cannot be secured with fencing i.e., remote sites, then appropriate signage and lighting is to be erected to notify all persons approaching that area that unauthorized access is prohibited and that trespass activity will be prosecuted.

Security Supervisors are to fit security rated padlocks on all locked gates around the facilities with keys being controlled via the key control procedures detailed in Section 4.5 of this SMP. All padlocks should be colour coded or otherwise marked to allow for ease of recognition by patrolling staff to reduce the possibility that security locks have been cut and removed and replaced with unauthorized padlocks. Non-company vehicle access roads and tracks intersecting the location perimeter are to be clearly sign posted indicating that unauthorized access is prohibited and where warranted fitted with vehicle bollards, gates or equivalent to prevent unauthorized access.

All perimeter areas shall be clear of vegetation and debris and have trespass warning signs displayed at regular intervals. Where appropriate a SSSP will be developed for each Project location with input from the PEC SHS Manager and site owners to ensure that security countermeasures meet project expectations.

4.5. Key Control

A system of key control is to be developed instituted by EPCC Contractor and location owners where appropriate. This program will include:

- A key register and key cabinet held at the security gatehouse or other appropriate location with personnel, other than designated key holders, signing for and returning security keys at the end of each working day.
- The tagging and numbering of all security keys with details recorded in the key register.
- A duplicate set of security keys to be held by the Security Supervisor.
- A lockable key cabinet to be maintained for each facility with a record of all keys held.
- Security keys to be secured in the key cabinet when not in use.
- Authorization to draw or hold keys to be verified against Master Access List. Identification is checked before keys are issued / access is granted.
- Only authorized personnel, with appropriate identification, are to be issued with security keys or be given access to facilities by security staff.
- A regular program of checks and audits to be implemented to verify that access and key control is being maintained. This will be verified at the beginning of each shift.

4.6. Lighting

Many attempts at unlawful and unauthorized access to facilities are made at night. If sufficient lighting is deployed in an effective manner it can offer an extension of a secure perimeter by illuminating likely approaches or observation points. Lighting is only effective if the area it illuminates is observed by both employees and security patrols.

Wherever practicable external lighting is to be sufficient to illuminate all fence lines, roads, footpaths, and gates within Project locations in order to provide for safe travel and facilitate

surveillance by night. Lighting is most efficient when spaced so that there is no shadow between lights (generally no more than 25 meters between light units).

4.7. Signage

Signage is to be established at all potential entry points to Project locations, including on peripheral approaches to facilities and where non-company vehicle access tracks intersect with Company roads and tracks. Where perimeter fencing is established signage should be installed at regular intervals on the fence structure. Signage should be clearly visible and sufficient to make people aware that unauthorized access to the site is prohibited. Signage should also indicate that:

- use of cameras and other image recording devices is prohibited (Unless approved);
- use of electronic and CCTV surveillance is prevalent on the property; and
- the conditions of entry (i.e. persons entering agree to allow vehicles/ bags and equipment to be inspected upon demand).

4.8. Closed Circuit Television

Most Project locations do not require extensive and sophisticated CCTV systems to supplement physical security. However there may be a requirement for some systems to be installed at a later stage of the Project based on the assessed threats facing the organization in the context of an SRA. CCTV resources are best utilized to monitor main access gates to individual sites. CCTV is useful to:

- Facilitate visitor processing (either pedestrian or vehicle);
- cover likely approaches that are remote from Security Officer locations; and
- support post incident events.

Deployed to support security operations in this manner, CCTV becomes a useful low-cost platform to detect security breaches and assist in incident investigation. Ideally cameras should be tested for serviceability on a daily basis and be positioned between 4m and 5m above ground level. Recorded CCTV tapes (VHS) or data are to be stored in an appropriate fire-proof security cabinet within a room that is protected by an alarm system. Tapes and data should be retained for a 30-day period.

Significant training for staff operating CCTV platforms should also be incorporated into the evaluation as the system is only effective if monitored.

Critical Equipment & Services Protection for equipment and services that are critical to continued business operations at work sites (as identified within the SRA and SSSP), warrant additional security controls to ensure they remain functional and accessible to the operation.

Measures should be commensurate with the identified risks and threats being faced and must be sufficient to deter attempts at unlawful access, interference, or damage. Each identified critical object or service will require a case-by-case approach when deciding the level of additional security controls that are to be applied to its protection.

In all cases it is expected that the physical, procedural and behavioural controls outlined in this SMP will be applied to a minimum level and where necessary additional lighting, fencing, alarm systems, CCTV, or other measures are installed relevant to the level of assessed threat, criticality and vulnerability.

4.9. Information Security

Security of communications, commercially sensitive and operational information is vital to business continuity. All employees, and sub-contractor personnel, should be aware of the requirement to safeguard important commercial and operational information and to use an appropriately secure communications channels when necessary.

An Information Security Plan and Policy has been developed that meets the requirements for the security of information. Project information management protocols are to be followed at all times in the conduct of Project business. Information security awareness should be

included in employee and sub-contractor training. All problems associated with computer driven equipment are to be reported to Project IT department immediately.

In order to enhance information security all staff and contractors are requested to adhere to the following:

- Clear Desk Policy. All persons are responsible for classified files, electronic and paper documents that are in their custody. During periods of absence from their work areas staff are to ensure that classified documents and material are secured in an appropriate manner.

- Copying of Classified Material. The risk of loss or compromise is proportionate to the number of copies in existence. Reproduction of classified documents is to be kept to a minimum.

- Disposal/Destruction of Classified Material. Destruction in this context means that the content is destroyed making it impossible to reconstruct the material to learn its contents. A suitable method of disposing of classified material is to be implemented and may be in the form of either placement in a confidential destruction bin or by shredding in an approved shredding machine.

- IT and Communication Security. The security of IT and phone systems are managed by logical controls administrated by the corporate IT Department. All staff can augment this by carrying out the following:

    - Ensuring that they log off after each day (shift).

    - Selecting a password that is difficult to figure out.

    - Not writing down their password.

    - Ensuring no one overlooks their workstation when entering their password.

    - Ensuring that all printed material is recovered promptly from common used printers and handled in an appropriate manner.

    - Ensuring laptops and all other portable electronic media are appropriately secured (Laptops Tethered) and password protected.

4.10. Visitor and contactors/sub-contractors' access

Clear procedures and measures are to be in place at Project locations to accommodate the entry and exit of all personnel, contractors and visitors. All personnel, subcontractors and visitors will be required to adhere to the established entry policies and instructions as set out below:

- Report to the on-duty security officer or reception desk
- Complete the sign in procedures as required by their status i.e. staff member, subcontractor or visitor.
- Where the visitor or contractor is not known to staff their identity is to be verified upon arrival.
- On completion of the sign in process all visitors will be issued with safety equipment and the staff member they are visiting will be contacted. The staff member will be required to meet the visitor from the gatehouse or reception area and will act as their escort for as long as they are present on the site
- The Site Specific Access Control Procedure is an appendix to the SSSP.

4.11. Background Checks

Direct and indirect recruitment of employees and subcontractors may require applicants may be subject to a background check prior to engagement. Each contract worker should be considered individually, but at a minimum, contract workers holding the following positions normally should have their backgrounds checked as described

- Car service drivers
- Workers with privileged access to computing facilities or telecommunication networks

Requirement for background checks will be determined later in the project, however employee or contractor background checks will include the following:

- have an history of Human Rights Violations;
- criminal history; and
- employment history including verification of stated qualifications

4.12. Vehicle Parking

Privately owned motor vehicles are not permitted at project locations, except in areas designated in the SSSPs. When authorized privately owned motor vehicles will be issued a parking pass allowing them to enter the site to access the secure private parking area.

4.13. Inspection procedures

Based on the established Threat Level, personnel baggage and vehicles entering/exiting Site will be subject to random security inspections. This is inclusive of all baggage and vehicles operated by contractors, sub-contractors and visitors.

The search may be conducted as a spot check and shall be consensual and all persons seeking entry to Site who refuse to be so inspected will be denied entry. The unauthorized removal of property from sites is a serious criminal offence and will be treated as such.

4.14. Unauthorised weapons

Unauthorized weapons (firearms, cross bows, swords, chemical sprays, knives with blades exceeding three inches, clubs and other items primarily intended for causing injury or harm to property or another person) are not to be carried, placed or kept within any property or vehicle by any person except by authorized government law enforcement and/or defence force personnel.

To combat and reduce the possibilities of unauthorized carriage or possession of weapons or other prohibited items into Project locations, inspections will be undertaken as detailed in Section 4.20 and 4.21.

4.15. Contract Security Officers

Security Officers must meet the requirements outlined in the Security Services Provider Contract. Security officer duties and responsibilities are to be undertaken with regard to the Security Concept and Security Contractors Expectations referred to in Section 2.10 of this Plan.

Failure to comply with lawful directions and instructions from Security management will result in disciplinary action being taken. This may include a request by Security Management for dismissal of an individual Security Officer or termination of the security provider's contract.

The specific duties and responsibilities assigned to Security Officers are detailed in the Gatehouse Security Operations Procedure relevant to the site they are employed at. The SHS Manager or designate is the ONLY person authorized to amend the duties and responsibilities of the contracted Security Officers.

The security provider organization will ensure that all contract Security Officers have a background check before being employed. PEC/PMC/EPCC reserves the right to refuse to audit the background checks and question employment to any candidate with a criminal record, or whose background, history and medical condition is considered unsuitable for security duties.

4.16. Security Patrols

Security patrols represent a significant preventative control measure in the protection of assets and operations. Regular and irregular inspections of the grounds, perimeter and key locations at frequent intervals should be undertaken by both contract Security Officers and Security Supervisors.

Such patrols are a combination of foot and vehicle mounted efforts. The frequency, intensity and structure of the patrols should increase in response to any escalation in security threat. Contract Security Officers and Security Supervisors should at no time place themselves in danger of injury during the course of a security patrol. Patrols should be seeking to detect any suspicious persons and evidence of unauthorized access into all site facilities. Examples of this are:

- damage to fencing and vegetation;
- evidence of locks and electricity services being tampered with;
- unauthorized persons in the Project location, and
- persons monitoring / doing surveillance on the facilities.

4.17. Security Response

The normal first level of response to a security incident at Site will be a Security Officer. The Security Officer may be supported by the Security Supervisor on duty and if unable to resolve any incident and require additional support, the required support will be sought from local authorities. The primary role of Security Officers is to observe and report activity rather than to attempt to apprehend persons undertaking unlawful acts. Reporting to and notification of local Law Enforcement Authorities is accordingly their focus of security response.

The SHS Manager or designate is the ONLY person authorized to amend the duties and responsibilities of Security Officers or to provide them with directions regarding the response to a security incident.

4.18. Trespass

This process describes the actions that are required to be followed at Project locations, when dealing with a person or group that is attempting to access a location area without management consent. The following key steps should be taken.

- Remain calm and politely inform the person(s) that they are not authorized access to the location. Inform Site Security, the Security Supervisor and where applicable the Camp Manager who will immediately make their way to the incident area and attempt to defuse the situation.
- The responding Managers are to advise the offending person(s) that they are trespassing on private property and request that they leave immediately.
- Be prepared to inform employees and contractors to avoid the area until the situation has been resolved.
- At the discretion of the responding Managers or Senior Security Advisor Police may be requested to attend the site to remove any person or group from site.

4.19. Response to the security Threat

In the event an employee or contractor becomes aware of a security incident or threat of a security incident, that person shall report the details of the incident/threat as soon as practicable to Security and the Security Supervisor. Where the incident/threat directly impacts upon another organization, the Security Supervisor is to relay details of the incident/threat to the affected organization as soon as possible.

The Security Supervisor, in consultation with the Senior Security Advisor, is to carry out a review of the particular situation and in conjunction with the Project Management Team,

determine an appropriate course of action and carry out the necessary action. When applicable, the Security Supervisor and / or Senior Security Advisor will seek Corporate advice and, if deemed prudent, wait for the arrival of expert assistance.

In the event of an employee or subcontractor becoming aware of a significant act of unlawful interference (e.g. one involving the use of weapons or force) or an unlawful threat (e.g. bomb or sabotage threat), that person shall report details on the incident / threat as soon as practicable to the Security Officer, Security Supervisor or Senior Security Advisor.

All telephone threats received by employees or subcontractors are to be treated seriously and the details recorded carefully on a 'Telephone Threat Checklist'.

The assessing and classifying of all threats, such as bomb or sabotage threats, against any Project facility, rests with PEC/PMC/EPCC. Threats are to be classified as either 'GENUINE', in which case appropriate response procedures are to be enacted, or 'HOAX', in which case no further action will be required other than to report the incident to the local police and relevant authorities.

In cases of doubt regarding validity of a threat against Project facilities it should be regarded as genuine until determined otherwise, prudent emergency evacuation procedures shall be affected.

Site Specific Emergency Response Procedures will be developed to address Bomb Threats, Kidnap/barricaded persons, intruder response, emergency lockdown and Threat Escalation.

4.20. Search Options

Where a search of a Project location is considered necessary, the threat shall remain genuine until the Security Supervisor or Senior Security Advisor advises that the threat has been reclassified as a hoax, or any suspicious object discovered during the search has been removed or declared safe.

Support from local Police may be required to verify the nature of suspicious objects. Security Officers are to be trained in basic search techniques. Details of all such incidents are also to be recorded in an appropriate incident register.

Following the decision to undertake a search of a Project location in response to a threat the Security Supervisor or Senior Security Advisor should determine using a process of positive and negative indicators if an evacuation of the facility is necessary. There are five possible alternatives to implement:

- Option 1 - Take no further action. It may be tempting to do nothing when a child or intoxicated person has made a threat but if the slightest doubt exists another option must be considered.

- Option 2 - Search with partial evacuation. If the threat is considered moderate, with no reason to believe a serious threat is imminent, then consideration may be given to a partial evacuation retaining only essential staff and search teams. Partial evacuation might also be appropriate where any personnel are spread over a wide area, as only those personnel at immediate risk may need to be evacuated initially.

- Option 3 – Search and evacuation. In this option personnel remain in place during initial search and are evacuated once the presence of a suspicious article is confirmed. Normally this option would be adopted in a low threat assessment scenario.

- Option 4 - Evacuate immediately. When the risk is high or when search is precluded due to the extreme short notice of the threat, then there is no option other than to evacuate as quickly and as safely as possible.

- Option 5 – Shelter in Place. Depending on the given circumstances it may be necessary to remain in place and seek refuge.

4.21. Search Types

There are four methods for conducting a search for a suspicious item which includes a search conducted by supervisors, by facility occupants or by special search teams. Each method has advantages and disadvantages.

- Supervisory Search - These are discreetly undertaken by supervisory staff without alerting staff to the threat.

- Occupant Search - The occupant of the area is normally the best person qualified as they should be able to readily assess items that do not belong. This type of search is relatively fast and efficient and it avoids the privacy issues associated with a supervisory search but may require some additional training.
- Trained Search Team - A team may comprise elected personnel from the facility. Regardless of origin the team needs formal search training and must apply discipline, logic and initiative to conduct an effective search. Team search provides a high level of staff safety and is thorough but is slower and affects production.
- Local Law Enforcement may wish to evacuate and conduct a search using their own trained resources.

4.22. Discovery of Suspicious object

If a suspicious object is discovered, then carry out these key actions:

- Do not touch. Explosive devices can be rigged to explode in many different ways.
- Clear people away from the immediate vicinity. The further people are away from an explosion the more protection they will have as blast pressure and flying object impact decreases over distance.
- Secure the area. Cordon off the area so no one accidentally goes near the device or interferes with it. From a crime scene perspective having less people around the area will assist police to investigate.
- Inform Management. On notification the Security Supervisor or Senior Security Advisor will commence the evacuation process.

- Initiate Evacuation. Carry out the normal evacuation process taking into account any extenuating circumstances.
- Inform Local Law Enforcement. As soon as possible inform the Local Law Enforcement agencies of the incident and request assistance.

4.23. Emergencies and Evacuations

Any declared emergency situation requiring a full or partial evacuation at any facility shall be responded to in accordance with the current approved Evacuation Plans for the Project location.

4.24. Evacuation Plans

Evacuation plans must be known to all personnel at the Project location including visitors. All persons are to be informed of existing security and evacuation plans on arrival. For visitors of a short duration this may be limited to a quick explanation of the plan and advise as to the locations of rendezvous points and safe havens. Visitors should always be provided with information detailing relevant safety and security points of contact.

4.25. Evacuation

The decision to evacuate a location should not be taken in isolation unless the situation obviously presents an Immediate Danger to Life or Health. It is highly likely that escalating tensions or security concerns will have been identified by security intelligence prior to an evacuation.

4.26. Alert Levels.

Alert levels in security and evacuation plans are mandatory. Adoption of a particular alert level triggers certain actions by security and employees. Actions may range from reminding staff of personal security and awareness requirements, to occupation of a pre-arranged Safe Havens and evacuation points. A Threat Escalation Matrix will be developed for all Project locations.

4.27. Security Awareness and Vigilance

Establishing security awareness and vigilance within the employee and contractor workforce to protect business operations is perhaps the most critical element of an asset protection system. Positive, negative or neutral attitudes can have a disproportionate effect on the effectiveness of the security program of any organization.

The attitude of individual employees is reflected in their own security awareness and threshold tolerance. Some employees who have worked for a long time in benign security risk environments become complacent regarding the importance of security controls to the maintenance of a safe and secure workplace and may often seek to circumvent them to increase personal convenience.

Their personal security tolerance threshold is uninformed and it would take a direct attack on them or a serious incident at their residence/place of work to alarm them. This type of attitude can be dangerous particularly if those individuals are in senior management positions. An individual's complacency should not dictate or affect the overall security program for a group or organization.

The natural surveillance of the workplace that employees and contractors perform in the course of their normal duties is difficult to replicate with Security Officers patrols alone. Accordingly, they should be educated to become proactive in monitoring the work locations they attend. This is particularly important in areas that are not generally occupied by personnel or that are geographically remote.

Employees and contractors should be encouraged to note and report damage, vandalism, attempts at illicit entry and any other issues that indicate a security concern. Employee and contractor induction packages should include information regarding this key role, and the respective reporting channels available to them for the reporting of concerns and incidents as detailed in Sections 4.18 and 4.19.

