Environmental and Social Management Plan (ESMP) for Proposed Pengerang Energy Complex (PEC), Pengerang Industrial Park, Mukim Pengerang, Daerah Kota Tinggi, Johor Darul Takzim

Prepared for

Pengerang Energy Complex Sdn Bhd

25.03 2022

ESC

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Environmental and Social Management Plan for Proposed Pengerang Energy Complex (PEC), Mukim Pengerang, Daerah Kota Tinggi, Johor Darul Takzim

For Pengerang Energy Complex Sdn Bhd

For and on behalf of
EnviroSolutions & Consulting Sdn Bhd,

Approved by,

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Group Director
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Acronyms

APCS	Air Pollution Control System
APHA	American Health Public Association
API	Air Pollution Index
ASR	Air Sensitive Receptor
ASU	Air Separation Unit
BAT	Best Available Techniques Economically Achievable/ Best Available Technology
BED	Basic Engineering Design
BMP	Best Management Practices
BOD	Biological Oxygen Demand
B-T	Benzene-Toluene
C_3	Propane
C_4	Butane
C_5	Pentane
CCR	Continuous Catalytic Reforming
CEMS	Continuous Emission Monitoring System
CIDB	Construction Industry Development Board
CM	Compliance Monitoring
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
CO_2	Carbon Dioxide
CRP	Contaminant Removal Process
CSR	Corporate Social Rsponsibility
CTF	Central Tank Facility
CUF	Common Utility Facilities
DAHS	Data Acquisition and Handling System
DEBZ	Diethylbenzene
DED	Detailed Engineering Design
DEM	Digital Elevation Model
DHT	Diesel Hydrotreating
DID	Department of Irrigation and Drainage
DoE	Department of Environment
Doe-CLM	DoE's Contaminated Land Management and Control Guidelines 2009
DOSH	Department of Occupational Safety and Health
DWT	Dead Weight Tonnes
EB	Ethylbenzene
ED	Extractive Distillation
EDP	Emergency Depressurizing
EHS	Environmentally Hazardous Substance
EIA	Environmental Impact Assessment
EIMAS	Environmental Institute of Malaysia
EMP	Environmental Management Plan
ERC	Emergency Response Centre
ERP	Emergency Response Plan
ERT	Emergency Response Team
ESA	Environmentally Sensitive Areas

ESC	EnviroSolutions & Consulting Sdn Bhd
ESCP	Erosion and Sedimentation Control Plan
ESD	Emergency Shut Down
ESI	Environmental Scoping Information
ESMP	Environmental and Social Management Plan
ETP	Economic Transformation Programme
EP	Equator Pronciples
EQA	Environmental Quality Act
EQ	Environmental Quality
FBR	Full Boiling Range
FRC	Flow Record and Control
FMA	Factories and Machinery Act
GLC	Ground Level Concentrations
H_2S	Hydrogen Sulphide
HAZID	Hazard Identification
HAZOP	Hazard and Operability
HCL	Hydrogen Chloride
HIA	Health Impact Assessment
HIRARC	Hazard Identification, Risk Assessment and Risk Control
HR	Human Resource
HRA	Health Risk Assessment
HSE	Health, Safety and Environment
IC	Incident Commander
ICC	Incident Commander Centre
IETS	Industrial Effluent Treatment System (WWTP)
IFC	International Finance Corporation
ILO	International Labour Organisation
IM	Impact Monitoring
IMT	Incident Management Team
IR	Individual Risk
ISBL	Inside Battery Limits
IUCN	International Union for Conservation of Nature
JCorp	Johor Corporation
JPDC	Johor Petroleum Development Corporation
KHT	Kerosene Hydrotreating
KMTA	Kilometric tonnes annum
kMtpd	kilometric tonnes per day
LD-P2M2	Land Disturbing Pollution Prevention and Mitigation Measures
L_{eq}	Equivalent Continuous Noise Level
L_{max}	Maximum Sound Level
L_{min}	Minimum Sound Level
LNG	Liquefied Natural Gas
LoC	Loss of Containment
LPG	Liquified Petroleum Gas
LSFO	Low Sulphur Fuel Oil
LVOC	Large Volume Petroleum-based Organic Chemicals
MAAQS	Malaysia Ambient Air Quality Standard

MAE	Major Accidents Event
MBR	Membrane Bioreactor System (MBR)
MEA	Mono-Ethanol Amine
MIAC	Maximum Incremental Average Concentration
MLD	Million Litres Per Day
MLSS	Mixed Liquor Suspended Solids
MMtpa	Million metric tonnes per annum
MOS	Margin of Safety
MTPA	Metric Tonnes Per Annum
MX	Metaxylene
NEL	Noise Exposure Limit
NH_3	Ammonia
NH_3-N	Ammoniacal Nitrogen
NHT	Naphtha Hydrotreating
NKEA	National Key Economic Area
NMVOC	Non-Methane Volatile Organic Compound
NO_2	Nitrogen Dioxide
NWQS	National Water Quality Standards
O_2	Oxygen
O_3	Ozone
ORP	Olefin Reduction Process
OSBL	Outside Battery Limits
OSC	On Scene Commander
OPSHA	Occupational Safety and Health
OX	Orthoxylene
P2M2	Pollution Prevention and Mitigation Measures
PAH	Polyaromatic Hydrocarbon
PAMER	PIPC Raw Water Supply Project
PCP	Project Closure Plan
PCS	Pollution Control System
PDT	Pengerang Deepwater Terminal
PDT2	Second Pengerang Deepwater Terminal
PE	Population Equivalent
PET	Polyethylene Terephthalate
PETRONAS	Petroliam Nasional Berhad
PFD	Process Flow Diagram
PGP	Pengerang Gas Pipeline
PGU	Peninsular Gas Utilisation
PIC	Pengerang Integrated Complex
PIP	Pengerang Industrial Park
PIPC	Pengerang Integrated Petroleum Complex
PM	Performance Monitoring
PM	Particulate Matter
PM_{10}	10 microns in size
PMIP	Pengerang Maritime Industrial Park
PO_4	Phosphate
PPE	Personal Protective Equipment

PRefChem	Pengerang Refining and Petrochemical
PRPC	Petronas Refinery & Petrochemical Corporation
PSA	Pressure Swing Adsorption
PTW	Permit to Work
PVC	Polyvinyl chloride
PX	Paraxylene
QRA	Quantitative Risk Assessment
RAPID	Refinery and Petrochemical Integrated Development
RGT2	Re-gasification Terminal 2
RWTP	Raw Water Treatment Plan (RWTP)
SAJ	Syarikat Air Johor
SAAM	Skim Akreditasi Makmal Malaysia / National Laboratory Accreditation Scheme
SBR	Sequencing Batch Reactor
SCBA	Self Containing Breathing Apparatus
SDS	Safety Datasheet
SEA	Social Economic Assessment
SEA	South East Asia
SIA	Social Impact Assessment
SO_2	Sulphur Dioxide
SR	Societal Risk
SRTM	Shuttle Radar Topography Mission
SRU	Sulphur Recovery Unit
STD	Sexually Transmitted Disease
SSL	Site Screening Levels
SVOC	Semi-Volatile Organic Compounds
SW	Scheduled Waste
SWL	Safe Working Load
TDP	Toluene Disproportionation
TDS	Total Dissolved Solids
TGCU	Tailgas Clean-up Unit
TIA	Traffic Impact Analysis
TMBZ	Trimethylbenzene
TMP	Traffic Management Plan
TPH	Petroleum Hydrocarbons
TMDL	Total Maximum Daily Load
TTMBZ	Tetramethylbenzene
ToR	Terms of Reference
ToRAC	ToR Adequacy Check
TRC	Technical Review Committee
TSS	Total Suspended Solid
TWA	Time-Weighted Average
UF	Utilities and Facilities
ULCC	Ultra Large Crude Carriers
ULSD	Ultra Low Sulphur Diesel
UOP	Universal Oil Products
UPENJ	Unit Perancang Ekonomi Negeri Johor
USEPA	US Environmental Protection Agency

USLE	Revised Universal Soil Loss Equation
VCE	Vapour Cloud Explosion
VLCC	Very Large Crude Carriers
VOC	Volatile Organic Compound
WMC	Waste Management Centre
WWTP	Wastewater Treatment Plant

1 INTRODUCTION

1.1 Project Overview

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) (refer to Figure 3.1). 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. The project will be utilising the latest generation of proven UOP technology which is considered the aromatics industry's Best Available Technology (BAT) supplier and assures process safety, environmental performance and production capacity.

1.2 Project Objective

The PEC project is estimated to cost RM13.0 billion (~USD 3.4 billion) and this scale of development will definitely spur more economic activities.

The PEC project is 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.

1.3 Project Siting

The facilities associated with the proposed Pengerang Energy Complex will be developed within the proposed Pengerang Industrial Park (PIP) in Pengerang Integrated Petroleum Complex, Mukim Pengerang, Daerah Kota Tinggi, Johor Darul Ta'zim. PIP is part of the full PIPC development spearheaded by Johor Corporation (JCorp). The PIP is proposed to 787.6 acres of land within Mukim Pengerang, Daerah Kota Tinggi, Johor, in to heavy industrial estate. It would consist of industrial, commercial, green areas and as well as supporting facilities (JCorp EIA, 2018).

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 50km 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). To the south is Petronas's RAPID development.

1.4 Site Layout & Elements

The proposed PEC will comprise the following key elements:

- Condensate Splitter;
- Aromatics Plant;
- An elevated flare;
- Bulk storage area;
- Wastewater treatment plant; and
- Office and administrative buildings.