Additionally, employees and contractors should be encouraged to politely question any person(s) they see in their workspace that they are not familiar with. They should be prepared to call for a Security officer or Security Supervisor and management support if they discover persons in their workspace who should not be there.

Altering workforce attitude regarding security, from a position of seeing it as obstructive and unnecessary to it being perceived as a value adding management component with a strong preventative focus, begins with management support at all levels. The premise that 'Security is everybody's business' is to be encouraged at every opportunity within normal workplace communications media.

4.28. Security Awareness Training

Basic security awareness, site security, crisis management and emergency drills need to be addressed with all personnel and should form the basis of induction packages for all new employees and contractors. On-going security communications, briefings and training for staff should be conducted regularly and is best achieved through toolbox and pre-work meetings.

All employees and contractors are to be made aware of what information should not be divulged regarding corporate operations and current security practices. Orientation training shall include:

- outline of the threat to the immediate work place;
- the role of staff members in keeping visitors to safe;
- information security policies;

- observing and reporting possible security breaches, evidence of break-ins or tampering, and any suspicious situation;
- escalation of preventive security in response to security threats; and
- emergency response procedures, including handling suspect mail and threats.

4.29. Employee, Contractors' and Visitor orientation

All employees, contractors and visitors are to undertake the appropriate level of orientation prior to entering or commencing work Project locations to ensure they are familiar with applicable security and safety measures and emergency procedures particular to the site.

4.30. Kidnap, Ransom and Extortion

The current assessed threat level of Kidnap, Ransom or Extortion (KRE) personnel is extremely Low. The preventative controls described in this SMP should continue to be applied to the workplace environment and to employees and contractors personal away from work situations. A high level of security awareness is the most effective preventative control in mitigating potential threats of KRE.

Any incidents of suspicious activity or the unexplained observation shall be reported to the Safety, Health and Security Manager as soon as practicable. The security risk of KRE events impacting Project locations and personnel shall be assessed annually as a component of the security risk assessment or on receipt of specific information of an increased threat.

Management of incidents of actual KRE are likely to require activation of the Crisis and Emergency Management organization to determine a reasonable and prudent management strategy for the incident.

4.31. Mail / Package Handling and Delivery Screening

Mail/Package Handling and Delivering Procedure is designed to ensure that any packages or mail that is delivered to the project locations will be screened for contraband such as weapons, alcohol, drugs and other items that pose a threat to the security of all the residents of the project. Procedure applies to all packages and envelopes that come via courier or regular mail system. This procedure does not include any items that are brought to site for warehousing, deliveries to warehouse will be handled by the material shipping record system. Site specific procedures will be developed for each location.

5. Cyber Security

This Cyber Security Policy includes guidelines and provisions for security to help mitigate cyber security risk. It applies to all the company employees, contractors, volunteers and anyone who has permanent or temporary access to the company's system and hardware.

5.1 Confidential Data

Confidential Data is valuable and is to be kept secret. Company confidential data includes:

- Unpublished Financial information
- Data of customer / technology partners / vendors /
- Patents, formulas, or new technologies
- Customer lists (existing and prospective)

All employees are obliged to protect the data.

5.2 Protect Personal and company Devices

When employees use their digital devices to access email or account, they introduce security risk to company data. Employee are to keep both their personal and company issued computer, tablet and cell phone secure. To keep these device secure:

- Keep all the devices password protected
- Choose and upgrade a complete antivirus software
- Do not leave devices exposed or unattended
- Install security updates of browses and system monthly or as soon as updates are available.
- Log into company account and systems through secure and private networks only.

Employees are advised to avoid accessing internal systems and accounts from the other people devices or lending their own devices to others.

When new hires receives company issued equipment, they will receive instruction for:

- Disk encryption setup
- Password Management tool setup
- Installation of antivirus – anti malware software

5.3 Safekeeping Emails

Emails can host scams and malicious software. To avoid virus infection or data theft, employee must:

- ✓ Avoid opening attachment and clicking on links when the content is not adequately explained (e.g. what this video, its amazing)
- ✓ Be suspicious of clickbait titles (e.g. offering prizes, advise)
- ✓ Check email and names of people they received a message from ensure they are legitimate.

- ✓ Look for inconsistencies or giveaways (e.g. grammar mistakes, capital letters, excessive numbers of exclamations marks)

If an employee's isn't sure that an email they received is safe, they can refer to the company IT security specialist.

5.4 Manging Passwords

Password leaks are dangerous, since they can compromise the company entire infrastructure. Not only should passwords to be secure so they will not be easily hacked, but they should also remain secret. For this reasons, employee are to

- Choose passwords with the at least eight characters (including capital and lower case letter, numbers and symbols) and avoid information that can be easily guessed.
- Remember passwords instead of writing them down, if employees need to write their passwords they are obliged to keep the paper or digital document and destroy it when their work is done.
- Exchange credential only when necessary. When exchanging them in person is not possible, employees should prefer the phone instead of email, and only if they personally recognize the person they are talking to.
- Change their passwords every two months.

The company will purchase the service of a password management tool which generates and stores password. Employees are obliged to create a secure password for the tool itself, following the abovementioned advice.

5.5 Data Transfers

Transferring data introduce security risk. Employee must:

Avoid Transferring sensitive data (e.g. customer information, employees records) to the other devices or account unless absolute necessary. When mass transfer od such data is needed, we request employees to ask the company's IT security specialist for help.

Share confidential data over the company network / system and not over public wifi or private connection.

Ensure that the recipients of the data are properly authorised people or organizations and have adequate security policies.

Report scams, privacy breaches and hacking attempts.

Company IT security specialist / network Engineers** need to know about the scams, breaches and malware so they can better protect company infrastructure. For this reason, we advise our employees to report perceived attacks, suspicions email or phishing attempts as soon as possible to our IT security specialist / network engineers, who must investigate promptly, resolve the issue and send a companywide alert when necessary.

IT Security Specialist are responsible for advising employees on how to detect scam email. We encourage our employees to reach out to them with any question and concern.

****PEC IT security specialist / network Engineers closely working along with the technology partners and EPC contractors to control any hacking or cyber-attack on the system.**

5.6 Additional Measures

To reduce the likelihood of security breaches, we also instruct our employees to

- Turn off their screen and lock their devices when leaving their desks.
- Report stolen or damaged equipment as soon possible to HR / IT department
- Change all account passwords at once when a device is stolen.
- Report a perceived threat or possible security weakness in company system
- Refrain from downloading suspicious, unauthorized or illegal software on the company equipment
- Avoid accessing suspicious websites.

We also expect our employees to comply with our social media and internet usage policy.

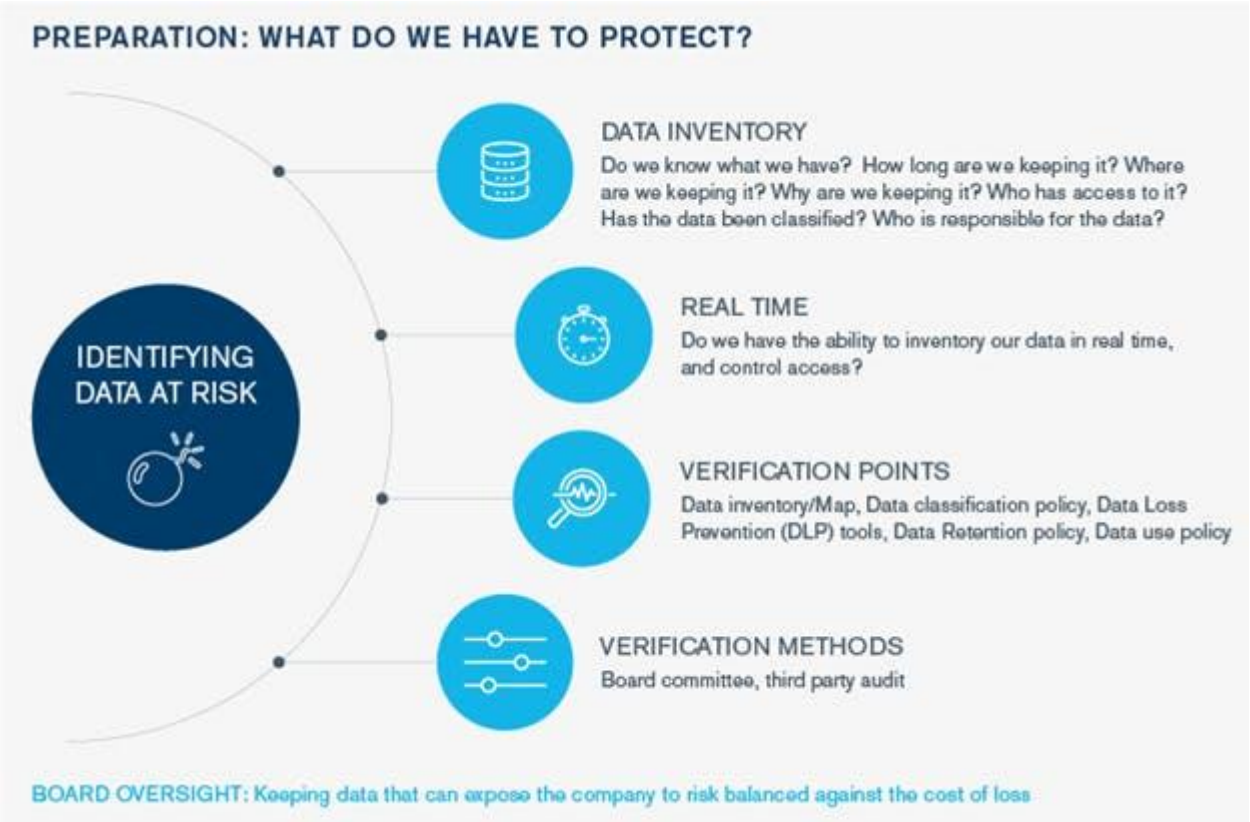
Company IT Security Specialist should:

- ✓ Install Firewall, anti malware software and access authentication system
- ✓ Arrange for security training for all employees
- ✓ Inform employees regularly about the new scam email or virus and ways to combat them.
- ✓ Investigate security breaches thoroughly
- ✓ Follow these policies provisions as other employees do
- ✓ Comply with the guideline provided by the technology partner (UOP, TCM)

Our company will have all physical and digital shields to protect information. In addition, PEC will make sure:

- Appoint Certified cyber–Security Team.
- Staff education:

    - Conduct a cybersecurity workshop.
    - Share stories about recent breaches and how they could have been prevented.
    - Organize a cybersecurity drill.
- Ransomware: recommended protective measures
- Enable multi-factor authentication on as many accounts as possible.
- Harden your email spam filter.
- Train your end users.
- Keep good backups, isolated from your network.
- Consider cyber insurance.
- Evaluate security controls of third parties.



5.7 Remote Employee

Remote employee must follow the Cyber Security Policy. As remote employees will be accessing the company's account and system from distance. They are obliged all the data encryption, protection standards and settings, and ensure their private network is secure.

Remote employees are encouraged to seek advice from company IT Security Specialist / IT administrator.

5.8 Disciplinary Action

All employees are to always follow this policy and those who cause security breached may face disciplinary action:

- First time, unintentional, small scale security breach the company may issue a waring letter and train the employee on security.
- Intentional, repeated or large scale breaches (which cause severe financial or other damage) the company invoke more sever action up to including termination.

Each incident will be examined on a case by case basis.

Additionally, employees who are observed to disregard the company security instruction will face progressive discipline, even if their behaviour has not resulted in a security breach.

6. Drone Detection and Defence System

With the decrease in the cost and size of drones in recent years, their number has also increased exponentially. As such, the concerns regarding security aspects that are raised by their presence are also becoming more serious. The necessity of designing and implementing systems that are able to detect and provide defense actions against such threats has become apparent. This technology is useful for measuring and monitoring progress of the project and also threat for the project for unknown objects flying in the company premises. PEC recognized these issues and impact of drone attack on the company assets.

To protect from such instance and PEC will keep Drone Detection and defence system during constructions and operation phase by engaging manned and unmanned Security System.

Manned Security: Manned guarding is a highly effective way of eliminating criminal damage and theft, making it one of the most proactive security measures that you can take against

crime. It is a security service that involves placing security guards at the premises, usually out of hours but sometimes when staff are still present.

The manned guarding security service that Carter Security offers is much more than a security patrol of your premises. The security guards are all trained to Security Industry Authority (SIA) standards, and are fitted with body cameras for audible and CCTV footage, ensuring you have a professional security officer managing your property at all times.

Un Manned Security: Apart from Access Control, CCTV Systems and Alarm System company will keep the equipment for control drone detection and defence systems. These equipment's detects drone presence by analysing signaling channel and radio transmission. Once a drone has been detected it triggers automatically a neutralization system which deactivate the drone/quadcopter from any operation.

KEY FEATURES:

- ✓ Detects and blocks common Civilian drone /Quadcopter / UAV bands selectively:
- ✓ Data
- ✓ Command and control
- ✓ GNSS (GPS, GLONASS, etc)
- ✓ Effective coverage of detection up to 1000m, 360°
- ✓ Reactive system (automatic performance)
- ✓ NO HUMAN FACTOR!

Aerial Surveillance Digital Radar: The ASDR – all weather 3D digital radar with all-dimensions electrical scan with effective coverage 0,1 to 33 km and outstanding accuracy. Radar is capable of detecting and tracking miniature targets (RCS=0,01 sq.m) on the distance of 5,5 km. ASDR is compatible with additional layers, such as RF devices, jammers, ground control stations, optical and remote controlled weapon sub-systems.

SAD-360-E: The SAD360 detects drone presence by multiple layers of the most reliable sensors with the effective coverage range of ~5 km. Once a drone has been detected, system provides smart neutralization options and optionally backs up the operator in automatic mode.

PEC

Emergency Response Plan – Operation phase

(DOC.No: PEC-02B2)

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1. Introduction

Safe design and operation of installations are basic obligations. Management and staff have legal and moral obligations to protect human life and health, and the environment.

The oil and gas industry processes, stores and distributes large quantities *of* flammable materials, including gasoline which is classified as highly flammable, and liquefied petroleum gases. Refineries and major storage depots are therefore classified as hazardous installations within the provisions of the PEC.

The key to safe operation is effective risk management. This involves assessing consequences should a problem occur, and judgements about acceptable levels of risk. Hazards can be reduced but not eliminated by safe working practices in the framework of safety management. All staff need to be vigilant in ensuring safety and proactive in seeking to reduce risks.

To enable effective emergency handling, block diagrams are prepared to give clear and concise direction to concerned individuals for necessary and timely action. These block diagrams should be used during mock drills for effective implementation during actual emergencies.

2. Intent and Purpose

When an emergency occurs, the main concern is to preserve life and safeguard property and the environment. Therefore, an Emergency Handling Block Diagrams needs to be designed with the following objectives:

1. Rescuing people
2. Treating the injured
3. Safeguarding others
4. Minimizing damage to property and environment
5. Controlling the incident, removing the hazard, preventing escalation
6. Maintaining the welfare of personnel involved in controlling the occurrence
7. Identifying casualties informing and assisting relatives
8. Informing/collaborating with the authorities and emergency services.
9. Preserving records.
10. Re-establishing Normal operations.

3. Scope and field of Application

The procedure scope & field of application are:

1. This procedure applies to all PEC Operation Areas process, Utility units and Offsite facilities.
2. All process emergencies arising out of any operations related activities are covered by this procedure.

4. References

- Operating Manuals
- Emergency Response Plan for Constructions Phase
- PEC HSE Policy / HSE Plan
- PEC PSM Manual
- Reference Procedures / formats of PEC Refinery
- HSSE Document Management System.
- Licensor Documents.

5. Abbreviations

Abbreviation	Definition
CCR	Central Control Room
DCEO	Deputy Chief Executive Officer
DCS	Distributed Control System
EPC	Engineering, Procurement & Construction
FO	Field Operator
HSSE	Health, Safety, Security & Environment
HSSEMS	Health, Safety, Security & Environment Management System
RSL	Refinery Shift: Leader
PEC	Pengerang Energy Complex
DEO	Department of Environment
MOC	Management of Change
PEFS	Process Engineering Flow Scheme
PHA	Process Hazard Analysis
PMR	Plant Modification review
PO	Panel Operator
PPE	Personal Protective Equipment
PSI	Process Safety Information
PSM	Process Safety Management
PT	Process Technology
RSC	Refinery Shift: Controller
SOP	Standard Operating Procedure

6. Definitions

Accident: An incident, which has caused harm/loss.

Hazard: An inherent property or characteristic of a material, system, or process that has the potential for causing serious injury to people and/or property or environmental damage.

Hazardous Substance: Any substance that when released or ignited or when its energy is released, can result in death or irreversible human health effects, significant property damage or significant environmental harm because of its acute toxicity, flammability, explosiveness, corrosiveness, thermal instability, latent heat or compression.

Hazard Identification: A systematic approach to characterizing handled material and process conditions that may result in hazardous events, like explosions, fires and releases of toxic materials.

Management of Change (MOC): A systematic procedure e.g., Minor Change Notice (MCN), Change of Design (COD), or Test Authorization (TA) procedure for the analytical review of changes (including subtle changes) to the documented process technology and/or facilities for consideration of potential hazards being introduced to the process, system, or operation and their elimination or control.

Operating Manual: A comprehensive set of information which provides basic introduction of plant, design basis, process principles and process flow, equipment details, startup & shut down procedures, emergency procedures, instruments, troubleshooting etc. Operating manual is important for basic induction, training of operation's crew, for preparation of standard Operating Procedures (SOP).

Process Safety Information (PSI): Documentation of all knowledge, data and understanding of the following three subject areas: process design basis, equipment design basis and hazards of materials.

Process Hazard Analysis (PHA): The application of organized and methodical Approaches to identify evaluate and control the hazards associated with process facilities.

Pre-Commissioning: Various activities, i.e., flushing with air / water / steam, electrical Motors rotation checks, instrument loop checks, and catalyst loading etc. carried out by Operation and Maintenance groups before making the facility ready for taking in hydrocarbon or intended feed.

Commissioning: The commissioning is marked by introduction of Feed /Hazardous substance to the new facility.

PSM Critical: Components, equipment or systems whose failure could contribute to the release of or exposure to sufficient quantities of hazardous substances or their energy (e.g., fires and explosions) that could result in death or irreversible health effects, significant property damage or significant environmental impact.

Pre-start up activities: Various activities like removal of LOTO, Leak test of equipment and piping, N2 or air Purging, Control valve and interlock testing, steaming, utility charging, refractory dry out,

scrubber and flare charging etc.

Standard Operating Procedures (SOP): A comprehensive set of step wise instructions for the operation of a process. They provide a clear understanding of the detailed operating parameters and limits for safe operation in all process modes (e.g., start-ups, normal operation, shutdowns), including an explanation of the consequences of operation outside the process limits and a description of steps to be taken to correct and/or avoid deviations.

Turn Around (TA): Scheduled major shutdown to complete the plant major modifications/ Changes.

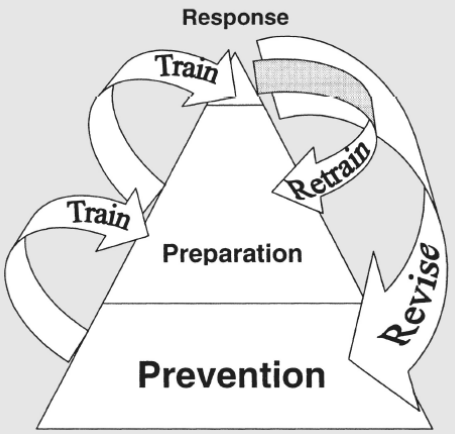
7. Management Responsibilities

Further to the Emergency response Plan of the construction phase, which covers

- Emergency reporting procedures
- Designated assembly areas
- Evacuation procedures
- Emergency response procedure
- Information regarding co-ordination with the local community and authorities
- Internal and external communications

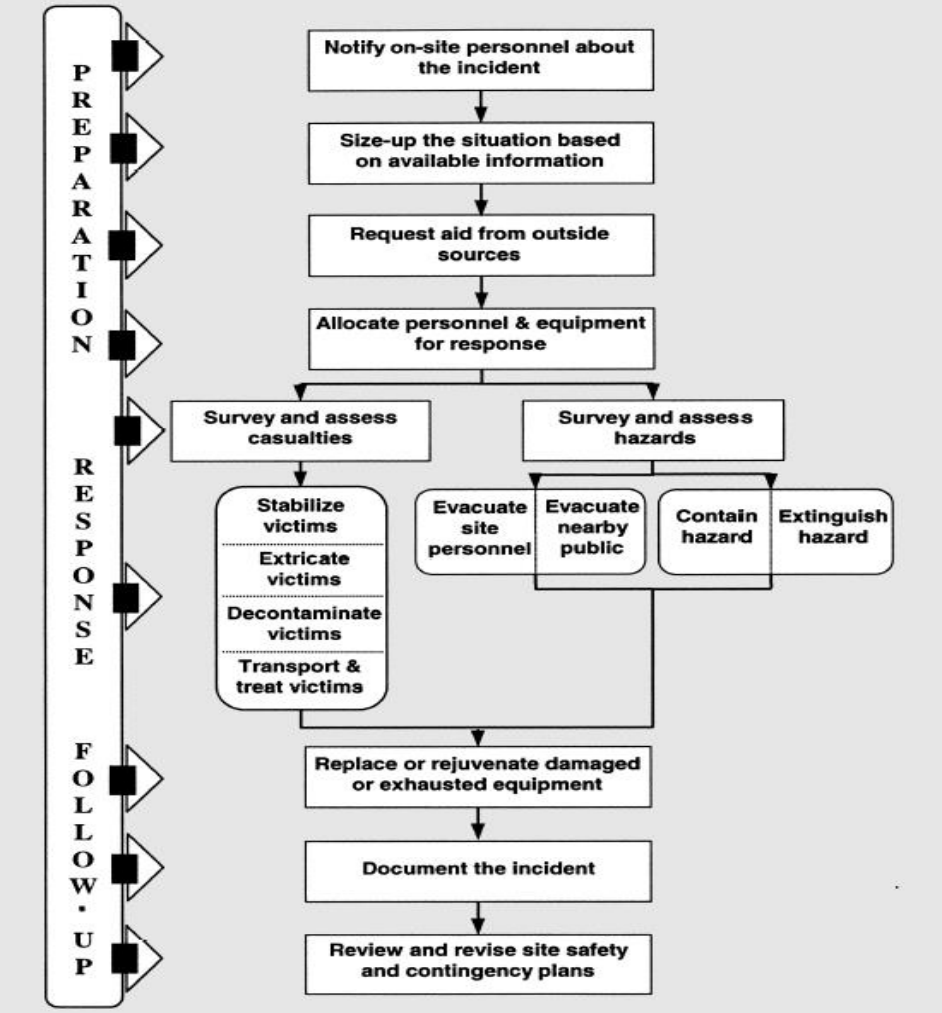
Proper emergency planning begins with the owners, operators and managers of the facilities involved in or coordinating to a potential or actual emergency

PYRAMID OF EFFORT IN EMERGENCY PLANNING. NOTE THAT THE VAST MAJORITY OF EFFORT MUST BE GIVEN TO PREVENTION AND PREPARATION



Further Line management in PEC has the responsibility to implement "Emergency Handling Block Diagrams development guidelines".

Based on the following process defined in the below diagram:



Roles and responsibilities are given as below:

7.1 The site leadership (Manager, Operations Group):

1. Establish and administer site systems to achieve and maintain safe plant operations.
2. Accountable for implementing this Procedure.
3. Ensure the Emergency Handling Block Diagrams related best practices are shared across the sites in Operations Group.

7.2 The Site Leadership (Team Leader, Operations):

1. Responsible to maintain, revise and implement the Emergency Handling Block Diagrams in respective Operations area.
2. Ensure sufficient training has been provided to staff on Emergency Handling Block Diagrams.
3. Support to audit and maintain the systems, programs and practices for the Emergency Handling Block Diagrams.
4. Ensure proper communication within the sections and other sections/groups for smooth and safe operation of process units.
5. Assumes the overall responsibilities for developing and maintaining Emergency Handling Block Diagrams for the facilities.

Note: Operations Group can take the assistance with Other Groups for review of the Emergency Handling Block Diagrams.

8. Emergency Handling Block Diagram Structure

In order to unify the Emergency Handling Block Diagrams formats among Operations Group, following guidelines to be followed while preparing:

8.1 Paper Size and Margin

The document shall be printed single/double sided on A4 size paper. A3 sizes should not be used. However, if used where necessary, A3 size pages shall be folded down to A4. The recommended paper margins for text are as follows:

- Top: 1.6 cm
- Bottom: 1.6 cm
- Left: 3.0 cm
- Right: 2.0 cm

8.2 Font Size and Style

'Tahoma' type font with 1.15 line spacing shall be generally used. The font size and line spacing shall be as follows:

- Main Heading: 11 bold, Title case
- Sub-Heading: 11 bold, Title case
- Paragraph: 11, Sentence case

8.3 Emergency Handling Block Diagram Sheet header:

Document header shall include the following information:

PENGERANG ENERGY COMPLEX SDN BHD	**PEC OPERATIONS AREA XX Unit XX**	**Unit Name - XX/'XX/XX** PEC/OP/22/9001

9. Emergency Handling Block Diagrams Specifications

Emergency Handling Block Diagrams must be developed and documented for process activities. An emergency Handling block diagram should use a Top Down Sequential activity flow scheme as shown in Annexure 1.

9.1 Emergency Handling Block Diagrams minimum contents:

Emergency Handling Block Diagram minimum contents are listed below. Some of the items specified below may be modified and/or changed depending upon the particular unit configurations/specialty. Refer the sample Emergency Handling Block Diagram format as mentioned in Annexure-1 and Annexure-2.

1. Emergency Handling Block Diagram title.
2. Consequences of Emergency
3. Concerned Personnel to direct or take action.
4. Sequence of Actions to be followed in case of emergency.
5. Sequence of Actions to be followed post emergency.

9.2 Emergency Handling Block Diagrams Applicability:

Emergency Handling Block Diagram to be prepared for following activities but not limited to and should be extended to emergencies as required for each unit. This may be modified and/or changed depending on the particular unit's requirements.

1. Emergency unit shut downs (Eg: Power Failure, Steam Failure, Feed Failure etc.)
2. Equipment/Line Failure (Eg: Heater Tube Rupture etc.)
3. Streams not available from other units (Eg: Makeup Hydrogen, etc.)
4. Difficulty in sending the product to other units (Eg: Fuel Oil rundown line plugged, Product line SOV malfunctions etc.)
5. *Off* spec product (E.g.: LPG *Off* spec, Naphtha *Off* spec)

9.3 Common Consideration during preparation of Emergency Handling Block Diagrams

Following aspects to be considered while preparing the Emergency Handling Block Diagrams:

1. A comprehensive occupational health, safety, Fire and Environmental control section is needed to inform the operators for the hazards involved, means of control of the hazards, and how to respond if there is a spill or exposure using PPEs, Special equipment & other safety related measures.
2. Emergency Handling Block Diagrams should be prepared for all process emergencies including failure of raw material, power, steam, cooling water & other utilities, DCS, PLC & other critical instruments failure and emergencies arising out of failures in adjacent units.
3. The critical raw materials and their MSDS reference should be given so operating personnel can respond properly to any unusual material problems.
4. Emergency Handling instructions must be accurate, understandable, & in simple language which can be followed with confidence.
5. As per MOC procedure, modifications to Emergency Handling Block Diagrams to be completed prior to implementing change wherever applicable.

9.4 Emergency Handling Block Diagrams Document Location/ Availability

Emergency Handling Block Diagrams should be available at locations in order to provide ease of access to all employees who needs to refer it. Table 9.4 shows the location details with target Employees where SOPs should be available.

Table 9.4: Emergency Handling Block Diagrams Document Location Details

Sl. No.	Location	Target Employees
1.	Manager *Office*	Management
2.	Team Leader *Office*	Team Leaders & Auditors
3.	Section Head *Office*	Section Head & Auditors
4.	Refinery Shift Leader Office	Refinery Shift Leaders, Controller I
5.	Controller Office	Shift Controllers
6.	Control Room	Panel Operators
7.	Operator Shelters	Field Operators
8.	Document Control Centre	Master copy for records

10. Management Systems

Following support services & audit requirements to be followed to implement the Emergency Handling Block Diagrams development guidelines.

10.1 Support resources

PEC sites Engineering, Technical Services and HSSE resources shall be made available to assist with implementation of this standard of operating practice.

10.2 Audit requirement

Following scope shall be included in review & audit of Emergency Handling Block Diagrams.

1. Emergency Handling Block Diagrams availability at locations where it is needed.
2. Emergency Handling Block Diagrams ease of access who needs to refer it.
3. Updated as per Revision frequency.
4. Emergency Handling Block Diagrams format as per Annexure 1.
5. Management of Change (MOC)/Plant modification Review(PMR) or changes in Risk Register included in Emergency Handling Block Diagrams revision.
6. All training records, deviation authorizations from any procedures etc.

10.3 Revision of Emergency Handling Block Diagrams

Emergency Handling Block Diagrams shall be reviewed and approved at intervals not exceeding three years. Revision frequency to be reviewed after stabilization of Refinery units.

10.4 Procedure Document Revision Process

This procedure for "Emergency Handling Block Diagrams Development Guidelines" shall be reviewed and revised as necessary, and at a minimum, not later than three years from the date of last revision or when the corporate Standard is to be revised. Revision frequency to be reviewed after stabilization of Refinery units.

10.5 Deviation Process

Deviations from this procedure shall be authorized by the site DCEO after consultation with the PEC HSSE and Operations Group. Deviations shall be documented and documentation shall include the relevant facts supporting the deviation decision. Deviation authorization shall be renewed periodically and renewal period shall not be more than three years.

10.6 Training and Communications Requirements

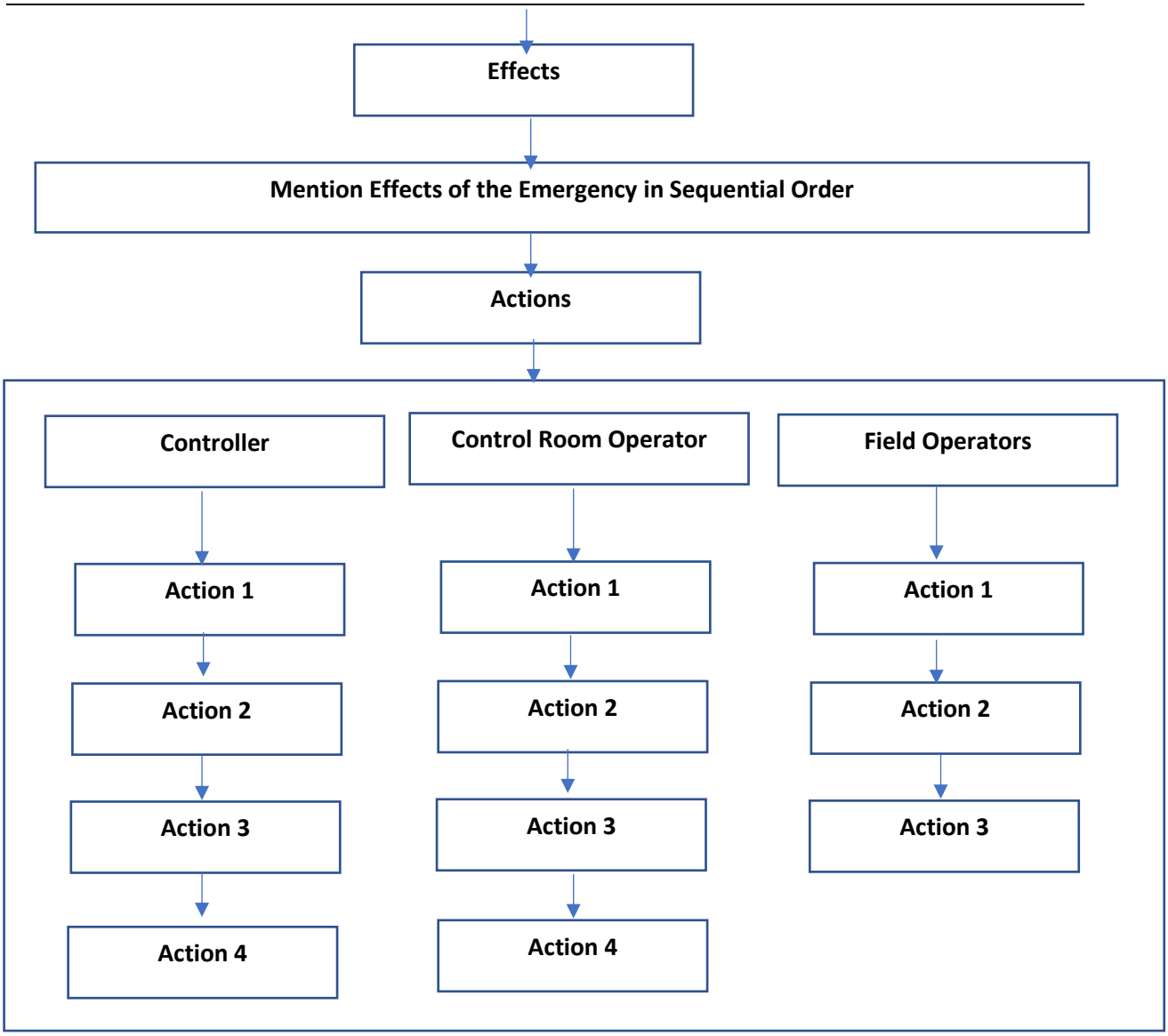
Emergency Handling Block Diagrams used in combination with planned training and regular performance feedback lead to an effective and motivated workforce. Following Training Communications Requirements to be ensured during implementation of this procedure.

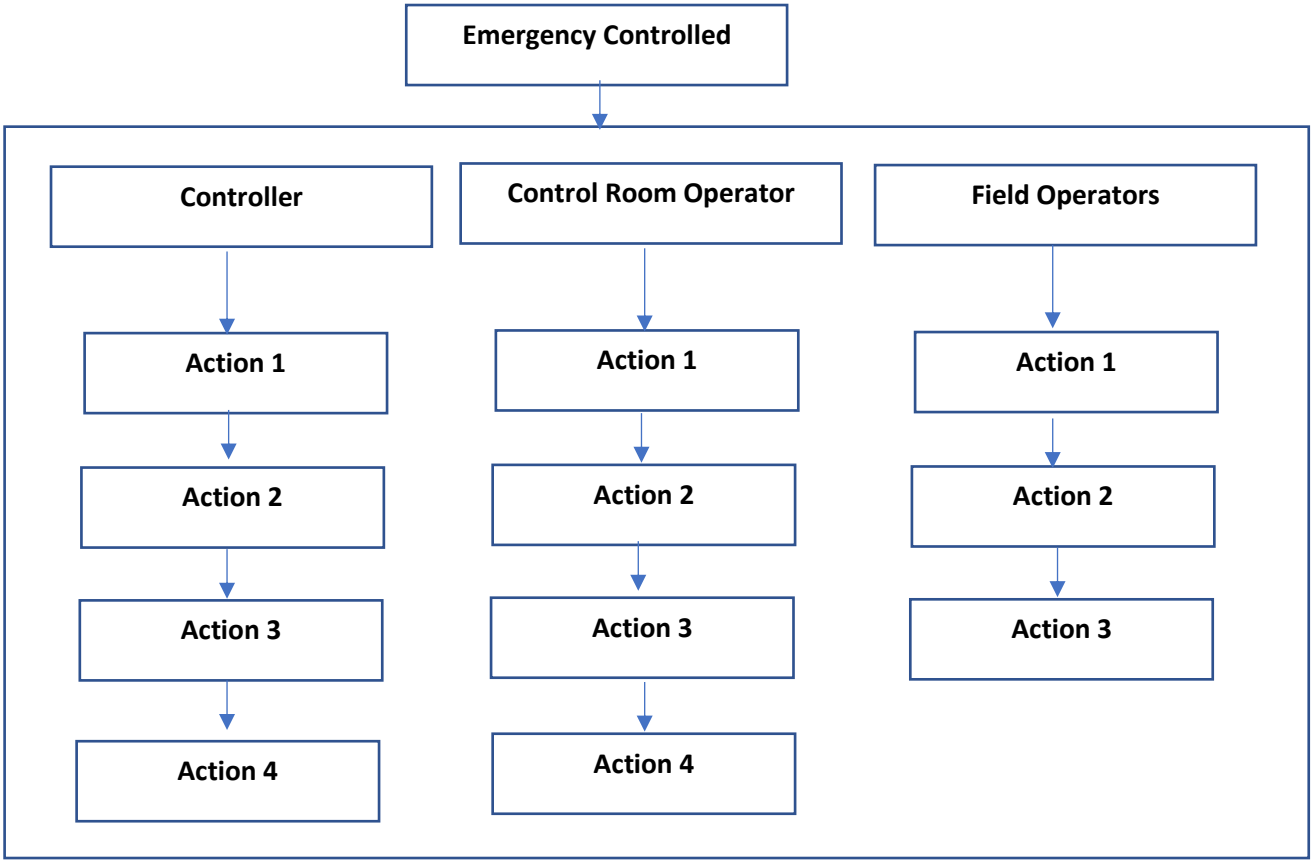
1. Each locations must determine whether each employee operating a process has received and understood the training on unit specific Emergency Handling Block Diagrams.
2. A record must be kept containing the identity of the employee, the date of training, and how the trainer verified that the employee understood the Emergency Handling Block Diagram training.
3. Refresher training shall be provided at least every two years, or more often if necessary, to each employee involved in operating a process to ensure that the employee understands the current revision of unit SOPs Manual.
4. The PEC sites, in consultation with concerned Group/division, must determine the appropriate frequency of refresher training.