Figure 1.1 below shows the conceptual layout plan of the PEC. The scope of this report comprises the major process areas detailed within the plan, which include:

- Condensate Splitter Section
    - Sour Water Stripping / Sulphur Recovery / Amine Regeneration / Spent Caustic Treatment DHT (C2 AREA); and
    - Prefractionation, KHT (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 AREA); and
    - Isomar unit (A3 AREA).
- Support facilities
    - 16 emissions stacks serving 10 furnace stacks, 3 vent stacks, 3 boiler stacks
    - 1 Elevated Flare stack for emergency use
    - Onsite tankage for bulk storage for chemicals
    - Waste water treatment plant
    - Offices and other Site support facilities

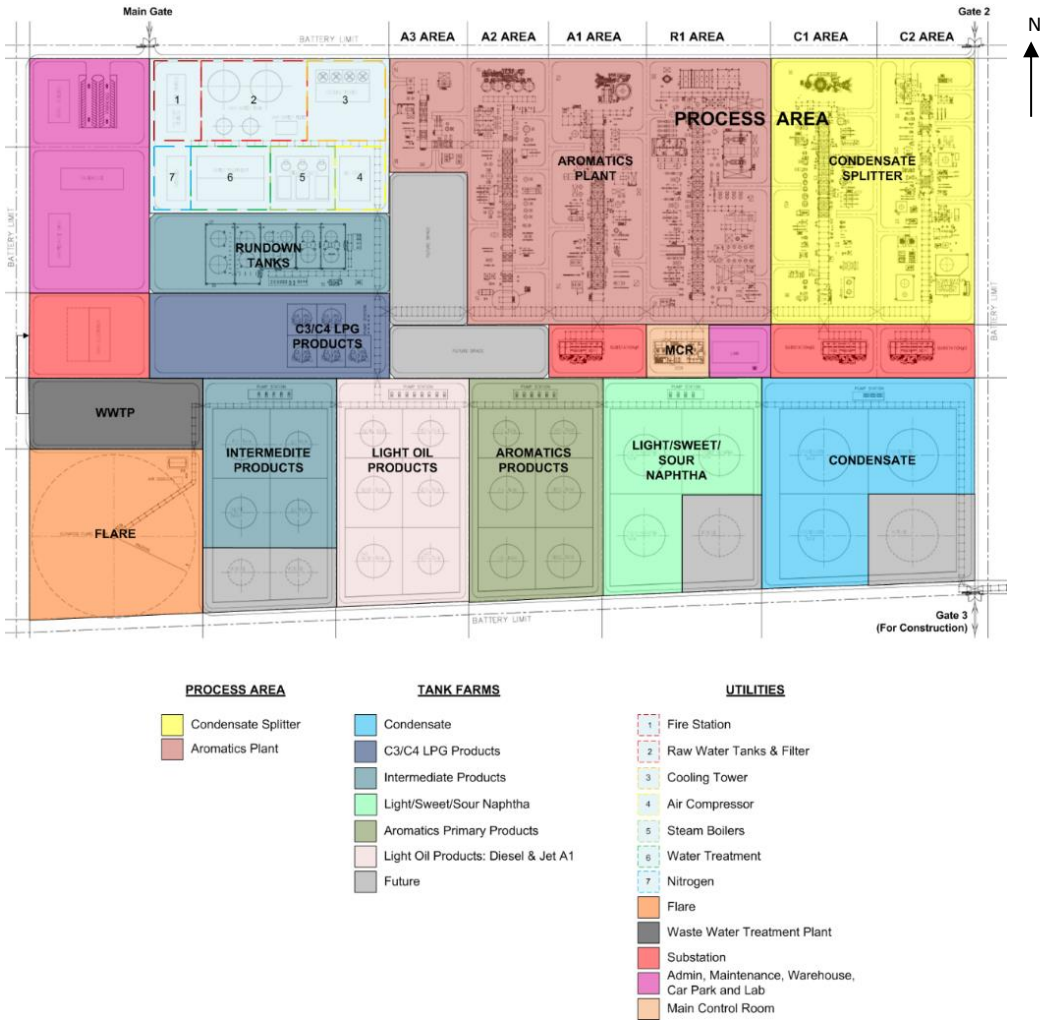


Figure 1.1 – PEC Conceptual Layout Plan

As indicated in the conceptual layout plan above, the flare system will be located on the southwest corner of the plot while the warehouse and associated buildings are located on the northwest portion of the plot.

1.5 Process Description

1.5.1 Raw Materials Supply

The PEC capacity for aromatics production is projected to be 2.161 million metric tonnes per annum (MMtpa) and 3.683 MMtpa for oil products from a feedstock input of 6.324 MMtpa of condensate. The primary feedstock to the PEC facility will be imported via the jetty and stored at the DIALOG Pengerang Deepwater Terminal (PDT).

Figure 1.2 provides a schematic overview of the PEC feedstock and product sales.

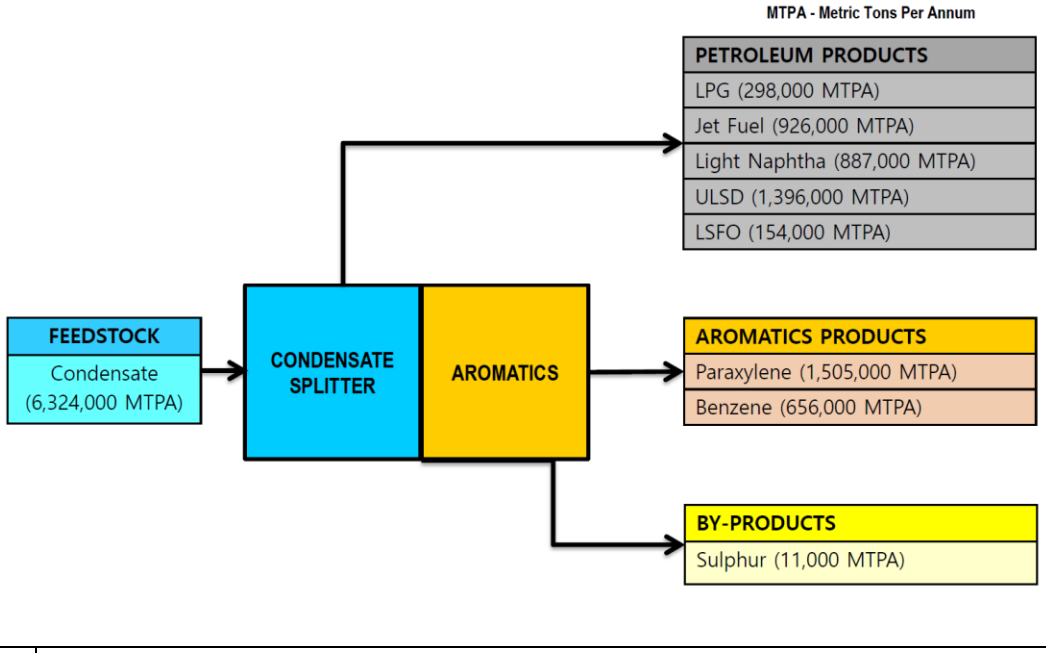


Figure 1.2 – PEC Feedstock and Product Slates
Source: PEC

The PEC's feedstock condensate will only be stored in limited quantity on site in 'weekly tanks' bulk storage with the main feedstock bulk storage managed by a third-party operator at a terminal in PDT CTF. Feedstock, in the form of condensate will be imported via marine vessels and unloaded by the 3rd party operator at a PEC dedicated jetty. It will be pumped from the 3rd party bulk storage terminal via ~5.3 km dual pipelines held in PIPC supplied pipe racks to the PEC site in the PIP.

PEC will have three aboveground bulk condensate tanks on site; with working capacity of 43,000 metric tonnes each, to receive and store the condensate from the jetty/ 3rd party terminal for daily consumption.

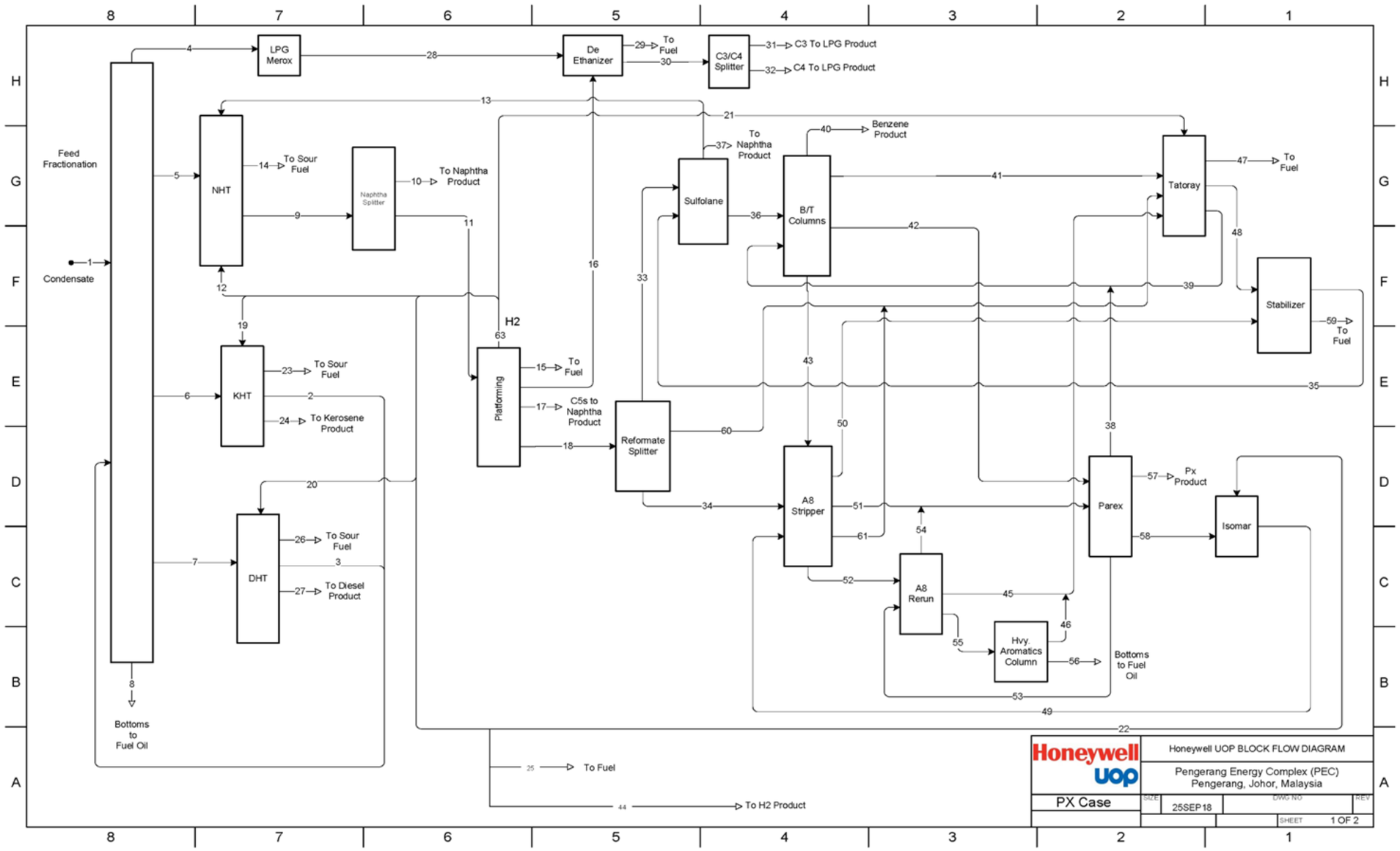
1.5.2 Process Overview

The PEC will be divided into two main sections, the 'condensate splitting plant' and the 'aromatics plant'. The condensate splitting plant will produce intermediate naphtha as feedstock for the aromatics plant and various petroleum products including LPG i.e. C_3 (propane), C_4 (butane and isobutane), Ultra Low Sulphur Diesel (ULSD) and Low Sulphur Fuel Oil (LSFO).

The PEC will be divided into two main sections, the 'condensate splitting plant' and the 'aromatics plant'. The overview block flow process diagram as shown in *Figure 1.3* below provides a simplified block flow diagram for the plant.

The condensate splitting plant will produce intermediate naphtha as feedstock for the aromatics plant and various petroleum products including LPG i.e. C_3 (propane), C_4 (butane and isobutane), Ultra Low Sulphur Diesel (ULSD) and Low Sulphur Fuel Oil (LSFO). In the aromatics plant, the intermediate naphtha will be processed to produce paraxylene, and benzene and sulphur as its by-product.

Feedstocks will be processed using standard oil refining 'unit operations' that utilise heating, cooling, fractionation, reforming and distillation processes. The PEC will utilise the refining and aromatics technologies of Honeywell UOP, a globally leading vendor.



Unit Capacities	BPD	KMTA
Condensate	150275	6324
LPG Merox	6091	180
NHT	103407	4134
Naphtha Splitter	102937	4118
Platforming	80849	3327
KHT	21278	946
DHT	28699	1342
Reformate Splitter	60957	2826
Sulfolane	18705	776
BT Fractionation	73515	3576
Tatoray	64224	3119
A8 Stripper	179300	8648
A8 Rerun	38822	1891
OX Column	2004	99
Parex	145680	7058
Isomar	117757	5716

Overall Material Balance	BPD	KMTA
Feed		
Condensate	150275	6324
Products		
C3 LPG	2548	72
C4 LPG	7004	226
Benzene		656
Paraxylene		1505
Light Naphtha	24781	887
Kerosene	20929	926
Diesel	29918	1396
Fuel Oil		154
Excess H2		11
Sulphur		11
Fuel & Loss		480

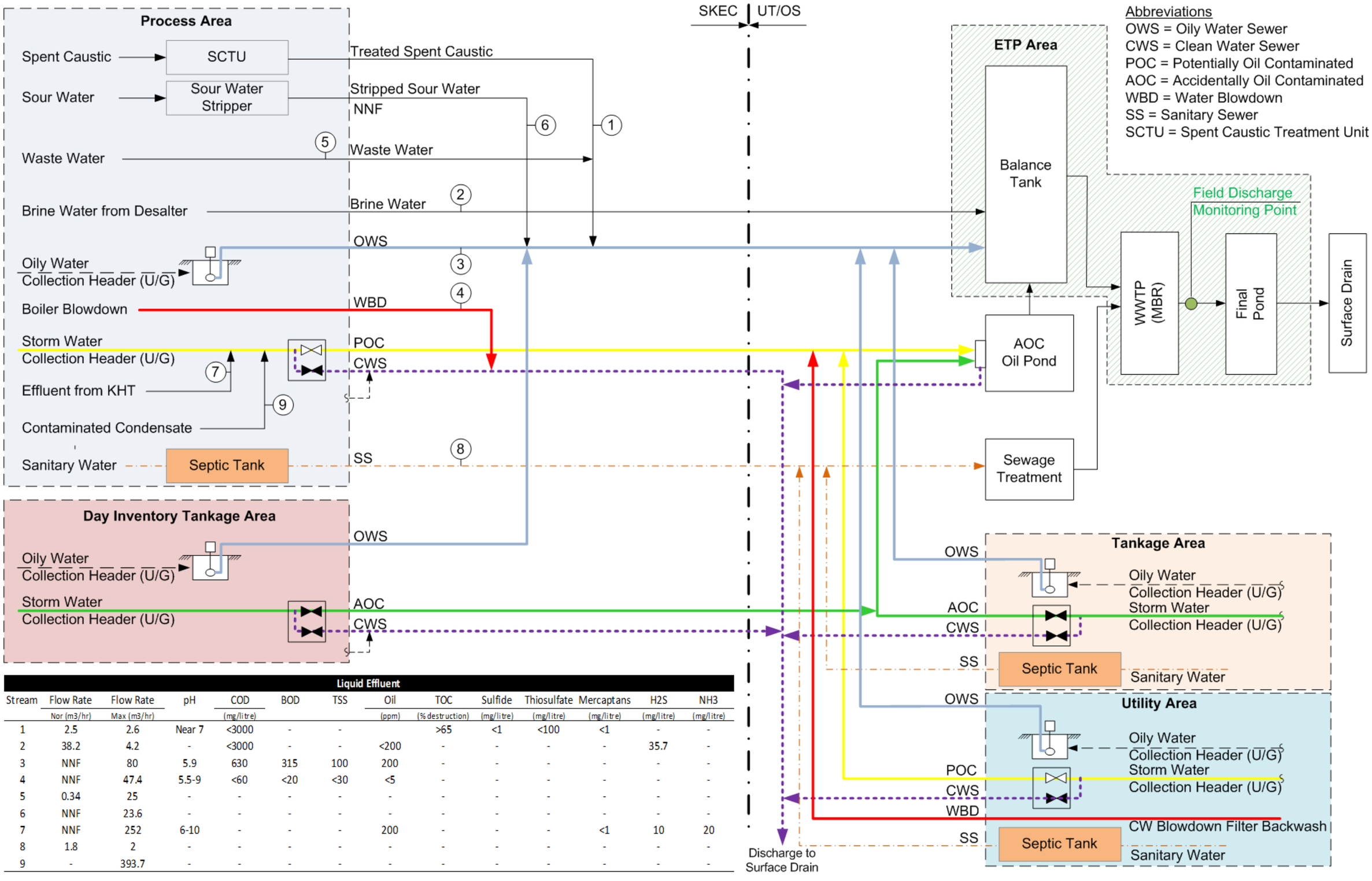
Stream Number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Description		Purch Cond	KHT Wild Naphtha	DHT Wild Naphtha	CFU LPG	CFU Naphtha	CFU Kerosene	CFU Diesel	CFU Residue	HT Naphtha	Nap Splt Tops	Nap Splt Bttms	H2 to NHT	Raffinate	NHT Offgas	CCR Fuel	CCR LPG	CCR C5	CCR Ref	H2 to KHT	H2 to DHT	H2 to Tatoray	H2 to Isomar	KHT Sour Offgas	HT Heavy Jet	H2 to Fuel	DHT Fuel	DHT HT Dsl
Mass Flow	KMTA	6324	17	4	180	3725	946	1342	154	4118	791	3327	11	409	27	6	124	71	2826	5	8	8	3	8	926	254	10	1336

Stream Number		28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Description		Treated LPG	Sat C1/C2	Sat C3/C4	Sat C3	Sat Mixd C4	Ref Splt Tops	Ref Splt Bttms	Stabilizer Bottoms	Extract	Raffinate to LN	Parex Des	TAT Product	Benzene	Toluene to Tatoray	Toluene to PX	BT Bttms	H2 to Product	A8 R Side	HAC Tops	TAT Fuel	TAT L Tops	Isomar Product	A8 S Tops	A8 S Side	A8 S Bottoms	Parex Bttm	A8 R Tops
Mass Flow	KMTA	180	6	298	72	226	736	1363	40	342	25	1	3232	656	1170	183	1567	11	1182	39	146	11	5718	66	6448	1872	19	609

Stream Number		55	56	57	58	59	60	61		63
Description		A8 R Bottoms	Hy Aromatics	PXY	Parex Raff	Stabilizer Fuel	Ref Splt Side Draw	A8 Stripper OVHD Lqd		PLT H2
Mass Flow	KMTA	99	60	1505	5716	36	728	262		300

Figure 5.4 – UOP Block Flow Diagram

Source: PEC



Liquid Effluent

Stream	Flow Rate Nor (m3/hr)	Flow Rate Max (m3/hr)	pH	COD (mg/litre)	BOD	TSS	Oil (ppm)	TOC (% destruction)	Sulfide (mg/litre)	Thiosulfate (mg/litre)	Mercaptans (mg/litre)	H2S (mg/litre)	NH3 (mg/litre)
1	2.5	2.6	Near 7	<3000	-	-		>65	<1	<100	<1	-	-
2	38.2	4.2	-	<3000	-	-	<200	-	-	-	-	35.7	-
3	NNF	80	5.9	630	315	100	200	-	-	-	-	-	-
4	NNF	47.4	5.5-9	<60	<20	<30	<5	-	-	-	-	-	-
5	0.34	25	-	-	-	-	-	-	-	-	-	-	-
6	NNF	23.6	-	-	-	-	-	-	-	-	-	-	-
7	NNF	252	6-10	-	-	-	200	-	-	-	<1	10	20
8	1.8	2	-	-	-	-	-	-	-	-	-	-	-
9	-	393.7	-	-	-	-	-	-	-	-	-	-	-