Emergency Handling Block Diagram Name

Operations Activity Name

Area : _____ Unit : _____

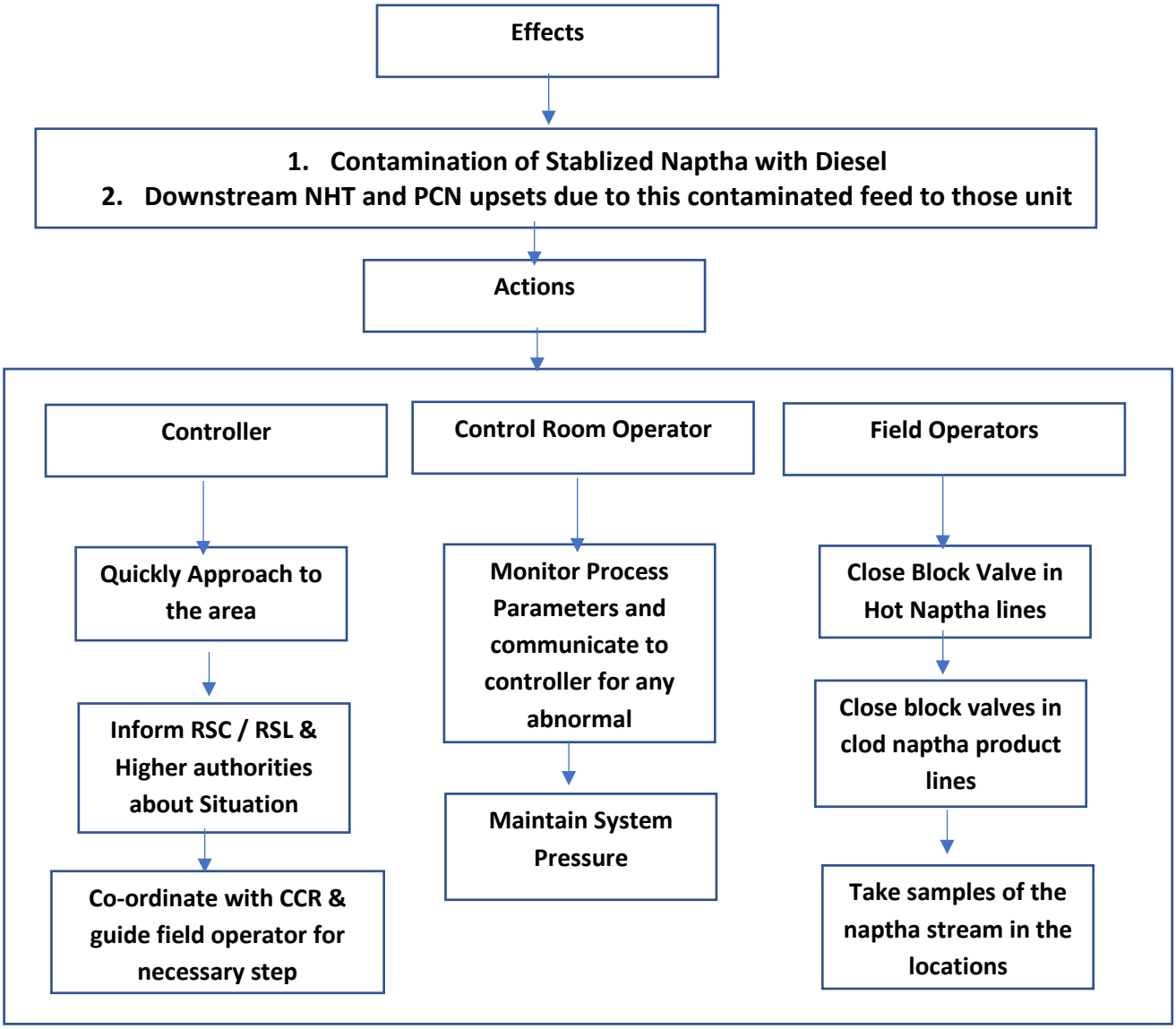



Emergency Controlled
Controller
Control Room Operator
Field Operators
Action 1
Action 2
Action 3
Action 4
Action 1
Action 2
Action 3
Action 4
Action 1
Action 2
Action 3

11. Annexure -2 : Emergency Handling Block Diagram Sample

Tube Rapture in Stabilizer Reboiler E-0019

Area -1 Unit -01



Pengerang Energy Complex Sdn Bhd
Unit 30-01, Level 30,
Tower A, Vertical Business Suite Avenue 3,
Bangsar South, No 8,
Jalan Kerinchi, 59200
Kuala Lumpur, Malaysia

Labor Camp Management Plan

Pengerang Energy Complex
9 November 2019
(Doc.No: PEC02D2)



Issue and Revision

Rev.	Document	Description	Date	HR Department			Company
				Prepared	Checked	Approved	Approved
A	Camp Management Plan	First version	09/11/2019	HR	HR	HR	PEC
B	Camp Management Plan	Second version	21/04/2022	HR	HR	HR	PEC

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Introduction

PEC (the Company) has developed this Camp Management Plan as part of its Environmental and Social Management Plan (ESMP) outlining a range of mitigation measures designed to avoid or reduce undesired camp management impacts during construction. This document establishes a basis and template for use by the Contractor to develop their own plans outlining not only mitigation measures but to also incorporate the roles and responsibilities described in the ESMP.

The objectives of the Camp Management Plan are:

- Avoid or reduce negative impacts on the community and maintain constructive relationships between local communities and workers' camps; and
- Establish standards on worker welfare and living conditions at the camps that provide a healthy, safe and comfortable environment.

This Plan should be read in conjunction with other environmental and social management plans (EMPs and SMP's), including:

- Traffic Management Plan
- Security Plan
- HSSE Management System
- Stakeholder Engagement Plan
- Labour Management Plan
- Grievance Management Procedure
- Labour Welfare Procedure

Legal Requirements and Grievances

The Contractor is required to operate within the parameters of the Malaysian Labor Law and the International Labor Organization guidelines. Malaysia has ratified 4 of the 8 ILO fundamental conventions. The IFC Performance Standards are applicable to this project, therefore Performance Standard 2 covering labor and working conditions will be followed. Furthermore, the Company has a Human Resources Policy which is required to be adhered to by the Contractor. Through this policy, the Contractor may file a grievance by sending an email, stating the causes of complaints, to: info@pengerangenergy.com. Furthermore, contractors will have access to the PEC worker grievance mechanism for escalation purposes.

The Company will acknowledge receipt of the complaints immediately and will go through an internal process to investigate. A more detailed response regarding the grievance will be provided within 60 days. In the event that no response is provided within 60 days, Contractor can contact the commercial and contract team leader. Furthermore, Company personnel conduct regular safety walks and an HSE committee will track performance against requirements stipulated in this plan. The Contractor will also have its grievance mechanism developed for the project.

Additionally, the Company Code of Business is applicable to this Project and the Contractor would be required to sign and acknowledge the Code of Business Conduct and agree to abide by its provisions.

Legal requirements applicable to this Plan are detailed in Appendix A.

PEC Project Plan

The proposed Pengerang Energy Complex Sdn Bhd (PEC) is planned as a world-scale condensate splitter and aromatics complex, on a 250-acre site in the Pengerang Industrial Park (PIP) that is located within the Pengerang Integrated Petroleum Complex (PIPC), Pengerang, Kota Tinggi District,Johor.

The production capacity of the PEC is about 5.844 million metric tonnes per annum (MMtpa), or 16.7 kilometric tonnes per day (kMtpd), of aromatic petrochemicals and oil products, which will be processed from 6.324 MMtpa of condensate feedstock using the latest generation of proven UOP technology.

Objective and Scope

The main objective of this Labor Camp Management Plan is providing the guideline for contractors for creating the life support services during the construction phase of the project. This document help contractor to identify, understand,assess, and address the concerns and issues related to labour camp management or activities on the human rights such as workers and community members.

The Labour camp Management Plan is also intended to provide the guideline for managing processes and dealing with Local and Migrant workers for the project during construction phase of the aromatic complex.

Initial Plan

Kota Tinggi District, Johor is known for petrochemical and Oil & gas industries. In Desaru, currently the Johor state government is developing an integrated tourism area which is spread over in many hectors. Many Hotels, resorts and residential properties are available in the range of 20 km.

Initially, PEC and EPC contractor will use the nearby facilities in Kota Tinggi District like Tiong Nam Dormitory or other rented accommodation facilities, including hotels and resorts that is Sebana Cove Resort , Tiara Desaru Residence actually utilized for the start-up personnel.

Once the EPC contractor finalizes the location for the temporary facility, temporary accommodation facilities will be created in 3 to 4 months.

These temporary facilities will be created per the ISO standards and guidelines with the local laws & regulations and meet PEC guidelines' requirements including quarantine rooms in case isolation is required .

These facilities will be created along with medical and life support service, canteen which will have dedicated menus in accordance to the nationality of the workers, industrial laundry , indoor and

outdoor recreational facilities for the construction staff and migrant workers which includes also internet availability for all to keep enable each one to be in constant contact with families.

An Highly Qualified Security Service will be provided to secure order and discipline inside the facilities. This will also include access card / bio metric control system for monitoring and controlling the movement of workers and control unauthorized entry for outsiders.

Permanent Office Set-up: Following things to be done for creating a permanent set- up at Project site. This set-up requires minimum 3 months time considering that all the statutory approvals have been obtained on time related to electricity, land, water supply, sewage.

1. Identify a place which will be available till the end of the project
2. Place order to create a set-up for accommodating XXX employees
3. Ground leveling
4. Fencing of the area
5. Security provision
6. Set-up will considering following facilities in mind
    a. Parking area
    b. Canteen space
    c. Mini mart
    d. Smoking area
    e. Treatment room
    f. Prayer room
    g. Meeting rooms
    h. Reception
    i. Conference facility with VC facility
    j. Pantry
    k. Drinking water facility
    l. Catering services
    m. Access control system
    n. Fire extinguishers
    o. Air conditioning
    p. Server room
    q. Printer / Plotter / Scanner
    r. Documentation room
    s. Waste bin
    t. Toilets
    u. Internet Room / Library

7. Tie-up with Hotels
8. Permanent Camp Facilities: Following things need to be considered while setting up the camp facility:

- Camp set-up to be done as per the guidelines provided by client
- As per the requirement minimum area per occupant is 40 m2
- Recreation space, indoor 0.5 m2 per person
- Dining hall space 0.65 m2 per person
- Fire code as per rules & regulations
- Toilet, shower, urinal, wash basin 1 per 8 people

Facilities in camp area:

a. Camp recreational building shall include Video TV lounge, dart area, Table tennis, Pool table, reading room with vending machines with beverages and snacks.
b. Internet connections / Wi fi / Satellite TVs
c. Laundry facilities
d. Cooking area
e. Dinning space
f. Catering services
g. Food services
h. Kitchen equipment's and set up
i. Drinking water facility
j. Location of all building, streets, side walk, parking area, outdoor & indoor recreational facilities
k. Smoke detectors
l. Designated smoking area
m. Emergency evacuation plan / mock drills
n. Fire safety plan
o. Furniture, fixture, bed, mattresses, TV, electrical points
p. Sewer services to meet the maximum requirement
q. Parking for vehicles
r. Designated side walks
s. Telephone system
t. DC battery system with the power back up of 24 hrs.
u. Landscaping (if required)
v. Medical facilities at camp with doctors and paramedic for 24 hrs.
w. Ambulance for emergency
x. Backup water storage tank in case of any emergency or fire
y. Waste disposal management
z. Pest control
aa. 24 hrs & 7 days a week trained personnel for firefighting equipment's
bb. Security Services personnel
cc. Vehicle movement control
dd. Material movement control
ee. Courier and mail service
ff. Housekeeping and Janitor services 24 hrs.
gg. Commissary items
hh. AC and refrigerators
ii. Cold storage units
jj. Visitor management
kk. Camp service administration and camp manager ll. Display area
mm. Camp rules & regulations
nn. Code of conduct
oo. Isolation rooms for any sick employees to take care pp. Emergency evacuation plan
qq. Air lift facility to attend any medical emergency
rr. Hospital tie up

9. Transportation Arrangements
10. Catering Services / Cooking Arrangements
11. Medical Insurance
12. Telephone connections / Mobile Connections etc
13. Attendance and Leave Record System
14. Gate Pass & ID control Management.
15. IT Infrastructure

16. Uniforms and Dress Codes
17. Housekeeping & Pantry Set-up
18. Waste Management
19. Water Facilities, Lightening Shelters, drinking Facility
20. Washing Bay
21. Security

Management and Monitoring

Figure 1 presents a flow chart summarising key management steps associated with implementation and review of this Plan, including steps to allow for continued improvement. Table 1 presents a summary of the potential impacts related to camp activities, together with mitigation and management measures to avoid or reduce these impacts, and the monitoring required to assess the performance of these measures.

The Contractor shall develop a Contractor Plan which shall, as a minimum, incorporate the camp management measures described in Table 1. The Contractor shall not be limited to these measures.

Monitoring to be undertaken as part of this Plan is described in Table 1.The Contractor is responsible for developing area or site-specific procedures for the monitoring program (where necessary) based upon the final design details of the infrastructure

Figure 1: Camp Management Process

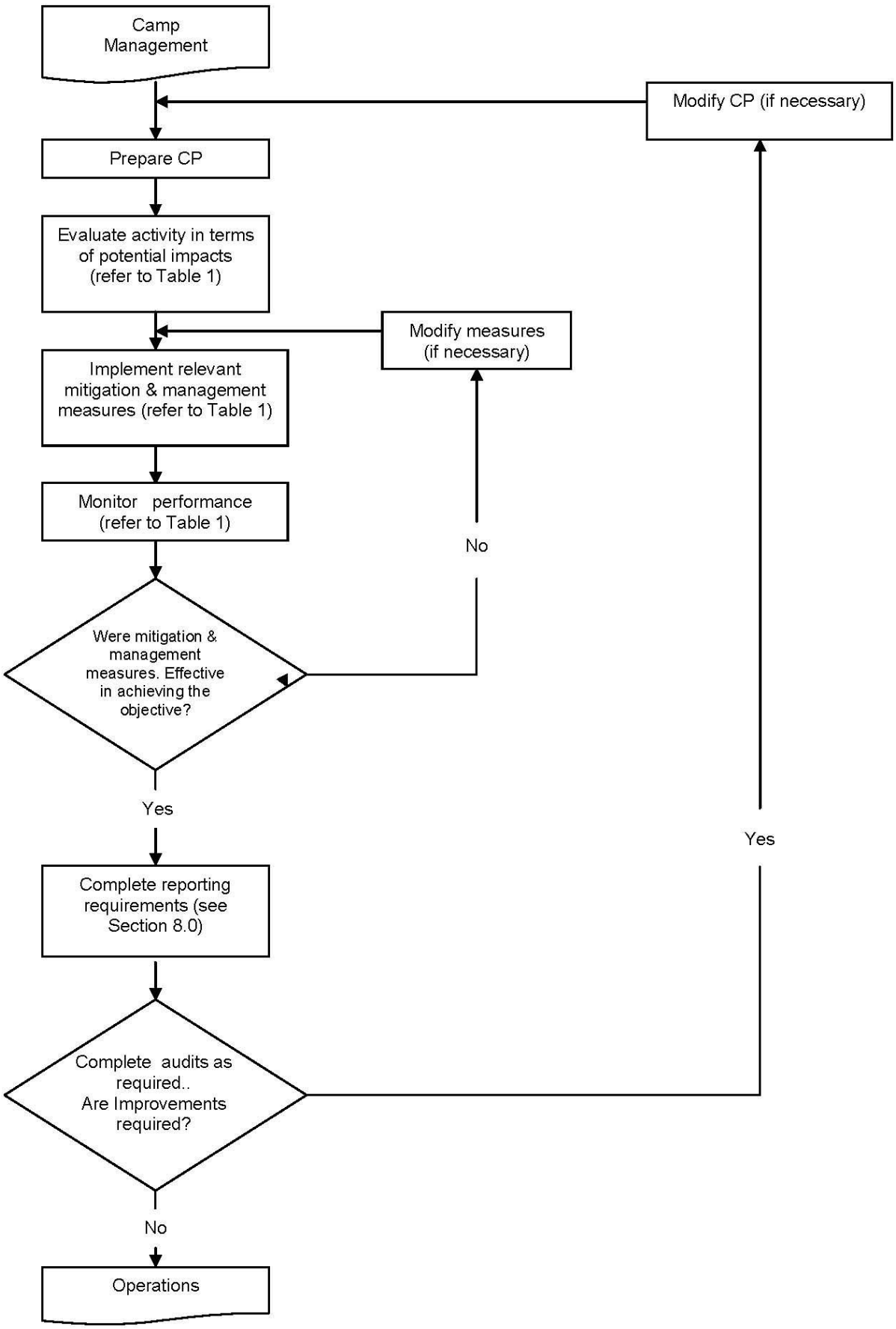


Table 1: Management and Monitoring

Aspect	Potential impact	Mitigation & Management	Monitoring	Frequency	Responsibility
Community Relations	Unauthorised movements of construction workers (during and after working hours) could result in trespassing, damage to local land and property and create amongst local residents a sense of their privacy being invaded. Residents may feel vulnerable and there may be increasing incidents of crime and or violence and threats to the safety of community members. Disparity of pay, increase in disposable income and potential availability of illegal substances, illicit or culturally inappropriate lifestyle choices, leading to increased tension between local communities and the workers at camps.	1. Contractor shall enforce a 'closed' camp policy unless otherwise agreed and approved by Company. Workers will comply with the agreed camp closure hours. 2. Contractor shall implement suitable measures to maintain the closed camp policy which may include perimeter security fences, security controls and guard houses, monitoring transfer of goods into and out of camps for contraband and stolen goods. Contractor should refer to the Project Security Management Plan. 3. Contractor, as appropriate, shall provide adequate recreation facilities for workers to reduce incentive for leaving camps during leisure time. 4. Contractor shall limit workers interaction with the community when outside the camp e.g., by organising transport directly to and from the worksite. 5. If community members or local businesses express grievances in relation to camp related activities/operations, the Project shall respond to the grievance in accordance with the grievance procedure outlined in this plan and the Community Grievance Procedure contained in the Stakeholder Engagement Plan (SEP). 6. Company may request that camp related activities/operations be amended to address community grievances. Contractor shall comply with these requests. 7. Workers shall abide by camp rules which include a disciplinary process to be developed by the contractor once appointed.	1. Monitoring 2. Verification 3. Verification 4. Verification 5. Notification 6. Verification 7. Verification 8. Verification 9. Verification	1. On-going 2. Every 3 months 3. Every 6 months 4. On-going 5. On-going 6. On-going 7. Every 3 months 8. On-going 9. Every 3 months	1. Contractor 2. Contractor 3. Contractor 4. Contractor 5. Contractor and/or Company 6. Contractor and/or Company 7. Contractor and/or Company 8. Contractor and/or Company 9. Contractor and/or Company