Figure 5.16 – Schematic Drawing for Drainage and Effluent System

Source: PEC

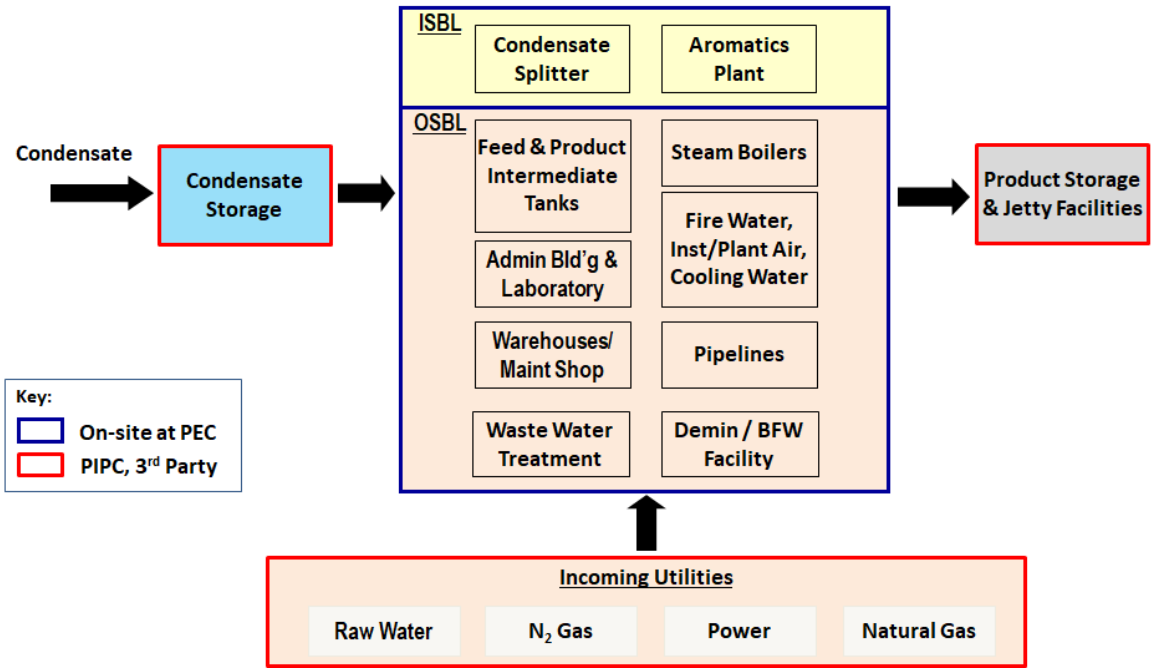


Figure 1.4 – PEC Processing Sections and Supporting Facilities Schematic Plan
Source: PEC

Main processing sections and the supporting facilities are schematically illustrated in *Figure 1.4.*

Principle operations at the proposed PEC are planned as follows:

- Feedstock, import and storage.
- Other raw materials.
- Processing.
- Supporting facilities and utilities.
- Products.

Table 1.1 provides the full list of products, co products and by-products. By-product hydrogen rich gas, fuel gas, light ends and tail gas 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.

Table 1.1: 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
C_3 / C_4 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

1.5.3 Emission, Effluents and Waste Inventory

An inventory of principal emissions, effluents and wastes that are expected to be generated during operation of the PEC facility are presented in the following sections. The emission scheme block diagram is presented in *Figure 1.5*. It should be noted that the presented streams are the best estimates on the basis of currently available design information.

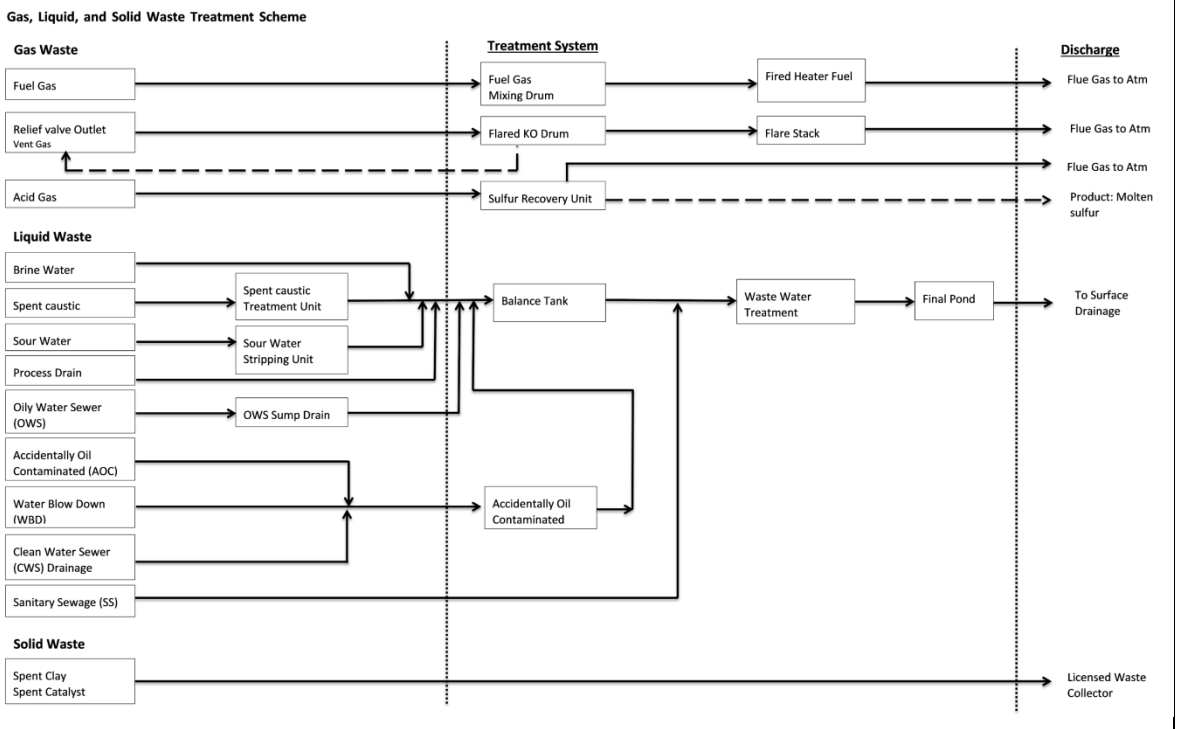


Figure 1.5 – Waste Treatment Scheme Block Diagram

1.6 Summary of Impact

This chapter summarise the impacts of the PEC project during the different phases of activities and prescribes the applicable and practicable mitigation measures to be implemented.

1.6.1 Pre-Construction Phase

JCorp will be responsible for the overall site clearing process to prepare a foundation for their tenants including PEC. Therefore, there will be no significant impacts during the pre-construction phase for the Project Proponent. The site will be presented at the correct level for construction.

Impacts for site clearing activities is presented in the EIA for the development of the PIP in the report titled *"Cadangan Pembangunan Taman Perindustrian Pengerang Di Atas Sebahagian PTD 2083, Mukim Pengerang, Daerah Kota Tinggi, Johor Darul Takzim bagi Tetuan Johor Corporation"* which was submitted to the Johor State DOE in November 2018.

1.6.2 Construction Phase

The construction of the PEC facility is projected to commence in Q1 2020 and will stretch up to the 2022, with start-up in 2023. Impacts during the construction phase will be from activities related to the construction of the facilities onsite which include the production, administrative and utilities structures, internal roads and vehicle parking areas. The summary of the potential impacts and its mitigation measures is shown in *Table 1.2.*

Table 1.2: Summary of Impacts and Mitigation Measures During Construction Phase

Issue	Impact	Impact	Mitigation	Residual Impact
Site Clearing	• Change in existing profile and drainage pattern of the land; • Clearing vegetation from large areas and exposing edible soil may lead to dust generation and sediment run-off; • Loss of agricultural land due to land acquisition for industrial development; and • Generation of solid waste in the form of construction spoils.	Low	• Exposed site should be kept to a minimum during construction; • Completed areas should be hard surfaced/ re-vegetated as soon as possible; • Temporary drainage with appropriate capacity to be provided prior to the site clearing activities; • Soil stabilisation technique to be implemented where turfing, paving and engineering measures to protect from erosion; • Temporary measures such as plastic sheets should be used to protect the exposed slopes; and • Ensure proper housekeeping and cleanliness of the site throughout the construction period.	Low
Water Quality	• Sedimentation from the erosion of the exposed site surfaces might cause the drainage to clog and the increased of surface runoff could result in potential flooding; • Water pollution due to sediment load in construction water and wastewater from construction camps; and • Impact on the local water source (Sg. Lepau) from runoff.	Medium	• Regular maintenance of the permanent drainage is required to ensure the discharge water quality; • Provision of check dams in the drain to help reduce the concentration of the sediments/ silts; • Temporary toilets and washing facilities shall be equipped with sanitary facilities to ensure that the wastewater will be treated prior to discharging into any drainage system or river; • Any spillage from fuel storage tank shall be contained within the containment bund of 110% capacity of the largest tank. The storage containers or tanks must be covered at all times; and • Water quality monitoring shall be conducted upon commencement of construction works and the data shall be compared with the baseline study and also Standard A of the *Environmental Quality (Industrial Effluents) Regulation 2009*.	Low
Air Quality	• Dust pollution due to excavation, backfilling and concreting, hauling and dumping of earth materials and construction spoils; • Fugitive dust due to the movement of construction vehicles on exposed soil, construction material handling and wind erosion; and • Combustion emission from diesel engine construction vehicles and machineries may affect	Low	• Exposed soil areas and on-site roads should be dampened with water; • Stockpile of construction materials will either be covered or dampened with water to minimise dust generation; • Vehicle wheel-wash facilities should be provided at the exit of the project site and wherever practical to reduce quantities of soil tracked out of the site and onto local roads; • Vehicles on-site speed restriction should be imposed to reduce dust generation;	Low