Aspect	Potential impact	Mitigation & Management	Monitoring	Frequency	Responsibility
		8. The Project shall, be cognisant of the environment in which it works and shall, where practicable, respect local cultural events such as religious events, funerals and the like. 9. The Project shall provide training to all workers, national and expatriate on camp management including: a. A briefing on camp rules, including closed camp policy, behaviour between fellow workers and the community; b. Procedures for dealing with camp related complaints, worker issues and community issues (as per Stakeholder Engagement Plan, SEP); and c. Community relations orientation. The objective of this orientation will be to increase awareness about the local area and cultural sensitivities.			
Health	Potential interaction between workers, persons engaged in illicit activities and the community increases the risk of spreading communicable diseases, particularly in more remote communities. Camp operations have the potential to develop favourable conditions for weeds, pests and disease, which could impact the health of workers and the community, as well as affect community livelihoods (e.g. rodent infestation affecting crops).	1. Contractor shall comply with the Minimum Health Requirements for Project Execution and the Community Health and Safety Management Plan which set out requirements and management measures on controlling communicable diseases within camps and to outside communities 2. Contractor shall enforce the closed camp policy to limit interaction with community 3. The Project shall comply with the Weed, Plant Pathogen and Pest Management Plan to prevent exotic weeds, plant pathogens and pests from entering the Project areas (including camps) and spreading outside of those areas. 4. Posters and informational sessions will be conducted to raise awareness among the	Verification	1. Every three months 2. On-going 3. Every three months	Contractor

Aspect	Potential impact	Mitigation & Management	Monitoring	Frequency	Responsibility
		workforce and communities locally around the worker camps.			
Waste management, pollution and environmental impacts	Camp has the potential to have off site pollution impacts from waste disposal, emissions and spills. Camp operations may also cause environmental issues including deteriorating water quality, erosion, sedimentation, noise and air quality issues. These factors have the potential to affect the community if not adequately managed.	1. Contractor shall exercise all reasonable due diligence to conduct its operations in a manner that will minimize pollution. 2. Contractor shall comply with the Waste Management Plan and Hazardous Materials Management Plan which define requirements to contain, transport, handle and dispose of camp wastes and hazardous materials to avoid impacts to human health and the environment. 3. Contractor shall also apply appropriate management controls set out in PEC's HSSE Management Plan.	1. Verification 2. Verification 3. Notification	On-going	Contractor
Community resources	• Any infrastructure, services or resources used by camps (e.g. water abstraction) that result in reductions/ shortage/interruptions for the local community will have a negative impact. • There is potential for social envy and increased resentment from the community towards the Project and project team if camp facilities are perceived to be superior to those in the community. Services of note include camp health facilities, power supply, clean running water. Restricted ability to access these services may increase frustration at the level of the services available to them.	1. Contractor shall utilise water sources for camp use in a manner that minimises impacts on local supply and use. Freshwater sources used by the Contractor should be reviewed and accepted by Company. 2. The Project shall routinely monitor quality and supply of water source used by camp through quarterly sampling exercises. 3. Company will implement the In-Country Value Plan and the Company Community Support Strategy which identifies strategic community investments.	1. Verification 2. On-going 3. Verification	1. Prior to establishing the camps 2. Every 3 months 3. Annual	1. Contractor 2. Contractor 3. Company

Aspect	Potential impact	Mitigation & Management	Monitoring	Frequency	Responsibility
Procurement and supply of goods	Increased demand for food and other provisions may deplete natural resources e.g. agriculture, fisheries, etc. potentially causing shortages of supply in the local community, and/or increasing the price of goods, affecting affordability for local communities.	The Project shall not purchase products in the local community unless through formal contracts with approved suppliers as per the In-Country Value[1] and Local Content Plan to be developed by contractors as detailed in Appendix B.	Verification	On-going	Contractor
Camp location	• Siting of camps may result in displacement of residents, loss of productive lands and the resources upon these lands. Camps may also restrict or impede access to areas for the local community. • Construction camps may result in a noticeable increase in traffic, noise, air emissions and light intrusion which could negatively affect the amenity and lifestyle of nearby communities and pose a potential safety issue.	1. Potential camp locations will be selected in consultation with Company and affected communities will be subsequently consulted. Necessary permits will be obtained from the relevant local government organizations for the approved camp location. 2. The Project shall refer to those Environmental Management Plan's (EMP) that include mitigation/avoidance measures that relate to the local community, including: ○ Noise and Vibration Management Plan; ○ Air Emissions Management Plan; and ○ Waste Management Plan.	Verification	1. Prior to establishing the camp 2. On-going	Contractor and/or Company
In-migration	There is a low likelihood of in-migration into areas around the construction camps. However, people from outside of the local area may migrate into existing settlements or develop new settlements in proximity to camps and the Project area. Existing communities may also relocate to be closer to camps. In-migration can result in disputes and sometimes violence between the new settlers and the resident community.	• Contractor shall enforce a 'closed' camp policy unless otherwise agreed by Company. This is intended to deter individuals setting up near camp. • Contractor shall develop a Labor and Working Conditions Management Plan with a minimum compliance with the Malaysian Labour Law, Company HSSE Policy, Human Rights and HR Policy, and HSSE Management Plan. • The Contractor is to refer and abide by the Workers Accommodation process and standards (IFC/EBRD).	Verification	On-going	Contractor and/or Company

Aspect	Potential impact	Mitigation & Management	Monitoring	Frequency	Responsibility
	Migrants moving into existing settlements may increase demand and inflate prices for housing, goods and services. Increased population and development of new and uncontrolled settlements increase pressure on infrastructure, services and resources. The increased traffic from in-migration may also result in greater theft and smuggling of goods.				
Worker welfare and living conditions	Construction workers living in camps may encounter stresses and discomforts that negatively impact their health and welfare. These stressors or discomforts may be caused by Poor living conditions (accommodation, ablution and sanitary, health, recreation catering and laundry).	Contractor shall comply with minimum standards for camp buildings, facilities and services cited in Malaysian Law, Workers Accommodation process and standards (IFC/EBRD) and the Project Invitation to Tender (ITT) requirements. Standards covered include but are not limited to: • Building requirements; • First aid facilities and services; • Sanitary and ablution facilities; • Entertainment and recreation facilities and services; • Communication services; • Food and canteen facilities and services; • Accommodation requirements; and • Laundry facilities.	Verification	On-going	Contractor
	There is potential for resentment if living conditions of Malaysia or other country nationals are of a lesser standard than expats.	• Where there is a difference in camp accommodation, Contractor shall manage this issue in an open and transparent manner. PEC will work with contractors to improve standards to an international level. • All camps will operate on a non-discriminatory basis and provide the same standard of accommodation and welfare facilities for workers; although distinctions may be appropriate	Verification	On-going	Contractor

Aspect	Potential impact	Mitigation & Management	Monitoring	Frequency	Responsibility
		based on seniority of individuals and job classifications.			
	Cultural issues (nationality, religion, discrimination and harassment, etc.).	• Contractor may provide prayer rooms and other facilities, as necessary and to the extent practicable, to satisfy the religious needs and customs of its workforce. • Contractor's personnel shall not engage in any discrimination or harassing behaviour. Contractor shall establish an Equal Opportunity Policy to promote non-discrimination in accordance with Labour and Worker Conditions Management Plan. • Contractor shall implement a worker grievance procedure to address grievances between workers. Refer to the Worker Grievance section of the Labour and Worker Conditions Management Plan.	Verification	On-going	Contractor
	Mental health issues (morale, isolation, family attachments, boredom).	1. Camps will be treated as closed camps. Camp rules in relation to alcohol consumption and drug prohibition will be complied with. 2. Contractor shall provide recreational facilities where practicable. 3. Contractor will provide counselling for all workers, with no discrimination by race, sex or religion.	Verification	1. On-going 2. Every 6 months	Contractor
	Personal security (crime, and emergencies).	• Camps will be controlled by security to avoid intrusions from outside community. • Work Site Security Plan to be developed by Contractor shall include security measures to be provided at the camps which may include fencing, locks, alarms, pass card systems, badge and pass system, access points, safe transport of personnel as appropriate. PEC has a site Security Plan as detailed in Appendix C. • Contractor shall develop an Emergency Response Plan that meets requirements set out in the ITT package	Verification	Prior to establishing camp	Contractor

Aspect	Potential impact	Mitigation & Management	Monitoring	Frequency	Responsibility
	Environmental stress (climate, noise etc.).	Contractor shall comply with the Minimum Health requirements for Project Execution Project Design Specifications (PDS) and Health Design Specifications for Projects, and as per requirements of the IFC/EBRD Guidance for Worker Processes and Accommodation in addressing environmental factors including: • Accommodation will be designed to suit climatic conditions; • Accommodation and surroundings shall be constructed so that noise does not interfere with sleep to the extent that is reasonably practicable; and • Health and hygiene inspections of facilities as per the above PDS.	Verification	On-going	Contractor
	Pandemic Disease Outbreak – Covid-19 kind of Situation - Community Spread and living with someone with infected with disease - Access / egress to camp area - Poor Hygiene - Monitoring Health Condition	• Company and Contractor need to Comply with the government norms and follow the rules and regulations • Controlling Movement of the workers outside dormitory • Provide Insolation facilities along with nursing staff and doctors • Strengthen Health Monitoring and controlling in the premises also facilitate contact tracing • Tighter Control of entry and exit • Proper Housekeeping and regular disinfection of the common area, shared services • Maintaining safe distance measures as per the guideline issued by the government.	Monitoring and Verification	Situation Base	Contractor and Company
	Prevent Aedes Mosquito Breeding – Control disease Dengue, Zika and Malaria - Mosquito Breeding at construction site	• Company and Contractor need to comply with the government and environmental rules and regulation • Monitoring and checking the blockage of waters and not to create or cause or permit to be created	Monitoring and Verification	On-going	Contractor and Company

Aspect	Potential impact	Mitigation & Management	Monitoring	Frequency	Responsibility
	- Mosquito Breeding in Workers dormitories - Sever Health Condition to the infected worker - Poor Hygiene	any condition favourable to the propagation or harbouring of vectors. • Contractor shall engage a competent and registered pest control company which shall create a programme and regularly generate report as per guideline • Weekly Check at all the points for the potential breeding areas • Waste to be disposed on daily basis			
Decommissioning	Decommissioning of camps has several potential impacts: • Local employment and provision of local goods and services at camps will no longer be required; • Locals employed and previously accommodated in camps will no longer have access to services and benefits available at camps (e.g. health services, recreation facilities); and • Infrastructure which provides benefits to communities may no longer be maintained (e.g. roads) and may be decommissioned and removed or reinstated (e.g. access tracks).	• Contractor is to follow the retrenchment procedure discussed in the Labour and Worker Conditions Management Plan. • Where Community requests, some infrastructure and services may be retained at the discretion of Company: o Disturbed areas will be reinstated as per the Reinstatement Plan; o Where practicable, Contractor will return camp areas to former landforms; o No facilities will be maintained in or near especially environmentally or socially sensitive areas; and • Where there are negative consequences of induced access, the facility will also be decommissioned and the area reinstated.	Verification	On-going	Contractor and Company

Roles and Responsibilities

The implementation to this plan required consistent and committed resources from the Company and Contractor. Below are the expectations of roles and responsibilities for this Plan:

- Contractor shall ensure sufficient resources are allocated on an on-going basis to meet the requirements of this Plan.
- The Contractor Plan shall describe the resources allocated to and responsible for the execution of each task and requirement contained therein, and shall describe how roles and responsibilities are communicated to relevant personnel.
- Company shall ensure sufficient resources are allocated on an on-going basis to achieve effective implementation of Company's responsibilities in the Camp Management Plan.

Training, Awareness and Competency

Training is a critical component to raise awareness on the various impacts and associated management functions of the Plan. As such, it is expected that:

- Contractor shall ensure that all personnel responsible for the execution of the tasks and requirements contained within this Plan are competent on the basis of education, training and experience.
- The Contractor Plan shall describe the training and awareness requirements necessary for its effective implementation.
- Contractor's training activity associated with the Contractor Plan shall be appropriately documented by means of a training needs assessment, training matrix/plan and records of training undertaken.
- Project shall ensure that personnel responsible for the execution of tasks and requirements in the Camp Management Plan are competent on the basis of education, training and experience.
- Project training activity associated with the Camp Management Plan shall be appropriately documented by means of a training needs assessment, training matrix/plan and records of training undertaken.

Performance Indicators

Table 2 outlines the indicators for measuring and verifying performance in relation to camp management. However Contractor may, subject to agreement with Company, may modify or add to these indicators to enhance the Contractor Plan based on lessons from the performance indicators.

Table 2: Performance Indicators

Performance Indicator	Measurement	Assessment Frequency*
Camp Management Training participation	100% of workers resident at camp undergo training on camp management.	Monthly
Company satisfaction with Camp Management	An 80% compliance with the standards outlined in the Company Camp Monitoring Plan (contained in the Temporary Construction Camp Standard).	Monthly
Worker satisfaction with living conditions	Number of workers' grievances related to camp management.	Monthly

* Frequency is determined by Company and may vary subject to Contractor's performance.

8.0 REPORTING AND NOTIFICATION

The Contractor shall submit to the Company a monthly report addressing the performance indicators (see Table 2). Other reporting or notifications required as part of the implementation of this Plan are summarised in Table 1.

Appendix A: Legal and Other Requirements

Labor Framework and Inspection in Malaysia

Labour inspection is one of the responsibilities of the department of Labour Division of the Ministry of Human Resources comes under the General Directorate of Labour Care (GDLC). The GDLC comprises the six departments: Labour Inspection, Occupational Safety and Health, Labour Dispute Settlement, Labour Services, Trade Unions and the Office of Joint Inspection.

The Department of Labour Inspection organizes inspection visits to the private sector's establishments, to ensure their compliance with the laws and decrees through three sections: the Routine Inspection Section, the Work Permits Inspection Section and the Foreign Workers Recruitment Agencies Section. General labour inspectors do not inspect safety and health conditions, but if they come across any relevant violations they report them to the director of OSH department who follows up with his inspectors. The Department of Occupational Safety and Health has within its mandate to conduct regular inspection visits to enterprises in all sectors to ensure that they abide by the safety and health provisions of the Malaysian Labour Law. The Department of Labour Services also monitors enterprises concerning the implementation of the labour law provisions related to workers' social welfare and services. The Office of Joint Inspection conducts regular routine visits to enterprises and workplaces to ensure that all their foreign workers are legal and have valid work permits.

Laws that cover organization and function

- Labour Laws of Malaysia
- LAWS OF MALAYSIA ACT 514 OCCUPATIONAL SAFETY AND HEALTH ACT 1994
- Labour Inspection Enforcement for Ensuring Workplace Compliance

Scope of Labour Inspection

The Labour inspectors have authority to carry out judicial investigations for the implementation of the provisions of the labour law and the regulations which applies to all enterprises and sectors, except members of the armed forces and public security organizations and employees of the state administrative apparatus and other government units; members of the employer's family of his dependants and domestic workers.

Labour inspectors have the right to enter the places of work and audit the books, records and documents, interview whoever they find necessary and prepare relevant reports. The labour inspectors do not usually deal with individual labour disputes, but such cases may be referred to them only if they concern labour rights, but not termination of service. Collective labour disputes may be handled by labour inspectors, when such cases come to them, either directly from the dispute parties or through the Department of Labour Dispute Settlement.

Some of the functions and activities carried out by the Department of Labour Inspection are not really related to labour inspection, such as auditing the applications and requests for licensing new recruitment agencies and auditing the applications of obtaining or renewing work permits for foreign workers.