Issue	Impact	Impact	Mitigation	Residual Impact
	the ambient air quality.		• Vehicles transporting earth and construction materials are required to cover its load with secured load covers extending over the tail and side boards; • A good standard of housekeeping should be maintained which consist of regular cleaning, sweeping and washing of road to further reduce dust generation; • Implementation of manufacturer recommended maintenance programs for all construction vehicles and machineries; and • Installing and maintaining emission control devices, such as catalytic converters.	
Noise	• Noise generated from construction tools and machineries; • The increases of vehicle entering and exiting the Project site may as well increase the noise pollution surrounding the area. Road J52 will be utilised during construction phase of this Project and vehicles particularly heavy vehicles such as lorries and trucks are expected to increase in number and therefore will increase the noise level; and • Noise pollution may cause hazards to health especially to the workers. Hypertension, hearing loss and sleep disturbances are some of potential health hazards cause by noise pollution.	Low	• Only well-maintained equipment should be operated on-site and regular service/ maintenance shall be conducted for each equipment that produce high noise emissions; • Silencers/ mufflers on construction equipment which produces high noise emissions should be utilised and maintained regularly; • Hoarding shall be constructed prior to the commencement of construction works and any construction activities that has potential of emitting high noise level shall be limited to daylight hours only (7.00 am – 7.00 pm); • Reducing speed limits of heavy vehicles and ensure all heavy vehicles e.g., trucks are maintained properly; • Monitoring for noise level during construction shall be carried out regularly to control the noise emission which may affect the sensitive receptors; and • Protective equipment such as ear-muff shall be provided to workers handling/ operating the high noise equipment to prevent from hearing impairment.	Negligible
Soil & Groundwater	• Soil erosion and off-site siltation due to the exposure of soil surfaces to rain, wind and movement of construction vehicles during site clearing, earth moving and excavation activities; • Soil and groundwater contamination due to accidental spillage of fuel and oil; • Impacts associated to improper on-site waste	Low	• Exposed site areas should be kept to a minimum during the construction of the new facilities and completed areas should be hard surfaced/re-vegetated as soon as practicable; • Provision of effective construction site run-off controls such as controlled discharge and temporary drains; • Proper management of refuelling activities, waste storage and disposal; • Hard surfaced re-fuelling areas;	Low

Issue	Impact	Impact	Mitigation	Residual Impact
	disposal practices and management; and • Excavation and associated pipe-laying activities.		• Drip collection devices to be readily available for use anywhere in the site in case of a spillage incident; • In-place spill response and clean-up procedures; and • Temporary fuel storage tanks constructed with adequate secondary containment.	
Wastes	• Contamination to soil and groundwater due to leaks or spills on unpaved ground; • Contamination to surface water bodies due to leaks or spills into drains and waterways; and • Potential fire hazard.	Medium	• All wastes will be properly segregated by type to ensure that incompatible wastes are stored separately; • Recyclable waste will be recovered and recycle on-site. • Third-party waste management companies will be engaged for recovering and recycling waste that cannot be handled on-site; • Ensure that the waste storage facilities are capable of containing the predicted waste volume in a manner that is unlikely to cause damage to the environment nor cause any harm on the wellbeing on the personnel on-site; • Wastes that will be disposed off-site will be fully documented in which the details of the waste, types, quantity, recipient, location of disposal will be recorded prior leaving the site; and • Wastes that will be disposed off-site will only be handled and transferred by parties that are licensed to transport and/or treat or dispose the waste in accordance to Malaysia Regulations.	Low
Health & Safety	• Exposure to dust, chemicals, hazardous or flammable materials; • Slips, trips and falls; • Over exertion; • Working at heights; • Moving machinery; • Struck by objects; • Working in confined spaces; and • Hazard (including failure of building structure, injuries as a consequence of falls or contact with heavy equipment, and dust) posed to the public while accessing PEC facility.	Medium	• Ensuring compliance with the *Occupational Safety and Health Act 1994, Factories and Machinery Act 1967, Petroleum Safety Measures Act 1984* and Codes of Practice and guidelines as administered by the Department of Occupational Safety and Health (DOSH); • Carry out comprehensive risk-based job safety/hazard analysis for all tasks; • Ensuring site design takes into account health & safety considerations; • Ensure adequate fire detection and response measures are put in place; • Ensure provision of trained first aid staff on site at all times and appropriate siting of first aid stations and equipment; • Provision of suitable PPE to protect sight, hearing, skin and respiratory systems etc; • Provision of adequate lighting and ventilation in all areas; • Provision of adequate toilet and shower facilities and clean eating area;	Medium

Issue	Impact	Impact	Mitigation	Residual Impact
			• Ensure all staff and visitors are provided with adequate basic OHS training and orientation; • Inclusion of buffer strips or other methods of physical separation around the facility to protect the public from major hazards associated with incidents, failure, as well as nuisance issues related to noise, dust, or other emissions; • Application of locally regulated or internationally recognized building codes to ensure structures are designed and constructed in accordance with sound architectural and engineering practice, including aspects of fire prevention and response; and • Engineers and architects responsible for designing and constructing facilities, building, plants and other structures should certify the applicability and appropriateness of the structural criteria employed.	
Human Health Assessment	• Increase of sexually transmitted diseases (STDs) or other diseases that may be brought in by foreign workers. • Increase of dust emission due to construction activities.	Low	• Conduct health screening for all foreign workers; and • Provide adequate sanitation facilities for workers.	Low
Socio-Economics	• The Project is also expected to generate a number of spin-off businesses along the supply value chain	Positive	• Communicate with the community on a regular basis the construction schedule and heavy vehicle movement	Positive

1.7 Project Planning Schedule

1.7.1 Construction, Commissioning & Start-up

The PEC facility is currently in the financing stage. Construction will start in Q4 2022 and will stretch up to mid of 2026, with start-up in 2026.

1.7.2 Scheduling and Duration

The current schedule indicates 45 months period with the following breakdown:

- Engineering Procurement Construction (ISBL) - 40 months
- Engineering Procurement Construction (OSBL) - 36 months
- Commissioning and start-up - 5 months

OSBL shall be completed 4 months earlier than ISBL to accommodate feedstock and provide utilities for commissioning and start-up of ISBL.

1.8 Project Proponent

The Project Proponent, or project owner, is Pengerang Energy Complex Sdn. Bhd. (PEC). Details pertaining to the Project Proponent are as follows:

Contact Person	: **Chong Ying Haur**
Designation	: **Director, PEC**
Office Address	: 1 Raffles Quay #21-02, One Raffles Quay North Tower, Singapore 048583
Telephone	: (+65) 6536 7055
Email	: ying.haur.chong@chemoneholdings.com

1.9 EMP Preparer

Objectives EnviroSolutions & Consulting Sdn Bhd (ESC) has been appointed as the lead Environmental Consultancy to manage the ESMP for the PEC project and to prepare the *PEC ESMP Report*. Enquiries and correspondence pertaining to this report can be made to:

EnviroSolutions & Consulting Sdn Bhd (*Company No.: 737279-T*)
WeWork Mercu 2, Level 40,
No 3 Jalan Bangsar KL ECO CITY,
59200 Kuala Lumpur.

Contact Person	: **Andrew Young**
Designation	: **EMP Project Manager/ Group Director**
Facsimile	: N/A
Email	: andrew@envirosc.com

1.10 Objectives for the ESMP

To ensure that PEC's environmental objectives are achieved for the Project, an Environmental and Social Management Plan (ESMP) is to be developed to cover the potential environmental concern during the construction phase of the project and to describe how legislative requirements and DoE Approval Conditions will be implemented. Note that the ESMP is a live document, hence it shall be amended accordingly based on the requirements. This ESMP documents serves only as

the basis for managing environmental and social aspect of the project during the construction period based on the approved EIA and ESHIA perspective.

The ESMP is an environmental and social management framework to ensure compliance with the requirements of the Environmental Quality Act 1974, DoE Conditional of Approval (CoAs) as well as the IFC's and Equator Principle's general framework relating to prevention, abatement and mitigation of environmental and social impacts resulted from PEC construction activities.

The ESMP outlines key strategy and programmes to manage the environmental issues and the facility's compliance status related to its construction phase.

The key objectives of the ESMP are as follow:

- To ensure continuing compliance with legal requirements, environmental policy and social obligations;
- To serve as a basic document for environmental and social control and protection in order to minimise the impacts from the construction activities;
- To provide an integrated action plans for mitigation and abatement of the negative impacts identified in the EISHA;
- To describe the roles and responsibility of the facility team in managing the environmental and social aspects; and
- To establish the framework for environmental monitoring and compliance audit programme, grievance mechanism, as well as the environmental and social management performance review framework.

1.11 Scope of the ESMP

The ESMP scope is to outline key strategy and programmes to manage environmental impacts of PEC during the construction phase. With the environmental aspects and impacts discussed and described in detail in PEC ESHIA studies, the ESMP compiles the EIA CoAs, environmental mitigation measures and environmental monitoring and audit programmes.

1.12 Structure of the ESMP

The ESMP report is structured as follows:

1. Section 1 – Introduction
2. Section 2 – Regulatory Framework, Standards, and Guidelines
3. Section 3 – Organisational Structure
4. Section 4 – Environmental and Social Requirements
5. Section 5 – Capacity Development and Training
6. Implementation Schedule and Cost Estimate

2 REGULATORY FRAMEWORK, STANDARDS AND GUIDELINES

Policy and Regulatory Framework is defined as the existence of the necessary infrastructure which supports the control, direction or implementation of a proposed or adopted course of action, rule, principle and law. In Malaysia, ministries are the highest bodies in the federal administrative machinery. Each ministry is responsible for formulating, planning, controlling and coordinating government policies pertaining to its functions. The second highest agencies in Malaysia are government departments which responsible for implementing government policies.

2.1 National Regulatory Framework Review

For the purpose of the project the following legislations and requirements were reviewed:

- Environmental Quality Act 1974 (Act 127);
- Occupational Safety and Health Act 1994 (Act 514);
- Factories and Machinery Act 1967 (Act 139);
- Fire Services Act 1988 (Act 341) and Uniform Building By-Laws (UBBL) 1984 (revision 2012);
- International Finance Corporation's (IFC) Environmental and Social Sustainability Performance Standards;
- International Finance Corporation's (IFC) Environmental, Health and Safety Guidelines for General Guidelines;
- International Finance Corporation's (IFC) Environmental, Health and Safety Guidelines for Large Volume Petroleum-based Organic Chemicals Manufacturing;
- Equator Principles; and
- OECD Guidelines for Multinational Enterprises.