IFC Performance Standards

IFC Performance Standard 2: Labor and Working Conditions; recognizes that employments should be accompanied by the protection of fundamental rights of workers. With respect to contracted workers, the Company will apply the following requirements[2]:

Occupational Health and Safety

The client will provide a safe and healthy work environment, taking into account inherent risks in its particular sector and specific classes of hazards in the client's work areas, including physical, chemical, biological, and radiological hazards, and specific threats to women. The client will take steps to prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, as far as reasonably practicable, the causes of hazards. In a manner consistent with good international industry practice, as reflected in various internationally recognized sources including the World Bank Group Environmental, Health and Safety Guidelines, the client will address areas that include the (i) identification of potential hazards to workers, particularly those that may be life-threatening; (ii) provision of preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances; (iii) training of workers; (iv) documentation and reporting of occupational accidents, diseases, and incidents; and (v) emergency prevention, preparedness, and response arrangements.

Workers Engaged by Third Parties

With respect to contracted workers the client will take commercially reasonable efforts to ascertain that the third parties who engage these workers are reputable and legitimate enterprises and have an appropriate ESMS that will allow them to operate in a manner consistent with the requirements of this Performance Standard, except for paragraphs 18–19, and 27–29.

The client will establish policies and procedures for managing and monitoring the performance of such third party employers in relation to the requirements of this Performance Standard. In addition, the client will use commercially reasonable efforts to incorporate these requirements in contractual agreements with such third party employers.

The client will ensure that contracted workers have access to a grievance mechanism through inclusion in on-boarding process for all workers. In cases where the third party is not able to provide a grievance mechanism the client will extend its own grievance mechanism to serve workers engaged by the third party.

[2] IFC Performance Standards on Environmental and Social Sustainability, Effective 1 January 2012

PEC TECHNICAL STANDARDS

HEALTH, SAFETY AND ENVIRONMENT

Social Accountability Plan
(Doc.No.: PEC04D5)

PREFACE

PEC Technical Standards (PTS) are based on the experience acquired during the involvement with the design, construction, operation and maintenance of processing units and facilities of Aromatic Complex Project in Singapore. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good technical practice to be applied by PEC' OPUs in oil and gas production facilities, refineries, gas processing plants, chemical plants, marketing facilities or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to users for their consideration and decision
to implement. This is of particular importance where PTS may not cover every requirement or diversity
of condition at each locality. The system of PTS is expected to be sufficiently flexible to allow individual operating units to adapt the information set forth in PTS to their own environment and requirements.

When Contractors or Manufacturers / Suppliers use PTS they shall be solely responsible for the quality
of work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, it is expected of them to follow those design and engineering practices which will achieve the same level of integrity as reflected in the PTS. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the
owner.

The right to use PTS rests with three categories of users:

1. PEC and its affiliates.
2. Other parties who are authorized to use PTS subject to appropriate contractual arrangements.
3. Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) and 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

Subject to any particular terms and conditions as may be set forth in specific agreements with users, PEC disclaims any liability of whatsoever nature for any damage (including injury or death) suffered by any company or person whomsoever as a result of or in connection with the use, application or implementation of any PTS, combination of PTS or any part thereof. The benefit of this disclaimer shall inure in all respects to PEC and/or any company affiliated to PEC that may issue PTS or require the use of PTS.

Without prejudice to any specific terms in respect of confidentiality under relevant contractual arrangements, PTS shall not, without the prior written consent of PEC, be disclosed by users to any company or person whomsoever and the PTS shall be used exclusively for the purpose they have been provided to the user. They shall be returned after use, including any copies which shall only be made by users with the express prior written consent of PEC.

The copyright of PTS vests in PEC. Users shall arrange for PTS to be held in safe custody and PEC may at any time require information satisfactory to PEC in order to ascertain how users implement this requirement.

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1. PURPOSE

The purpose of this Plan is to define the SA activities to be carried out in the workplaces within the boundaries of the construction site, temporary facilities, lay-down areas, camps and accommodations, canteens etc., during the execution and operation stage of the PROJECT.

2. SCOPE

This Plan applies to all construction, commissioning, start up and operation activities to be carried out by all PERSONNEL working on the PROJECT and/or visiting the PROJECT as well.

It is a working document subject to ongoing review, and possible revision, during the lifetime of the PROJECT.

3.1 SA DEFINITION

CHILD	Any person less than 15 years of age, unless the minimum age for work or mandatory schooling is stipulated as being higher by local law, in which case the stipulated higher age applies in that locality
CHILD LABOUR	Any work performed by a child younger than the age(s) specified in the above definition of a child, except as provided for by ILO Recommendation 146.
COMPANY	The entirety of any organization or business entity responsible for implementing the requirements of this standard, including all personnel employed by the company
CORRECTIVE AND PREVENTIVE ACTION	An immediate and continuing remedy to a non-conformance to the IFC PS2 standard
PERSONNEL	All individual men and women directly employed or contracted by a company including directors, executives, managers, supervisors, and workers

WORKER	All non-management personnel
YOUNG WORKER	Any worker over the age of a child, as defined above, and under the age of 18.

LEADERSHIP AND COMMITTMENT

Owners Management Team (All levels) and CONTRACTOR's management (Project Director, Project Manager, Site and Construction Managers, Functional managers Home Office and Construction Site) is committed to execute the Plan in a manner that is uncompromising on issues of health, safety, environment and security.

Senior management of CONTRACTOR will personally practice SA leadership, demonstrate visible commitment to the project's SA policy and strategic objectives, and provide resources to foster a project culture that embraces and accepts nothing but optimal SA behavior.

CONTRACTOR management is committed to never, for whatsoever reason, let that cost, schedule, and any other possible concerns could prevail over SA requirements of the PROJECT.

POLICY AND OBJECTIVES

SA Policy

Pengerang Energy Complex SDN BHD recognises the creation of a proper human workplace for among the highest corporate priorities, and as a key contribution to cultural sensitivity, sustainable development and therefore human evolution. Our goal is to promote continual improvement of our organization through education, training, communication and through the involvement of all the employees.

The Social Accountability Policy is established to fulfil our social obligation to provide a fair and human working environment to each and to the whole to our employees. The social accountability system is to be considered both as an integral part of our business and as a key element of management.

In pursuing its activities, PEC is committed to develop awareness, competence and control in compliance with the applicable law and regulation, the conventions of the ILO and other subscribe requirement, as well as to respect the agreed international labour criteria and their local interpretation.

PEC management commits itself to accomplish perceived social obligation by talking all appropriate measures to meet and – wherever possible – to exceed requirement addressed by IFC – PS2 standards. The organization will therefore:

- ✓ Avoid Child Labour
- ✓ Avoid forced and compulsory labour
- ✓ Provide safe working environment at workplace
- ✓ Identification of potential hazards to workers
- ✓ Provision of preventive and protective measures
- ✓ Training and Awareness

Wherever PEC has control or influence, including operations with contractor, we will improve social accountability management system through periodically verification of specific results and of overall actuation.

We believe that by complying with this policy as well as with our customers and stakeholders, we will ultimately contribute to enhance the standard of life of our employees of our contractors and of our society in general.

Chong Ying Haur
Director - Pengerang Energy Complex SDN BHD

Policies, distribution and publicizing

Signed copy of the SA Policy and the PROJECT HSE Policy shall be affixed on strategic places of site offices and other relevant site premises where can be well visible to all employees.

The principles of the SA Policy will be exposed to all employees during the HSE Orientation (which includes a dedicated SA Orientation section) upon arrival on site, and during other relevant trainings and meetings.

Copy of the SA Policy is distributed to all SUBCONTRACTORs.

Copy of the SA Policy, if necessary or requested, is distributed to other interested parties (Public Authorities, citizens' Associations, etc.).

Objectives

- ✓ Strive to eliminate all occupational injuries and illnesses;

- ✓ Achieving Zero Accidents and Zero Incidents;
- ✓ Promote SA objectives as a constant value while executing work;
- ✓ Enhance employee awareness and involvement in our health, safety and SA program implementation;
- ✓ Meet each governmental authority's SA legal requirements;
- ✓ Increase employees' consistent use of correct SA practices in their daily work activities;
- ✓ Implement a training program that support the achievement of personal competency in relation to SA program;
- ✓ Ensure that SA concerns can be raised and addressed at all level of the organization;
- ✓ Continually monitor and improve the SA performance;
- ✓ Select CONTRACTORs that are committed to SA implementation in their organization;
- ✓ Ensure that all our employees return home at the end of the workday in sound physical condition.

SITE SA ROLES AND RESPONSIBILITIES

The execution of the Plan requires a continuous active input from CONTRACTOR,

CONTRACTOR's role is to manage the "PROJECT" SA program and to coordinate the actions of all parties involved to ensure a concerted effort to achieve the maximum SA performance level.

Responsibilities and Competencies

1. CONTRACTOR Project Director and/or Project Manager

Roles and responsibilities:

- He takes overall responsibility for PROJECT SA requirements and for the achievement of PROJECT SA objectives as per SA Policy and Commitments;
- Assurance that SA Management System is implemented throughout all phases of the PROJECT;
- Assurance that suitably competent SA personnel are assigned to the PROJECT;
- Assurance that sufficient resources, human and material are allocated for all SA requirements;
- Monitor the PROJECT SA performances.

2. CONTRACTOR Site Manager

Roles and responsibilities:

- Ensure the implementation of the SA policy and the SA Plan on Site;
- Ensure that all relevant SA requirements are well known and implemented by the site personnel, and that all delegations of responsibility and authority concerning SA (from himself to other field management personnel) are fully understood and appreciated;
- Ensure that all SA procedures and instructions are fully implemented;
- Participate at the SA meeting periodically organized by CONTRACTOR and OWNER;
- Verify that inspection and audit follow up activities are fully and timely taken;
- Participate in the investigation of high-potential events that might have impact on the SA program;
- Promote corrective actions for any identified anomaly and non-conformity.

3. CONTRACTOR Commissioning Manager

Roles and responsibilities:

The Commissioning Manager shall assist the Site Manager in planning and implements the SA program, ensuring that all the Pre-Commissioning and Commissioning activities are:

- Performed in accordance with PROJECT SA Standards
- Participate to the SA monitoring program to Ensure that the SUBCONTRACTORS operating

Pre-Commissioning and Commissioning are aware of and comply with the SA requirements

- Participate in the investigation of high-potential events that might have impact on the SA program;
- Promote corrective actions for any identified anomaly and non-conformity.

4. CONTRACTOR Construction Manager

Roles and Responsibilities:

- Assist the Site Manager in planning and implement the SA Program to ensure that all the working places are in accordance with SA standard;
- Perform and co-ordinate construction work in the safest manner;
- Conduct regular SA inspections and Audits on the area of competence to ensure that all SUBCONTRACTORs are aware of and comply with the SA requirements;
- Verify that inspection and audit follow up actions are fully and timely taken;
- Participate in the investigation of high-potential events that might have impact on the SA program;
- Promote corrective actions for any identified anomaly and non-conformity.

5. CONTRACTOR Site HSE Manager

The Site HSE Manager takes the following roles and responsibilities:

- Assist the Site Manager in the general supervision of the SA program;
- Monitor the implementation of the SA program;
- Provide a dedicated “Audit and Inspection program”;
- Assist the Construction Manager, Supervisors and foreman in promoting a preventive approach within their respective work groups;
- Execute periodical Audits and Inspections on site and address appropriate CORRECTIVE AND PREVENTIVE ACTIONS
- Prepare Audits and Inspection formal reports and verify the follow up;
- Guide and facilitate the investigation of high-potential events that might have impact on the SA program;
- Organize and participate to all relevant site “SA Meetings” and prepare the relevant MOM;
- Verify the adequacy and application of the Site SA Plan and all related practices to the evolution of the PROJECT;
- Update the SA documentation during all the construction phases when deemed necessary;
- Provide a “Site SA Training program”;
- Coordinate and directly participate, while appropriate, the SA Training activities on site;
- Keep SA anomalies and events recording, identifying the areas to which prevention must be addressed;
- Lead and coordinate the activities at Site of the SA Committee;
- Provide the SA section of the periodical Site PROJECT Report;
- Prepare and update the Site SA Statistics, verifying the SUBCONTRACTOR's performance versus the PROJECT and RAPID SA Objectives, Targets and performance indicators; propose recovery plan in case of deficiencies

6. HSE Supervisors/Officers

The HSE Supervisors/Officers report to the Site HSE Manager. Roles and responsibilities:

- Participate to monitoring the SA activities at Site, including auditing and inspections;
- During the daily inspections conducted in the working areas, they will monitor also the implementation of the SA aspects;
- Conducting the training of new hires at all levels of personnel present at Site on SA matters;
- Participate to the investigation of all incidents, accidents and near misses;
- Take action and report immediately to the Site HSE Manager in case of any anomalies;
- To be of constant advisor on the field for any problem related to SA for all the personnel present at Site;
- Participate to the SA Committee meeting;

- Contribute actively to the investigation of high-potential events that might have impact on the SA program.

7. Superintendents and Supervisors

Roles and responsibilities:
- Participate in the CONTRACTOR's and OWNER's scheduled work area Audits or Inspections and implement and document required corrective actions;
- Verify the enforcement of SA rules, regulations and document all actions taken to ensure compliance with those;
- Attend, actively participate and consistently demonstrate a strong leadership at weekly Toolbox Safety Meetings;
- Shall be thoroughly familiar with this procedure and with their individual responsibilities regarding its implementation and enforcement;
- Supervisor shall ensure that only competent persons are assigned work tasks. This includes ensuring the WORKER has the skills, physique and knowledge to safely execute the work task.

8. Employees

Roles and responsibilities:
- Employees must know, understand and comply with the SA requirements as applicable to the work they perform;
- Employees must report to their Supervisor any anomalies that may affect their health and safety at work or disregard of the SA principles;
- Employee must advise their immediate Supervisor whenever unsure of the instructions received for the assigned task or where concerned for the safety of the work environment or for any SA principle disregarded.

9. Chief Labour Officer

Roles and responsibilities:
- He/She will be responsible for the implementation of labor management plan during constructions and operation phase.
- Implement the labor management procedure for contractor and sub-contractors. Also responsible for the compliance and audits process and submitting report to the management
- He/she will evolve, prepare and implement grievance handling procedure for the social local / specific issues related to employees, workers, community etc
- Compliance as per the local and Malaysian laws, Employment Acts, Minimum Wages Acts etc
- Advice management in the fulfillment of obligations as per statutory or otherwise concerning, prevention of personal injuries and maintaining safe working environment.

10. HR - Representative

- Assist the Site Manager in the general supervision of the SA program;
- Provide support for the verification of the workers' accommodations with reference to the country applicable laws, regulations and related SA standards;
- Update the site team regarding possible changing of the local laws and regulations in relation to SA implementation;
- Contribute to the monitoring implementation of the SA program at site and accommodation areas;
- Assist the Construction Manager, Supervisors and foreman in promoting a preventive approach within their respective work groups;
- Participate to the periodical Audits and Inspections on site and address appropriate CORRECTIVE AND PREVENTIVE ACTIONS.

11. SUBCONTRACTOR's SA Referent

Each SUBCONTRACTOR shall nominate a person, within its site management team, that will act as a referent for the entire SA related issues.
In particular, this person will be referent to:

- Assist the CONTRACTORs SA Team present at site to promote the SA Policy, within the respective organization;
- Participate to SA activities at Site, including auditing and inspections;
- Monitor the implementation of the SA program;
- Participate to the investigation of high-potential events that might have impact on the SA program;
- Participate to all relevant SA Meetings;
- Organize SA Meetings and prepare relative MOM, when deemed necessary;
- Verify the adequacy and application of the Site SA Plan and all related practices to the evolution of the PROJECT;
- Update the SUBCONTRACTOR's SA documentation during all the PROJECT phases;
- Provide a SA Training program;
- Coordinate and directly participate to the SA Training activities at site;
- Keep SA anomalies and events recording, identifying the areas to which prevention must be addressed.

STANDARDS AND SPECIFICATIONS

The following laws, regulations, codes, standards and specifications will be applied in order of priority in this PROJECT:

- ✓ Malaysian applicable laws, prevailing industry standards and IFC – PS2 standards

EMPLOYMENT contract specifications;

- ✓ OWNER's standards and procedures;
- ✓ CONTRACTOR's SA Management System, Plans, Programs, Procedures and work practices.
- ✓ When national applicable laws, prevailing industry standards, other requirements to which the CONTRACTOR subscribes, and this standard address the same issue, the provision most favorable to WORKERSs shall apply.

COMMUNICATIONS

Language

PROJECT publications and general communication or notices at site will be both English and Malaysian language, in accordance with contractual requirements.

In order to facilitate the communication between the work force and all other parties, an adequate number of bilingual staff (English and Malaysian language) will be employed in the working area.

All HSE/SA trainings for the workforce, including training material and booklets, will be translated in prevalent languages spoken by the employees.

Communication

PEC recognizes that an efficient communication between all the parties involved is a key factor for an effective implementation of the SA management system.

PEC will utilize many different mediums to educate, raise SA awareness of workers, motivate and stimulate participation.

These may include:

TOP-DOWN	BOTTOM-UP
✓ HSE/SA General Induction course ✓ HSE/SA fliers; ✓ HSE/SA news; ✓ Bulletins and posters; ✓ Tool box meetings; ✓ Periodical SA meetings; ✓ SA Meetings between the management and employees' representatives; ✓ Internal communications; ✓ Display of information on notice	✓ Suggestions by sheets or by computer advisory to the HSE/SA Office; ✓ Submission of non-conformity reports about anomalous conditions; ✓ Tool box meetings; ✓ Meetings on SA between the Management and employees' representatives.

boards; ✓ Specific SA meetings or courses with WORKERS participation.	

Meetings

CONTRACTOR and SUBCONTRACTORS will conduct, as minimum, the following meetings that may have content relevant to SA:

1. Kick-off HSE/ SA Meeting
   • Attended by: SUBCONTRACTOR and CONTRACTOR Site Management

   • Chaired/conducted by: CONTRACTOR Site Manager

   • Timing: As required

2. Tailgate Meeting (Tool Box Meetings)

   • Attended by: All SUBCONTRACTOR's workers and CONTRACTOR's representative • Chaired/conducted by: SUBCONTRACTOR's Supervisors and/or SA Referent
   • Timing: as per schedule/ need

3. Discipline supervisor's meeting
   • Attended by: All SUBCONTRACTOR's and CONTRACTOR's discipline Supervisors

   • Chaired/conducted by: CONTRACTOR's Superintendent/Supervisor

   • Timing: as per schedule/ need

4. HSE/SA coordination meetings
   • Attended by: All SUBCONTRACTOR's and CONTRACTOR's Site Managers/Representative, All

   SUBCONTRACTOR's HSE Managers/Representative
   • Chaired/conducted by: CONTRACTOR's HSE Manager • Timing: Weekly

5. HSE/SA PROJECT Committee Review meeting
   • Attended by: All members of SA Committee

   • Chaired/conducted by: CONTRACTOR's Site Manager

   • Timing: Monthly

Records and Reports

SA communication is retained and transmitted in written records and reports.

A PROJECT HSE/SA monthly report will be produced; it will address to SA matters, incidents, issues requiring attention, look ahead items, and status of SA site performance through analysis of defined key performance indicators for the period of agreed upon.

SA records will be retained by the CONTRACTOR's HSE Manager and by the SUBCONTRACTOR's SA representative, or both.

TRAINING

PEC will provide a detailed SA Training program that will be combined and integrated with the HSE Training Program in agreement with OWNER contractual requirements and CONTRACTOR standards.

This program will be revised and updated periodically to reflect and incorporate, just in time, trainings that may arise from work execution issues.
The SA training embraces the following:

SA Induction (as part of the “HSE Orientation”); all PERSONNEL

SA Training for Management and supervision; Management and supervision of CONTRACTOR and OWNER.

COMPETENCY TESTING:

All HSE/SA inductions and trainings will have competency testing as part of the course.

No PERSONNEL will be able to undertake work on the PROJECT unless they have successfully passed the relevant competency test.

Following successful completion of the HSE Orientation, individuals will be provided with a HSE sticker to be put on the helmet.

SELECTION OF SUBCONTRACTORS AND VENDORS

CONTRACTOR applies specific procedures in order to, first, qualify and insert in a “vendor list database” and, second, select the possible SUBCONTRACTORS to be included in the ITB (instructions to bidders) Phase.

A database has been created with all the information relevant to all aspects and capacity of the SUBCONTRACTOR including the SA performance.

SA concurs to the semi quantity evaluation and general evaluation of the candidates during all stages of the selection process.

In particular, during the ITB stage the candidates are informed about all SA general and PROJECT specific requirements and are requested to submit the following information as a minimum:

- HSE Organization;
- HSE Policy;
- HSE MS;
- HSE Statistics for the last 3 year • Code of ethics.

MEASURE TO PREVENT AND MONITOR CHILD AND YOUNG LABOR

CONTRACTOR shall not engage in or support the use of CHILD labor and will request to SUBCONTRACTORs to do the same, in line with SA plan or IFS2 requirements, local Laws and Regulations

CONTRACTOR will issue a specific Security procedure in order to address the monitoring and control of the construction site and related facilities accesses.

CONTRACTOR will issue and consign to each individual, that wish to enter at site premises for work and / or visit purpose, a Personal Site Gate Pass which allow the requester to enter from the controlled site accesses.

The Security Procedure will specify terms and conditions that the requester must meet to be entitled/ authorized to enter the PROJECT premises.

Any request of access for a CHILD will be rejected by CONTRACTOR and access will be denied; furthermore, this request will generate an “Alert Observation” which will be sent to the SA Team in order to proceed with a detailed investigation regarding the involvement of CHILDS, as per Procedure.

Request of access for YOUNG WORKER shall be approved by CONTRACTOR Site Manager and HSE Manager after having checked that the Malaysian Labor Law and the Procedure requirements are met.

CONTRACTOR SA Team and Security Team, if applicable, will continually monitor the site accesses and perform random checks and control of gate passes, in order to ensure that the Security procedure instruction are fully implemented during the PROJECT execution.

CONTRACTOR SA Team will perform Audits and Inspections activities also in the SUBCONTRACTORS Camp, Canteen and facilities in order to ensure that PROJECT requirements are met also for the specific matter.

FREEDOM OF ASSOCIATION & RIGHT TO COLLECTIVE BARGAINING

CONTRACTOR will facilitate and support the workers right to form, join, and organize trade unions of their choice and to bargain collectively on their behalf with their company during the PROJECT execution and will request SUBCONTRACTORS to do the same, in line with SA requirement, Malaysian Laws and regulations.

CONTRACTOR will ensure that the workers have the possibility to meet at CONTRACTOR or SUBCONTRACTORS Site Facilities i.e. training room, site canteen, etc to discuss, for one hour during working time, any issue pertaining to labor right, contracts, working time, over time, etc.

In case unions representatives are not available on site, workers can address any SA issue to the SA team and/or to headquarters Worker Representatives.

DISCRIMINATION

CONTRACTOR bans all form of discrimination in all activities and/or place where it can execute its influence, as specified in the Procedure and SA Policy, in line with SA requirement, local Law and regulations.

CONTRACTOR will not engage in or support discrimination in hiring, remuneration, access to training, national or social origin, caste, birth, religion, disability, gender, sexual orientation, marital status, union membership, political opinions, age, or any other condition that could give rise to discrimination.

CONTRACTOR will not allow any behavior that is threatening, abusive, exploitative, or sexually coercive, including gestures, language, and physical contact, in the workplace and, where applicable, i.e. facilities, camp, accommodation, etc.

CONTRACTOR SA Team will monitor and prevent, through continuous Audit/Inspections and dialogue, that all workers, involved with PEC PROJECT, will never suffer or be threatened or abused in any way by the above said discrimination actions/factors.

CONTRACTOR Site Management will be immediately alerted in case of any discrimination is detected for information and proper corrective actions.

DISCIPLINARY PRACTICES

CONTRACTOR will treat all PERSONNEL with dignity and respect and will not engage in or tolerate the use of corporal punishment, mental or physical coercion, or verbal abuse of PERSONNEL involved in the PROJECT including SUBCONTRACTORS, Suppliers, Vendors etc., in line with SA requirement, local Law and regulations.

CONTRACTOR SA Team will monitor, through continuous Audit/Inspection and dialogue, that all workers, involved with PROJECT, will be treated with dignity and respect.

CONTRACTOR Site Management will be immediately alerted in case of any disciplinary action is detected for information and proper corrective actions.

REMUNERATION

CONTRACTOR will respect the right of PERSONNEL to a living wage and ensure that wages paid shall always meet at least legal or industry minimum standards and shall be sufficient to meet the basic needs of PERSONNEL and to provide some discretionary income, in line with SA requirement, local Law and regulations.

CONTRACTOR will ensure that deductions from wages are not made for disciplinary purposes. Exceptions to this rule apply only when both of the following conditions exist:

- Deductions from wages for disciplinary purposes are permitted by national law;
- A freely negotiated collective bargaining agreement is in force.

CONTRACTOR will not use false apprenticeship schemes to avoid fulfilling its obligations to PERSONNEL under applicable laws pertaining to Labor and social security legislation and regulations and will request SUBCONTRACTORS to do the same.

CONTRACTOR SA Team will monitor, through continuous Audit/ Inspections and dialogue, with all workers, that these requirements are meet for all PROJECT involved PERSONNEL.

CONTRACTOR Site Management will be immediately alerted in case of any non-conformity detected in the subject matter, for information and proper corrective actions.

Workers Organization

PEC will not engage any direct or indirect labor workforce during the constructions and operational phase for the project. However, company will make the arrangement to out-source the work by engaging contractor or third parties for specific job in the construction and operation phase. PEC will comply with national law. Where national law substantially restricts workers' organizations, PEC will not restrict workers from developing alternative mechanisms to express their grievances and protect their rights regarding working conditions and terms of employment.

Workers Engaged by Third Parties

With respect to contracted workers the PEC will take commercially reasonable efforts to ascertain that the third parties who engage these workers are reputable and legitimate enterprises and have an appropriate ESMS that will allow them to operate in a manner consistent with the requirements of this Performance Standard.

PEC will establish policies and procedures for managing and monitoring the performance of such third-party employers in relation to the requirements of this Performance Standard. In addition, the PEC will use commercially reasonable efforts to incorporate these requirements in contractual agreements with such third party employers.

PEC will ensure that contracted workers, have access to a grievance mechanism. In cases where the third party is not able to provide a grievance mechanism the client will extend its own grievance mechanism to serve workers engaged by the third party.

Supply Chain

Where there is a high risk of child labor or forced labor in the primary supply chain, PEC will identify those risks and make the procedure and guidelines for the contractor. If child labor or forced labor cases are identified, PEC will take appropriate steps to remedy them. PEC will also monitor its primary supply chain on an ongoing basis in order to identify any significant changes in its supply chain and if new risks or incidents of child and/or forced labor are identified, the company will take appropriate steps to remedy them.

A HEALTH IMPACT ASSESSMENT (HIA) REPORT IN SUPPORT OF A SECOND SCHEDULE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) OF THE PROPOSED PENGERANG ENERGY COMPLEX, JOHOR
FOR CHEMONE HOLDINGS PTE LTD

SUBMITTED TO

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HEALTH IMPACT ASSESSMENT

Health impact assessment (HIA) is the process of estimating the potential impact of a chemical, biological, physical or social agent on a specified human population system under a specific set of conditions and for a certain time frame (EnHealth Council, 2001; DOE, 2012). The main approach in this HIA is to assess the impacts of the proposed Pengerang Energy Complex in Pengerang, Johor, on the health of residents of affected communities within the vicinity of the proposed project that may emanate from environmental impacts. The HIA reported here is based on the Guidance Document on HIA in EIA by the Department of Environment Malaysia (DOE, 2012). The impacts of the proposed project on workers' health are not included in this HIA, as it is not within the scope specified in the Guidance Document.

Health risk assessment (HRA) is a component of HIA. There are two forms of HRA, namely qualitative and quantitative HRA. Qualitative HRA merely characterizes or compares the hazard of a chemical relative to others, or in comparison to reference values or standards, or defines the hazard in only qualitative terms such as mutagen or carcinogen, which connotes certain risk or safety procedures. In qualitative HRA, only subjective and comparative assessment of environmental hazards are attempted without generating any quantitative estimate of the risks involved.

Quantitative HRA is a methodological approach in which the toxicities of a chemical are identified, characterized, analyzed for dose-response relationships, and the data generated are applied to a mathematical model to produce a numeric estimate representing a guideline or decision concerning allowable exposure (James, 1985a). Quantitative HRA generates a numerical measure of the risk or safety of a chemical exposure. The numerical measure of the risk generated is compared against a guideline value or an acceptable risk level. When conducting a quantitative HRA, there are two categories of risks being assessed, namely non-carcinogenic and carcinogenic health risk.

When interpreting the results of a quantitative HRA, and more so when it is applied for the purpose of a HIA, it should be cautioned that no mathematical modelling can simulate the human body with high accuracy. Therefore, the predictions made in this report are to be taken as a guideline, mainly for a more informed decision-making process, which in this case is whether the operation of the proposed project will incur potentially significant health impacts upon the exposed or affected population. This quantitative HRA will rely heavily on data generated from the air quality modeling study (Chapter 7, Section 7.5.1 of the Main Report). Uncertainties and assumptions made in the air quality modeling will also be translated into uncertainties in the quantitative HRA outcomes. It is the aim of quantitative HRA to minimise these uncertainties related to human health risks, but the fact remains that these uncertainties can never be totally avoided. With that background assumption, the results of quantitative HRA need to be interpreted with due limitations and a high regard for human health and safety.

For the purpose of this HRA, both qualitative and quantitative HRA were employed. There are 6 steps involved in the HRA methodology.

1.1 Issues Identification

This first step explores the source-pathway-receptor link, the component of each is essential in the expression of risk. Health impacts are mainly secondary impacts upon the human community that emanate from primary impacts upon the physical (air, water and soil); biological (animals and plants) and social environments. In the case of this proposed project, the main health impacts will emanate from human exposure to air pollutants that will be released during the construction and operational phases of the proposed project. The major pathway for human exposure to the released air pollutants during the construction and operational phases will be through direct inhalation. Indirect exposure to air pollutants through the ingestion route is highly unlikely in this case. The proposed project site is adjacent to the Petronas Refinery and Petrochemical Integrated Development (RAPID). There is no food crop grown in the vicinity of the proposed project. Therefore, there is low probability of human health risk from the consumption of contaminated foods.

1.2 Hazard Identification

This second step in HRA involves the identification of potential environmental hazards and characterization of their innate adverse toxic or health effects. The purpose is to scope for potential environmental and health hazards that may emanate from the operation of the proposed project. The review indicated that the major environmental hazards from the proposed project will be mainly particulate and gaseous air pollutants during the proposed project operational phase.

1.2.1 Project Construction Phase

It is estimated that at a maximum, 7,000 workers will be employed during the proposed project construction phase over a period of about 15 months. Some of these workers might be Malaysians and foreigners from outside of Johor. Workers who are not properly screened for infectious diseases may transmit them to the local population. These workers who will be mostly young males may present an increased risk in the transmission of sexually-transmitted diseases (STD). Common STDs includes human papillomavirus (HPV) infection, trichomoniasis, chlamydia, herpes simplex virus (HSV) infection, gonorrhea, syphilis, human immunodeficiency virus (HIV) infection and hepatitis B. In 2008, 31.5% of malaria cases were imported cases among foreigners (Ministry of Health, 2008). Immigrants who are likely to harbour malarial parasites can reintroduce the disease to previously malaria-free areas because the vectors may still be present there. Other diseases that may be brought in by foreign workers are tuberculosis, dengue fever and chikungunya. Therefore, it is imperative that proper pre-employment and periodic health screening be done on all workers

According to the Air Quality Modeling Report in Section 7.5.1 of the Main Report, no major earthwork is anticipated during the project construction phase as the industrial park developer will hand over the project site to the project proponent to the required platform. The sources of air pollution during the project construction phase would be heavy

equipment and vehicular emissions during process unit development, transportation, construction of road, and supporting facility. The air pollutants would be mainly combustion gases such as particulate matters (PM), nitrogen dioxide (NO_2), carbon monoxide (CO) due to incomplete combustion if any, and sulphur dioxide (SO_2) due to low sulphur content in the fuel. Dusty materials produced as a result of construction work being carried out may include cement, earth, aggregates, silt, stone fines, sand and debris.

Dust is expected to be generated during the construction phase of the project especially from the movement of vehicles on-site. However, dust pollution due to the construction activities is temporary and the local air quality is expected to return to its normal ambient levels when the construction ceases. Vehicle exhaust emissions on the local road network will be intermittent and transient in nature where associated impacts are considered minor. Exhaust emissions from the diesel engine driven equipment is also expected to result in insignificant impacts on air quality. Generally, the exhaust emissions for the project during construction will be minor.

The area of influence for fugitive dust is anticipated to be localized within the construction area (usually less than 50 m away) as the work area will be limited in nature. The duration of impact for the construction phase will be short-term to medium term. For this project, the nearest residential area is more than 500 m away from the project site. Hence, the air quality impact due to the construction activity is anticipated to be minimal or insignificant.

1.2.2 Project Operational Phase

1.2.2.1 Air Pollutants during the Project Operational Phase

During normal project operation, the main point sources would be mainly emissions from fuel burning equipment. Air pollutants emitted by the proposed project during the operational phase include particulate pollutants in the form of respirable particles (PM10) and fine particles (PM2.5), as well as gaseous pollutants as sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), hydrogen sulphide (H_2S) and hydrogen chloride (HCl). Minimal fugitive emission of volatile organic compounds (VOCs) is anticipated as these fugitive gases will be mainly collected and use as waste gas for fuel in its fuel burning equipment. Residual hydrogen sulphide (H_2S) will also be emitted from the SRU Stack and residual hydrogen chloride (HCl) emission from the CCR RCR Vent.

1.2.2.2 Health Hazards of the Air Pollutants Generated

Particulate matter, especially the fraction of PM2.5 and PM10, with an aerodynamic diameter of 5 μm and 10 μm, respectively, have great impact on human health as they can penetrate beyond the nasopharyngeal region and reach the lower human respiratory tract (Dockery and Pope, 1994; Dockery and Pope, 1996). Acute exposure may lead to asthmatic attack, respiratory infections and acute bronchitis (USEPA, 2003), as well as alveolar inflammation, increased blood coagulability and exacerbation of lung and cardiovascular diseases (Seaton *et al*., 1995).

Sulphur dioxide may cause bronchoconstriction and increased asthma symptoms among children, the elderly, and asthmatics (USEPA, 2013a). Nitrogen dioxide may lead to reduced lung function, airway responsiveness and respiratory symptoms (Searl, 2004), as well as airway inflammation in healthy people and increased respiratory symptoms in people with asthma (USEPA, 2013b). Carbon monoxide causes the formation of carboxyhaemoglobin and reduced oxygen transport by blood causing headache, nausea, rapid breathing, weakness, exhaustion, dizziness, confusion, neurological and cardiological effects including death (CDC, 2013).

Volatile organic compounds (VOCs) are a mixture of volatile organic chemicals which are generally neurotoxic (James, 1985b). They have high vapour pressure and are highly volatile. They may be related to asthma and chronic respiratory symptoms (Ware *et al.*, 1993).

Hydrogen sulphide (H_2S) is a potentially toxic gas. The gas can generate hydrogen sulphide anion (HS^-), which is a potent inhibitor of cytochrome oxidase, an enzyme responsible for cell respiration. This inhibition will interfere with the utilization of oxygen during cell metabolism, even in the presence of adequate blood supply of oxygen. High concentrations of H_2S will lead to a condition called cytotoxic hypoxia which may results in a respiratory arrest. At lower concentrations, H_2S is an irritant gas that may cause conjunctivitis, inflammation of the nasal mucosa and pulmonary edema (James, 1985c).

Hydrogen chloride (HCl) is irritating and corrosive to any tissue it comes into contact. Brief exposure to low levels causes throat irritation. Exposure to higher levels can result in rapid breathing, narrowing of the bronchioles, blue coloring of the skin, accumulation of fluid in the lungs, and even death. Exposure to even higher levels can cause swelling and spasm of the throat and suffocation. Some people may develop an inflammatory reaction to hydrogen chloride. This condition is called reactive airways dysfunction syndrome (RADS), a type of asthma caused by some irritating or corrosive substances (ATSDR, 2019).