Applicable legislation, regulations, guidance and strategies enacted by the Malaysian governments regarding environmental, safety and health are described in *Table 2.1* below.

Table 2.1: Applicable Regulations and Requirements

	Act/ Regulation/ Policy	Brief Description
1.	Environmental Quality Act 1974 (Act 127)	An act relating to the prevention, abatement, control of pollution and enhancement of the environment. It controls all activities relating to the discharge of wastes into the environment and for preventing or controlling pollution and protecting and enhancing the quality of the environment. Applicable regulations in the EQA are: 1. EQ (Licensing) Regulations 1977; 2. EQ (Scheduled Wastes) Regulations 2005; 3. EQ (Sewage) Regulations 2009; 4. EQ (Industrial Effluent) Regulations 2009; and 5. EQ (Clean Air) Regulations 2014.
2.	Occupational Safety and Health	This act provides the legislative framework for the safety, health, and welfare among all Malaysian workforces. The

	Act/ Regulation/ Policy	Brief Description
	Act 1994 (Act 514)	principle is to prevent and protect the workers against hazards and its risks in connection with their activities at work. Applicable regulations in the OPSHA are: 1. OSH (Safety and Health Committee) Regulations 1996; 2. OSH (Safety and Health Officer) Regulations 1997; 3. OSH (Notification of Accident, Dangerous Occurrence, Occupational Poisoning and Occupational Disease) Regulations 2004; and 4. OSH (Classification, Labelling and Safety Data Sheet of Hazardous Chemicals) Regulations 2013.
3.	Factories and Machinery Act 1967 (Act 139)	Factories and Machinery Act is an act to provide for the control of factories with respect to matters relating to the safety, health and welfare of person therein, the registration and inspection of machinery and for matters connected therewith. Applicable related to FMA are: 1. FM (Steam Boiler and Unfired Pressure Vessel) Regulations 1970; 2. FM (Electric Passenger and Good Lifts) Regulations 1970; 3. FM (Fencing of Machinery and Safety) Regulations 1970; 4. FM (Person-in-Charge) Regulations 1970; 5. FM (Safety, Health and Welfare) Regulations 1970; 6. FM (Notification, Certificate of Fitness and Inspection) Regulations 1970; 7. FM (Building Operations and Works of Engineering Construction (Safety)) Regulations 1986; and 8. FM (Noise Exposure) Regulations 1989.
	Fire Services Act 1988 (Act 341) and Uniform Building By-Laws (UBBL) 1984 (revision 2012)	The Fire Services Department prescribes requirements for fire-fighting services through Part VII (Fire Requirements) and Part VIII (Fire Alarm, Fire Detection, Fire Extinguishment, and Fire Fighting Access) of the UBBL 1984 and Fire Services Act 1988. The act requires all premises to have a fire certificate from Fire and Rescue Department (BOMBA). The fire certificate is to be renewed annually. Application for the fire certificate shall be made in prescribed form and upon approval, the premise will be inspected by BOMBA. The Act regulates the following: - Administration;

	Act/ Regulation/ Policy	Brief Description
		- Abatement of fire-hazard; - Water and fire hydrants; - Fire certificate & fire services; - Enforcement; - Inquiries into fire; - Welfare fund; and - Miscellaneous, such as: special duty, failure to comply, offences, penalty and compounding of offences, repeal, etc.
4.	International Finance Corporation's Environmental and Social Sustainability Performance Standards	The IFC Performance Standards offer helpful guidance on the requirements including reference materials and on good sustainability practices to improve project performance.
5.	International Finance Corporation's Environmental, Health and Safety General Guidelines	This EHS general guideline is a technical document providing approach to managing issues associated with environment such as air, water, noise and land pollution as well as issues related to the health and safety of the workers. This guideline also provides the performance levels and measures in line with the good international industry practice.
	International Finance Corporation's Environmental, Health and Safety Guidelines for Large Volume Petroleum-based Organic Chemicals Manufacturing	The EHS Guidelines include information relevant to Large Volume petroleum-based Organic Chemicals (LVOC) projects and facilities. This document provides a summary of the most significant EHS issues associated with LVOC manufacturing facilities, which occur during the operational phase, along with recommendations for their management.
6.	Equator Principles	The Equator Principles (EP) comprise a group of ten principles voluntarily adopted by the Equator Principle Financial Institutions (EPFIs) in order to ensure that the projects funded by them are developed in a manner that is socially responsible and reflect sound environmental management practices.
7.	OECD Guidelines for Multinational Enterprises	The Guidelines are recommendations jointly addressed by governments to multinational enterprises. They provide principles and standards of good practice consistent with applicable laws and internationally recognised standards. Observance of the Guidelines by enterprises is voluntary and not legally enforceable. Nevertheless, some matter covered by the Guidelines may also be regulated by national law or international commitments such as bribery and extortion.

2.1.1 Malaysia Labour Law

In Malaysia, related employment law that regulates employers, workers and work environment are:

1. Workmen's Compensation Act 1952;
2. Employment Act 1955, Trade Unions Act 1959;
3. Children and Young Persons (Employment) Act 1966;
4. Industrial Relations Act 1967;
5. Factories and Machineries Act 1967;
6. Employees' Social Security Act 1969;
7. Employment (Termination and Lay-Off Benefits) Regulations 1980;
8. Employees' Provident Fund Act 1991;
9. Occupational Safety and Health Act 1994; and
10. Employment Insurance System Act 2018.

2.1.2 Environmental Quality Act

Environmental Quality Act 1974 (Act 127) is an act relating to the prevention, abatement, control of pollution and enhancement of the environment. The EQA outlined national environmental standards for element such as water quality, effluent discharge, air quality and noise level.

2.1.3 Air Quality Standard and Regulations

An air quality standard to be used is in accordance with the Environmental Quality (Clean Air) Regulations 2014 for operational stage and Malaysia Ambient Air Quality Standard.

2.1.3.1 Malaysia Ambient Air Quality Standard (MAAQS)

A new Ambient Air Quality was established in order to replace the older Malaysia Ambient Air Quality Guidelines that has been used since 1989. The new Ambient Air Quality Standard adopt six (6) air pollutants criteria that include five (5) existing air pollutants which are particulate matter with the size less than 10 micron (PM_{10}), sulphur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2) and ground level ozone (O_2) as well as an additional parameter which is particulate matter with the size less than 2.5 micron ($PM_{2.5}$). The air pollutants concentration limit will be strengthened in stages until 2020. There are three (3) interim targets set which include interim target 1 (T-1) in 2015, interim target 2 (T-2) in 2018 and the full implementation of the standard in 2020.

Table 2.2: Malaysian Ambient Air Quality Standard

Pollutants	Averaging Time	Ambient Air Quality Standard (µg/m³)		
		IT-1 (2015)	IT-2 (2018)	Standard (2020)
Particulate Matter with the size of less than 10 micron (PM_{10})	1 Year	50	45	40
	24 Hour	150	120	100
Particulate Matter with the size of less than 2.5 micron ($PM_{2.5}$)	1 Year	35	25	15
	24 Hour	75	50	35
Sulphur Dioxide (SO_2)	1 Year	350	300	250
	24 Hour	105	90	80
Nitrogen Dioxide (NO_2)	1 Year	320	300	280

Pollutants	Averaging Time	Ambient Air Quality Standard (µg/m³)		
		IT-1 (2015)	IT-2 (2018)	Standard (2020)
	24 Hour	75	75	70
Ground Level Ozone (O_3)	1 Year	200	200	180
	8 Hour	120	120	100
*Carbon Monoxide (CO)	1 Year	35	35	30
	8 Hour	10	10	10

*mg/m^3

2.1.3.2 Environmental Quality (Clean Air) Regulations 2014

The EQ (Clean Air) Regulations 2014 is applicable for:

a) Any premises used for any industrial or trade purposes, or on which matter is burnt in connection with any industrial or trade purposes, including burning of waste, whether or not the premises are prescribed under section 18 of the Act;

b) Any other premises or process that discharges or is capable of discharging air pollutants into the open air;

c) Any industrial plant; and

d) Any fuel burning equipment.

Limit values in these Regulations are divided into two (2) categories, Limit Values and Technical Standard (General) and Limit Values and Technical Standards (By Activity or Industry).

2.1.4 Noise

DoE published The Planning Guidelines for Environmental Noise Limits and Control which provide noise acceptance criteria for quantitative assessment of noise to define disturbance or otherwise. Based on the guideline, there are six (6) schedules to be referred to depending on the location and receiver. Each schedule prescribes different limits and the limits are:

Table 2.3: Schedule of Permissible Sound Levels

Schedule 1: Maximum Permissible Sound Level (L_{Aeq}) by Receiving Land Use for Planning and New Development		
Receiving Land Use Category	Day Time 7.00 am – 10.00 pm	Night Time 10.00 pm – 7.00 am
Noise Sensitive Areas, Low Density Residential, Institutional (School, Hospital), Worship Areas	50 dBA	40 dBA
Suburban Residential (Medium Density) Areas, Public Spaces, Parks, Recreational Areas	55 dBA	45 dBA
Urban Residential (High Density) Areas, Designated Mixed Development Areas (Residential – Commercial)	60 dBA	50 dBA
Commercial Business Zone	65 dBA	55 dBA
Designated Industrial Zone	70 dBA	60 dBA

Schedule 2: Maximum Permissible Sound Level (L_{Aeq}) of New Development (Roads, Rails, Industrial) in Areas of Existing High Environmental Noise Climate		
Receiving Land Use Category	**Day Time 7.00 am – 10.00 pm**	**Night Time 10.00 pm – 7.00 am**
Noise Sensitive Area, Low Density Residential	L_{90} + 10 dBA	L_{90} + 5 dBA
Suburban and Urban Residential Area	L_{90} + 10 dBA	L_{90} + 10 dBA
Commercial, Business	L_{90} + 10 dBA	L_{90} + 10 dBA
Industrial	L_{90} + 10 dBA	L_{90} + 10 dBA

L_{90} is the measured ninety percentile sound level for the respective time period of the existing areas of interest in the absence of the proposed new development.