1.3 Dose-Response Assessment

The probability of seeing a health effect from human exposure to a toxicant is dependent on the dose of exposure. The only possible human exposure to pollutants that may originate from the proposed project is inhalation exposure to air pollutants during the project construction and operational phase. However, for the project construction phase, exposure to air pollutants is anticipated to be minimal or insignificant. For inhalation exposure to air pollutants, the non-carcinogenic dose-response relationship is reflected in the reference concentration (RfC). RfC is an estimated daily concentration of a toxicant in air, with uncertainty spanning perhaps an order of magnitude, of which an inhalation exposure to the human population including sensitive subgroups, is likely to be without an appreciable risk of deleterious effect during a lifetime of 70 years (DOE, 2012). Therefore, the RfC is described in the form of an air concentration which may be safely inhaled by an exposed person over a lifetime exposure. Where applicable, the RfC is used as a direct comparison with the exposure concentration (EC) of the air pollutant. The unit for RfC is is usually in mg/m^3.

1.4 Exposure Assessment

1.4.1 During Project Construction Phase

As mentioned earlier, exposure to air pollutants during the project construction phase is anticipated to be minimal or insignificant.

1.4.2 During Project Operational Phase

Air pollutants that may be released from the proposed project during its operational phase include PM2.5, PM10, SO_2, NO_2, CO, H_2S and HCl. For the project operational phase, two air pollution emission scenarios were simulated. One is the normal emission scenario whereby all air pollution devices are functioning normally. The other is the abnormal emission scenario when there is a process upset or emergency situation, whereby the stream from the project will be routed to the proposed flare for flaring. For each of the emission scenario, two exposure scenarios were simulated. One exposure scenario is the highest predicted ambient air pollutant concentration. The other is the sensitive receptor ambient air pollutant concentration.

Six air sensitive receptor sites were identified and modeled as described below:

Table 1: **Identified Community Air Sensitive Receptors (ASRs).**

Point	Description	UTM Coordinates (x, y)	Approximate Distance from the Proposed Project Site (km)
ASR1	Open space near Kg. Lepau	405440.40, 153531.26	2.33
ASR2	Sebana Cove Resort	406368.00, 155680.00	2.20
ASR3	Sebana Golf Resort	408531.48, 155476.93	1.55
ASR4	Bukit Pelali	411003.52, 154757.55	1.90
ASR5	Open space near Kg. Bukit Gelugor	412239.45, 154143.02	2.70
ASR6	Open space near Lake View	412857.32, 153528.69	3.35

Table 2 is taken from the Air Quality Modeling Report. It shows the highest predicted maximum ambient incremental concentrations (MAICs) and ground level concentrations (GLCs) at the 6 air sensitive receptors (ASRs) for selected air pollutants during a normal project operational phase.

Table 3 is also taken from the Air Quality Modeling Report. It shows the highest predicted MAICs and GLCs at the 6 air sensitive receptors (ASRs) for selected air pollutants during an abnormal project operation. Here, the reference values used are the acute

exposure guideline levels (AEGLs) by the USEPA. AEGLs describe the human health effects from a once-in-a-lifetime, or rare, exposure to airborne chemicals. AEGLs are used by emergency planners and responders worldwide as guidance in dealing with rare, usually accidental, releases of chemicals into the air. AEGLS are expressed as specific concentrations of airborne chemicals at which health effects may occur. They are designed to protect the elderly and children, and other individuals who may be susceptible. The abnormal project operation scenario was simulated for SO_2 and H_2S.

1.5 Health Risk Characterization

1.5.1 Air Pollutant Exposure Guidelines

This involves a qualitative HRA, whereby the predicted exposure levels of the concerned air pollutants were compared to local and foreign ambient air quality guidelines.

1.5.1.1 During Project Construction Phase

As mentioned earlier, exposure to air pollutants during the project construction phase is anticipated to be minimal or insignificant.

1.5.1.2 During Project Operational Phase

During normal project operation (**Table 2**), all the predicted GLCs for PM2.5, PM10, SO_2, NO_2 and CO at the 6 ASRs will fall below their MAAQS 2013 (Standard 2020), while the predicted GLCs for H_2S and HCl will not exceed their Ontario' Ambient Air Quality Criteria 2012.

During abnormal project operation (**Table 3**), the GLCs for SO_2 at the 6 ASRs will be below its AEGL-2 limit, while the GLCs for H2S will be below its AEGL-1 limit. Therefore, public exposures to the resulting GLCs of either SO_2 or H_2S are not expected to cause any long-lasting adverse health effects, since AEGL-2 is the airborne concentration of a susbtance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

Table 2: Highest Predicted MAICs and GLCs at ASR for Selected Air Pollutants during Normal Project Operation.

Parameter	Averaging Time	Baseline Level (µg/m³) [Average]	Concentration (µg/m³)												MAAQS 2013 (Standard [2020]) (µg/m³)
			Highest Predicted MAIC	ASR1 Open Space Near Kampung Lepau		ASR2 Sebana Cove Resort		ASR3 Sebana Golf Resort		ASR4 Bukit Pelali		ASR5 Open Space Near Kampung Bukit Gelugor		ASR6 Open Space Near Lake View		
				MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	
PM_{10}	24-hours	ASR1 = 65.5 ASR2 = 41.0 ASR3 = 60.5 ASR4 = 23.0 ASR5 = 48.5 ASR6 = 41.0	2.92 (Outside PIP; Within PIC)	0.56	66.06	0.68	41.68	1.08	61.58	0.31	23.31	0.38	48.88	0.55	41.55	100
	Annual	-	0.47 (Outside PIP)	0.024	0.024	0.061	0.061	0.138	0.138	0.019	0.019	0.012	0.012	0.010	0.010	40
$PM_{2.5}$	24-hours	ASR1 = 34.3 ASR2 = 30.0 ASR3 = 25.7 ASR4 = 17.7 ASR5 = 34.0 ASR6 = 22.7	2.92 (Outside PIP; Within PIC)	0.56	34.86	0.68	30.68	1.08	26.78	0.31	18.01	0.38	34.38	0.55	23.25	35
	Annual	-	0.47 (Outside PIP)	0.024	0.024	0.061	0.061	0.138	0.138	0.019	0.019	0.012	0.012	0.010	0.010	15

Parameter	Averaging Time	Baseline Level (µg/m^3) [Average]	Concentration (µg/m^3)												MAAQS 2013 (Standard [2020]) (µg/m^3)
			Highest Predicted MAIC	ASR1 Open Space Near Kampung Lepau		ASR2 Sebana Cove Resort		ASR3 Sebana Golf Resort		ASR4 Bukit Pelali		ASR5 Open Space Near Kampung Bukit Gelugor		ASR6 Open Space Near Lake View		
				MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	
SO_2	1-hour	-	235.47 (Outside PIP)	12.11	12.11	13.81	13.81	15.93	15.93	12.75	12.75	11.88	11.88	14.61	14.61	250
	24-hours	ASR1= <5 ASR2= <5 ASR3= <5 ASR4= <5 ASR5= <5 ASR6= <5	23.32 (Outside PIP)	1.11	1.11	2.64	2.64	3.29	3.29	0.69	0.69	1.17	1.17	1.36	1.36	80
	Annual	-	1.84 (Within PIP)	0.048	0.048	0.157	0.157	0.304	0.304	0.043	0.043	0.025	0.025	0.023	0.023	-
NO_X as 100% NO_2	1-hour	-	359.34 (Outside PIP)	33.84	33.84	37.13	37.13	40.56	40.56	42.78	42.78	35.23	35.23	36.52	36.52	280
	24-hours	ASR1 = 4.5 ASR2 = <5 ASR3 = 5.0 ASR4 = 4.0 ASR5 = <5 ASR6 = <5	42.26 (Outside PIP, Within PIC)	6.20	10.70	8.14	8.14	10.96	15.96	3.22	7.22	4.16	4.16	6.01	6.01	70
	Annual	-	5.95 (Within PIP)	0.262	0.262	0.705	0.705	1.203	1.203	0.188	0.188	0.120	0.120	0.104	0.104	-

Parameter	Averaging Time	Baseline Level (µg/m^3) [Average]	Concentration (µg/m^3)												MAAQS 2013 (Standard [2020]) (µg/m^3)
			Highest Predicted MAIC	ASR1 Open Space Near Kampung Lepau		ASR2 Sebana Cove Resort		ASR3 Sebana Golf Resort		ASR4 Bukit Pelali		ASR5 Open Space Near Kampung Bukit Gelugor		ASR6 Open Space Near Lake View		
				MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	
CO	1-hour	-	1,118.97 (Outside PIP; Near ASR 4)	179.43	179.43	171.65	171.65	153.38	153.38	217.69	217.69	180.03	180.03	131.14	131.14	30,000
	8-hour	ASR1 = 1,250 ASR2 = 950 ASR3 = 800 ASR4 = 1,550 ASR5 = 2,600 ASR6 = 2,600	323.12 (Within PIP)	47.94	1,297.94	70.47	1,020.47	118.29	918.29	41.51	1,591 .51	27.95	2,627.95	33.00	2,633.00	10,000
	Annual	-	25.52 (Within PIP)	1.31	1.31	3.09	3.09	8.17	8.17	1.09	1.09	0.64	0.64	0.55	0.55	-
H_2S	8-hour	ASR1= <10 ASR2= <10 ASR3= <10 ASR4= <10 ASR5= <10 ASR6= <10	1.01 (Outside PIP)	0.02	0.02	0.08	0.08	0.12	0.12	0.04	0.04	0.04	0.04	0.03	0.03	-
	24-hour	-	0.44 (Outside PIP)	0.02	0.02	0.03	0.03	0.06	0.06	0.01	0.01	0.02	0.02	0.02	0.02	7 *(Ontario)*
	Annual	-	0.0323 (Within PIP)	0.0005	0.0005	0.0019	0.0019	0.0053	0.0053	0.0007	0.0007	0.0004	0.0004	0.0003	0.0003	-

Parameter	Averaging Time	Baseline Level (µg/m^3) [Average]	Concentration (µg/m^3)												MAAQS 2013 (Standard [2020]) (µg/m^3)
			Highest Predicted MAIC	ASR1 Open Space Near Kampung Lepau		ASR2 Sebana Cove Resort		ASR3 Sebana Golf Resort		ASR4 Bukit Pelali		ASR5 Open Space Near Kampung Bukit Gelugor		ASR6 Open Space Near Lake View		
				MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	
HCl	8-hour	-	2.02 (Outside PIP, Near ASR4)	0.10	0.10	0.16	0.16	0.16	0.16	0.12	0.12	0.11	0.11	0.09	0.09	-
	24-hour	-	0.83 (Outside PIP)	0.05	0.05	0.06	0.06	0.11	0.11	0.04	0.04	0.04	0.04	0.05	0.05	20 *(Ontario)*
	Annual	-	0.0540 (Within PIP)	0.0018	0.0018	0.0046	0.0046	0.0120	0.0120	0.0015	0.0015	0.0010	0.0010	0.0008	0.0008	-

Note: PM is conservatively assumed as 100% PM10 and PM2.5
Ground Level Concentration (GLC) = Baseline Level (BL) + Maximum Average Incremental Concentration (MAIC)
Average Baseline Levels were based on the Ambient Air Quality Monitoring Results carried out on April, May, June and July 2019
For calculation of average, values of Less than the Minimum Detectable Limit or not detected was assumed to be null
PIP = Pengerang Industrial Park
PIC = Pengerang Integrated Complex (Rapid)
Ontario = Ontario's Ambient Air Quality Criteria (April 2012)

Table 3: Highest Predicted MAICs and GLCs at ASR for Selected Air Pollutants during Abnormal Project Operation.

Para-meter	Averaging Time	Baseline Level (µg/m^3)	Percentile (%)	Concentration (µg/m^3)							AEGL-1 (Non-disabling)	AEGL-2 (Disabling)	AEGL-3 (Lethal)
				Highest Predicted MAIC	ASR1: Open Space Near Kampung Lepau	ASR2: Sebana Cove Resort	ASR3: Sebana Golf Resort	ASR4: Bukit Pelali	ASR5: Open Space Near Kampung Bukit Gelugor	ASR6: Open Space Near Lake View			
SO_2	1-hour	ASR1 = <5 ASR2 = <5 ASR3 = <5 ASR4 = <5 ASR5 = <5 ASR6 = <5 (24-hours averaging time)	100	7,543.9 (Outside PIP, Within PIC)	1,649.1	1,279.3	790.8	502.2	893.0	559.6	520 µg/m^3 (0.20 ppm)	1,950 µg/m^3 (0.75 ppm)	78,000 µg/m^3 (30 ppm)
			99.98	2,449.1 (Outside PIP, Within PIC)	748.2	697.9	506.3	308.6	466.9	274.0			
H_2S	1-hour	ASR1= 27.1 ASR2= 22.9 ASR3= 27.1 ASR4= 20.8 ASR5= 22.9 ASR6= 22.9 (8-hours averaging time)	100	419.6 (Outside PIP, Within PIC)	91.7	71.2	44.0	27.9	49.7	31.1	710 µg/m^3 (0.51ppm)	39,000 µg/m^3 (27 ppm)	71,000 µg/m^3 (50 ppm)

Note: PIP = Pengerang Industry Park
PIC = Pengerang Integrated Complex (RAPID)
AEGL = Acute Exposure Guidelines Level
AEGL-1 is the airborne concentration of a substance above which is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptimatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure;

AEGL-2 is the airborne concentration of a susbtance above which is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape; and
AEGL-3 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening adverse health effects or death..

1.5.2 Hazard Quotient for Air Pollutants

The hazard quotient (HQ) is a measure of the possibility of seeing chronic, non-carcinogenic health effects among the exposed population. The HQ due to chronic inhalation exposure to H_2S and HCl at the highest predicted GLC at ASR under normal project operation were calculated. This HQ was obtained by taking the ratio of the ambient air concentration or exposure air concentration (EC) to the reference concentration (RfC). The unit for EC and RfC is $\mu g/m^3$.

$$HQ = \frac{EC}{RfC}$$

$$EC = \frac{Ca \times EF \times ED}{AT \times 365\ days/yr}$$

Where, EC = Exposure concentration ($\mu g/m^3$)
RfC = Reference concentration ($\mu g/m^3$)
C_a = Ambient air concentration ($\mu g/m^3$)
EF = Exposure frequency = 350 days/year
ED = Exposure duration = 40 years for adults
AT = Averaging time = ED = 40years

A HQ of 1 or greater signifies a hazardous condition, whereby EC equals or exceeds RfC. A HQ of less than 1 is categorized as an acceptable risk for a chronic, non-carcinogenic health effect by the USEPA.

As shown in **Table 4**, the highest predicted GLC for H_2S (0.06 $\mu g/m^3$) and HCl (0.11 $\mu g/m^3$) at the Sebana Golf Resort (ASR3) during normal project operation gives a HQ of 0.029 and 0.005, respectively. Since the HQ is less than 1, it means that it is unlikely that a chronic, non-carcinogenic health effect will not be seen among those exposed over a lifetime.

Table 4: **Highest Predicted GLCs and Adjusted Exposure Concentrations at ASRs, RfC and HQ for Non-carcinogenic Health Effects of Hydrogen Sulphide and Hydrogen Chloride during Normal Project Operation**

Air pollutant	Highest predicted GLC at ASR ($\mu g/m^3$)	Adjusted exposure concentration (EC) ($\mu g/m^3$)	RfC [a] ($\mu g/m^3$)	HQ	Non-carcinogenic health effects
Hydrogen sulphide (H_2S) (24-hour)	0.06 [1]	0.058	2.0	0.029	Nasal lesions of the olfactory mucosa
Hydrogen chloride (HCl) (24-hour)	0.11 [1]	0.105	20.0	0.005	Hyperplasia of nasal mucosa larynx and trachea

Note: [1] ASR3, Sebana Golf Resort

Sources: [a] USEPA's Integrated Risk Information System (database accessed 6 May 2019).

1.6 Uncertainty Analysis

Quantitative HRA is not a tool that can emulate or model "reality" with unquestionable accuracy and precision. The model it generates is a representation of reality which the current scientific tools will render. Therefore, there is always a certain degree of uncertainty involved in the quantitative HRA process. This uncertainty is internalized in the form of assumptions made in generating parameters such as the RfC, exposure frequency, exposure duration and body weight. These assumptions are made with respect to the various default values used such as the average adult body weight of 70 kg, and inhalation rate of 20 m^3/day. These default values refer to an average person.

1.7 Summary of Assessment

Exposure to air pollutants during the project construction phase may happen but is anticipated to be minimal or insignificant.

During normal project operation (**Table 2**), all the predicted GLCs for PM2.5, PM10, SO_2, NO_2 and CO at the 6 ASRs will fall below their MAAQS 2013 (Standard 2020), while the predicted GLCs for H_2S and HCl will not exceed their Ontario' Ambient Air Quality Criteria 2012.

During abnormal project operation (**Table 3**), the GLCs for SO_2 at the 6 ASRs will be below its AEGL-2 limit, while the GLCs for H2S will be below its AEGL-1 limit. Therefore, public exposures to the resulting GLCs of either SO_2 or H_2S are not expected to cause any long-lasting adverse health effects, since AEGL-2 is the airborne concentration of a susbtance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

As shown in **Table 4**, the highest predicted GLC for H_2S (0.06 µg/m^3) and HCI (0.11 µg/m^3) at the Sebana Golf Resort (ASR3) during normal project operation gives a HQ of 0.029 and 0.005, respectively. Since the HQ is less than 1, it means that it is unlikely that a chronic, non-carcinogenic health effect will not be seen among those exposed over a lifetime.

1.8 Conclusion

During normal project operation, the particulate and gaseous pollutant GLCs at all ASRs will fall below their MAAQS 2013 (Standard 2020) and Ontario' Ambient Air Quality Criteria 2012 limits. During abnormal project operation, the GLCs for SO_2 at the 6 ASRs will be below its AEGL-2 limit, while the GLCs for H2S will be below its AEGL-1 limit. The highest predicted GLC for H_2S (0.06 µg/m^3) and HCI (0.11 µg/m^3) at the Sebana Golf Resort (ASR3) during normal project operation gives a HQ of 0.029 and 0.005, respectively, which means that a chronic, non-carcinogenic health effect will not be seen among those exposed over a lifetime.

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