Schedule 3: Maximum Permissible Sound Level (L_{Aeq}) to be Maintained at the Existing Noise Climate		
Existing Levels	**New Desirable Levels**	**Maximum Permissible Levels**
L_{Aeq}	L_{Aeq}	L_{Aeq} + 3 dBA

Schedule 4: Limiting Sound Level (L_{Aeq}) from Road Traffic (for Proposed New Roads and/ or Redevelopment of Existing Roads)		
Receiving Land Use Category	**Day Time 7.00 am – 10.00 pm**	**Night Time 10.00 pm – 7.00 am**
Noise Sensitive Areas, Low Density Residential	55 dBA	50 dBA
Suburban Residential (Medium Density)	60 dBA	55 dBA
Urban Residential (High Density)	65 dBA	60 dBA
Commercial, Business	70 dBA	60 dBA
Industrial	75 dBA	65 dBA

Schedule 5: Limiting Sound Level (L_{Aeq}) for Railways Including Transits (for New Development and Re-Alignments)			
Receiving Land Use Category	**Day Time 7.00 am – 10.00 pm**	**Night Time 10.00 pm – 7.00 am**	**L_{max} (Day & Night)**
Noise Sensitive Areas, Low Density Residential	60 dBA	50 dBA	74 dBA
Suburban Residential (Medium Density)	65 dBA	60 dBA	80 dBA
Commercial, Business	70 dBA	65 dBA	80 dBA
Industrial	75 dBA	65 dBA	NA

Schedule 6: Maximum Permissible Sound Levels (Percentile L_n and L_{max}) of Construction, Maintenance and Demolition Work by Receiving Land Use				
Receiving Land Use Category	**Noise Parameter**	**Day Time 7.00 am – 7.00 pm**	**Evening 7.00 pm – 10.00 pm**	**Night Time 10.00 pm – 7.00 pm**
Residential (Note 2**)	L_{90}	60 dBA	55 dBA	*(Note 1)
	L_{10}	75 dBA	70 dBA	*
	L_{max}	90 dBA	85 dBA	*

Schedule 6: Maximum Permissible Sound Levels (Percentile L_n and L_{max}) of Construction, Maintenance and Demolition Work by Receiving Land Use				
Receiving Land Use Category	**Noise Parameter**	**Day Time 7.00 am – 7.00 pm**	**Evening 7.00 pm – 10.00 pm**	**Night Time 10.00 pm – 7.00 pm**
Commercial (Note 2**)	L_{90}	65 dBA	60 dBA	NA
	L_{10}	75 dBA	70 dBA	NA
Industrial	L_{90}	70 dBA	NA	NA
	L_{10}	80 dBA	NA	NA

Notes:

**1. At these times the maximum permissible levels as stipulated in the Schedule 1 for the respective residential density type shall apply. This may mean that no noisy construction work can take place during these hours.*

***2. A reduction of these levels in the vicinity of certain institutions such as schools, hospital, mosque and noise sensitive premises (apartments, residential dwellings, hotel) may be exercised by the local authorities or Department of Environment.*
Where the affected premises are noise sensitive, the limits of the Schedule 1 shall apply.

3. In the event that the existing ambient sound level (L_{90}) without construction, maintenance and demolition works higher than the L_{90} limit of the above Schedule the higher measured ambient L_{90} sound level; shall prevail. In this case, the maximum permissible L_{90} sound level shall not exceed the Ambient L_{90} level + 10 dBA, or the above Schedule L_{10} whichever is the higher.

4. NA = Not Applicable

2.1.5 Soil and Groundwater

In Malaysia, there are a series of guidelines for soil and groundwater published by the DoE namely Contaminated Land Management and Control Guidelines. These guidelines are:

1. Malaysian Recommended Site Screening Levels for Contaminated Land;
2. Assessment and Reporting Contaminated Sites; and
3. Remediation of Contaminated Sites.

The guidelines are prepared according to the United States Environmental Protection Agency (USEPA) and the limits for Site Screening Levels (SSLs) were referred from the USEPA guidelines. The USEPA SSLs table provides the SSLs for four (4) different categories of scenarios that direct contact exposure pathways:

a) Residential soils;
b) Industrial soil;
c) Ambient air; and
d) Tap water.

Soil and groundwater concentration will be compared against the respective SSLs depending on the land use and exposure scenario at the subject land property.

2.1.6 Water Quality

In Malaysia, there are two (2) regulations related to water quality, Sewage and Industrial Effluent, which mostly referred to during operational phase and two (2) standards as guidelines for river and marine water quality.

2.1.6.1 Environmental Quality (Sewage) Regulations 2009

The regulations are applicable to any premises which discharge sewage onto or into any soil, or into any inland waters or Malaysian waters, other than any housing or commercial development or both having population equivalent of less than one hundred and fifty (<150). According to Second Schedule of the *Environmental Quality (Sewage) Regulations 2009,* there are three (3) different Acceptable Conditions of Sewage Discharge of Standard A and B which are:

1. Acceptable conditions for new sewage treatment system;
2. Acceptable conditions for existing sewage treatment system (approved before January 1999); and
3. Acceptable conditions for existing sewage treatment system (approved after January 1999).

2.1.6.2 Environmental Quality (Industrial Effluent) Regulations 2009

The *Environmental Quality (Industrial Effluent) Regulations 2009* is applicable to any premises which discharge or release industrial effluent or mixed effluent, onto or into any soil, or into inland waters or Malaysian waters, other than the premises as specified in the First Schedule.

The limit value for industrial effluent and mixed effluent discharge is listed under Fifth Schedule for Standards A and B. The limits are as shown in *Table 2.4* below.

Table 2.4: Acceptable Conditions for Discharge of Industrial Effluent or Mixed Effluent of Standards A and B

Parameters	Unit	Standard	
		A	B
Temperature	°C	40	40
pH Value	-	6.0 – 9.0	5.5 – 9.0
BOD_5 at 20°C	mg/L	20	50
Suspended Solids	mg/L	50	100
Mercury	mg/L	0.005	0.05
Cadmium	mg/L	0.01	0.02
Chromium, Hexavalent	mg/L	0.05	0.05
Chromium, Trivalent	mg/L	0.20	1.00
Arsenic	mg/L	0.05	0.10
Cyanide	mg/L	0.05	0.10
Lead	mg/L	0.10	0.50
Copper	mg/L	0.20	1.00
Manganese	mg/L	0.20	1.00
Nickel	mg/L	0.20	1.00
Tin	mg/L	0.20	1.00
Zinc	mg/L	2.00	2.00
Boron	mg/L	1.00	4.00
Iron (Fe)	mg/L	1.00	5.00
Silver	mg/L	0.10	1.00
Aluminium	mg/L	10.00	15.00
Selenium	mg/L	0.02	0.50
Barium	mg/L	1.00	2.00
Fluoride	mg/L	2.00	5.00

Parameters	Unit	Standard	
		A	B
Formaldehyde	mg/L	1.00	2.00
Phenol	mg/L	0.001	1.00
Free Chlorine	mg/L	1.00	2.00
Sulphide	mg/L	0.50	0.50
Oil and Grease	mg/L	1.00	10.00
Ammoniacal Nitrogen	mg/L	10.00	20.00
Colour	ADMI*	100.00	200.00

*ADMI – American Dye Manufacturer Institute

2.1.7 Waste Management

2.1.7.1 Environmental Quality (Scheduled Wastes) Regulations 2005

The Environmental Quality (Scheduled Wastes) Regulations 2005 replaced the Environmental Quality (Scheduled Wastes) Regulations 1989. Under these regulations, 77 types of scheduled wastes listed in the First Schedule are divided into five (5) categories namely:

1. SW 1 – Metal and metal-bearing wastes (10 types of scheduled wastes);
2. SW 2 – Wastes containing principally inorganic constituents which contain metals and organic materials (7 types of scheduled wastes);
3. SW 3 – Waste containing principally organic constituents which may contain metals and inorganic materials (27 types of scheduled wastes);
4. SW 4 – Waste which may contain either inorganic or organic constituents (32 types of scheduled wastes); and
5. SW 5 – Other wastes (1 type of scheduled waste).

There are 17 regulations under the Environmental Quality (Scheduled Wastes) Regulations 2005 which include:

1. Regulation 1: Citation and commencement
2. Regulation 2: Interpretation
3. Regulation 3: Notification of the generation of scheduled wastes
4. Regulation 4: Disposal of scheduled wastes
5. Regulation 5: Treatment of scheduled wastes
6. Regulation 6: recovery of material or product from scheduled wastes
7. Regulation 7: Application for special management of scheduled wastes
8. Regulation 8: Responsibility of waste generator
9. Regulation 9: Storage of scheduled wastes
10. Regulation 10: Labelling of scheduled wastes
11. Regulation 11: Waste generator shall keep an inventory of scheduled wastes
12. Regulation 12: Information to be provided by waste generator, contractor and occupier of prescribed premises
13. Regulation 13: Scheduled wastes transported outside waste generator's premises to be accompanied by information

14. Regulation 14: Spill or accidental discharge
15. Regulation 15: Conduct of training
16. Regulation 16: Compounding of offences
17. Regulation 17: Revocation

2.1.8 Land and Infrastructure

2.1.8.1 Land Development Act 1956

The Land Development Act 1956 is an act to provide for the establishment of a federal development authority and local development boards to promote and carry out projects for land development and settlement, for making funds available therefore, and for purposes connected therewith. The act comprises of seven (7) parts, which are:

1. Part I: Introductory
2. Part II: Federal Land Development Authority
3. Part III: Local Land Development Boards
4. Part IV: Corporation
5. Part V: Regulation and Incorporation of Boards and Corporation
6. Part VII: Movable and Immovable Property
7. Part VIII: General

2.1.8.2 Road Transport Act 1987

The *Road Transport Act 1987* is an act to make provision for:

- Motor vehicles and traffic in streets and other thing that have linkages with roads and vehicles;
- Protection of third parties against risks arising from the use of motor vehicles;
- Co-ordination and control of means of and facilities for transport;
- Co-ordination and control of means of and facilities for construction and adaptation of motor vehicles; and
- Connected purposes.

The act comprises of 7 parts namely:

1. Part I: Preliminary
2. Part II: Classification, Registration and Licensing of Motor Vehicles and Drivers
3. Part IIA: Periodic Inspection of Motor Vehicles
4. Part IIB: Foreign Motor Vehicles
5. Part III: Roads
6. Part IV: Provision Against Third Party Risks Arising Out of the Use of Motor Vehicles
7. Part V: Offences and Miscellaneous Provisions

2.1.9 Occupational Health and Safety

2.1.9.1 Occupational Safety and Health Act 1994

The Occupational Safety and Health Act 1994 or Act 514 provides the legislative framework for the safety, health and welfare among all Malaysian workforces. The principle is to prevent and protect the workers against hazards and its risk in connection with their activities at work. It requires all companies to establish and document:

1. Safety and health policy;
2. Duties of the employer, employees and the safety and health officers;
3. The safety and health committee of companies; and
4. Occupational safety and health inspection and officers.

The purposes of this Act are:

1. To secure the safety, health and welfare or persons at work against hazards and risks arising out of the activities of person at work;
2. To protect person at place of work, other than persons at work, against risks arising out of the activities of persons at work;
3. To promote an occupational environment for persons at work which is adapted to their physiological and psychological needs; and
4. To provide the means whereby the associated occupational safety and health legislation may be progressively replaced by a system of regulations and approved industry codes of practice operating in combination with the provision of this Act designed to maintain or improve the standards of safety and health.

There are 8 parts in total for this Act. The parts are:

1. Part I: Preliminary
2. Part II: Appointment of Officers
3. Part III: National Council for Occupational Safety and Health
4. Part IV: General Duties of Employers and Self-Employed Persons
5. Part V: Genera; Duties of Designers, Manufacturers and Suppliers
6. Part VI: General Duties of Employees
7. Part VII: Safety and Health Organizations
8. Part VIII: Notification of Accidents, Dangerous Occurrence, Occupational Poisoning and Occupational Disease and Injury
9. Part IX: Prohibition Against Use of Plant or Substance
10. Part X: Industry Codes of Practice
11. Part XI: Enforcement and Investigation
12. Part XII: Liability for Offences
13. Part XIII: Appeals
14. Part XIV: Regulations
15. Part XV: Miscellaneous

2.1.10 Other National Regulatory Requirements

2.1.10.1 National Policy on Environment

The Policy aims at continued economic, social and cultural progress of Malaysia and enhancement of the quality of life of its people, through environmentally sound and sustainable development. The Policy aims at achieving:

- A clean, safe, healthy and productive environment for present and future generations;
- The conservation of the country's unique and diverse cultural and natural heritage with effective participation by all sectors of society; and
- A sustainable lifestyle and pattern of consumption and production.

Malaysia's national environmental policy emphasises on:

- Exercising respect and care for the environment in accordance with the highest moral and ethical standards;
- Conserving the natural ecosystems to ensure the integrity of biodiversity and life support systems;
- Ensuring continuous improvement in the productivity and quality of the environment while pursuing economic growth and human development objectives;
- Managing natural resources utilisation to sustain the resources base and prevent degradation of the environment;
- Integrating environmental dimensions in the planning and implementation of the policies, objectives and mandates of all sectors to protect environment;
- Strengthening the role of the private sector in the environmental protection and management;
- Ensuring the highest commitment to environmental protection and accountability by all decision-makers in the public and private sectors., resource users, non-governmental organisations and the general public in formulating, planning and implementing their activities; and
- Participating actively and effectively in regional and global efforts towards environmental conservation and enhancement.

2.1.10.2 EIA Conditions of Approval

Under the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order, 2015 (EIA Order 2015), the construction of a petrochemical complex of this scale is a 'Prescribed Activity' and subject to a mandatory Environmental Impact Assessment (EIA) study. Prior to project implementation the EIA Report must be submitted to the Department of Environment (DoE) for environmental planning approval.

As the PEC is a Prescribed Activity under the Second Schedule, i.e., an activity with greater scope to lead to significant impacts to the environment, its EIA is subject to a more detailed approval process, including review at DoE Headquarters, mandatory public display and opportunity for public comment.

An EIA have been submitted to DoE in April 2019. Following the EIA submission, an EIA Technical Review Committee (EIATRC) meeting was held on 10th July 2019 at DoE Putrajaya and submitted the revised EIA report in October 2019. The EIA report is approved by the DoE with conditions as shown in *Table 2.5*.

Table 2.5: EIA Conditions of Approval

No.	CoA
A.	**Compliance**
1.	The conditions of approval are based on the Environmental Impact Assessment titled "PROPOSED PENGERANG ENERGY COMPLEX SDN. BHD., PENGERANG INDUSTRIAL PARK, SUB-DISTRICT OF PENGERANG, DISTRICT OF KOTA TINGGI, JOHOR DARUL TAKZIM" via letter from the EIA consultant with reference J18-780_DOE-Ltr32 dated 3 October 2019.
2.	All statements and pledges stated in the EIA report should be complied and carried out by the Project Proponent.
3.	The development of this project should be conducted in compliance with **the Environmental Act 1974 and its regulations.**
B.	**Prescribed Activity Information**
4.	The title of this project is PROPOSED PENGERANG ENERGY COMPLEX SDN. BHD., PENGERANG INDUSTRIAL PARK, SUB-DISTRICT OF PENGERANG, DISTRICT OF KOTA TINGGI, JOHOR DARUL TAKZIM and is subjected to the following Environmental Quality Order (Prescribed Activities) (Environmental Impact Assessment) 2015: **Second Schedule** Activity 6: Industry (d) Petrochemical: Production capacity of each product or combined product of 50 tonnes or more per day.
C.	**Project Concept and Design**
5.	The EIA report approval is limited to the construction of Pengerang Energy Complex for the processing plant, condensate splitter (north east, C1 and C2) and aromatic plant (R1 and A-A3).
6.	Location and coordinates of the project is as shown in Figure 1.1 and Figure 1.2, page 1-2 and 1-3 respectively. Location of the Pengerang Industrial Park (PIP) is as shown in Figure 4.2, page 4-3.
7.	Components and layout plan of this proposed project should be as stated and shown in item 5.3 Site Layout & Elements and Figure 5.1, page 5-2 to 5-6.
8.	Any changes of components, layout plan as stated in the EIA report should be submitted for approval of Director General Department of Environment prior to implementation.
D.	**Written Notification**
9.	Written Notification i. Any installation of fuel burning equipment, power generation and air pollution control equipment should be notified to the related Department of Environment Johor as required under Environmental Quality (Clean Air) Regulations 2014. ii. Any construction of industrial effluent system for the purpose of disposal and releasing the Industrial Effluent should be informed via written notification to the Department of Environment Johor as stated in the Environmental Quality (Industrial Effluent) Regulations 2009. iii. Any construction of sewage treatment system for the purpose of disposal and releasing the sewage should be informed via written notification to the related Department of Environment Johor as stated in the Environmental Quality (Sewage) Regulations 2009.
E.	**Land Disturbing-Pollution Prevention and Mitigation Measures (LD-P2M2)**
10.	Surface run-off control, erosion control and sedimentation control should be implemented effectively and maintain as outlined in the Environmental Management Plan (EMP) and comply with the Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2) document.
11.	Schedule for earthwork activities should be adjusted and implemented according to phases to reduce erosion and sedimentation problem. Development of each project phases should be notified to the Department of Environment Johor **three (3) months** prior to the implementation of each phase.
12.	Inspection and maintenance of all Best Management Practices (BMPs) components should be implemented on daily basis and maintained necessarily. Inspection and maintenance should be recorded.
13.	If the rainfall reading is at 12.5 mm or more at a certain time, reporting via ESC Online should be

<table>
<tr><th>No.</th><th>CoA</th></tr>
<tr><td></td><td>prepared within 24 hours.</td></tr>
<tr><td>14.</td><td>Access road and construction road should be constructed as per the road alignment and specification in the LDP2M2 drawing.</td></tr>
<tr><td>15.</td><td>Machinery and vehicle tyres exiting the project site should be cleaned before entering public road.</td></tr>
<tr><td>16.</td><td>BMPs for erosion and sediment control should be prepared at each area that have potential to cause erosion and sediment problem including area with space, workspace and mitigation space constraints.</td></tr>
<tr><td>17.</td><td>Location and method for disposal of any wastes for example over burden soil and slurry from the construction activities should obtain approval from Local Authority and detailed out in the EMP. The wastes should be placed a minimum of 20 metres from any inland water reserve.</td></tr>
<tr><td>18.</td><td>Any activity related to river or tributaries diversion including working in the river/ tributary is prohibited except for obtaining approval from related agency.</td></tr>
<tr><td>19.</td><td>All exposed and undeveloped area should be covered with effective BMPs for erosion and sedimentation control.</td></tr>
<tr><td colspan="2">F. Water Quality Control and Monitoring</td></tr>
<tr><td>20.</td><td>Water quality monitoring programme should be conducted as follows:
<table>
<tr><th>No.</th><th>Control and Monitoring</th><th>Sampling Frequency</th><th>Standard</th><th>Monitoring Phase</th></tr>
<tr><td>1.</td><td>Control of surface run-off discharge</td><td>Once every three (3) months</td><td>i. Total Suspended Solids (TSS) less than 50 mg/L: or
ii. Turbidity less than 250 Nephelometric Turbidity Unit (NTU)</td><td>Starting from land disturbing until project completion</td></tr>
<tr><td>2.</td><td>Control of Effluent Discharge</td><td>Once every three (3) months</td><td>Standard A of Environmental Quality (Industrial Effluent) Regulations 2009</td><td>During operational phase</td></tr>
<tr><td>3.</td><td>River water quality monitoring</td><td>Once every three (3) months</td><td>National Water Quality Standards (NWQS) for Malaysia</td><td>Starting from land disturbing/ operational phase/ until project completion/ end of operation</td></tr>
<tr><td>5.</td><td>Groundwater Monitoring</td><td>Once every three (3) months</td><td>Groundwater Quality Standards for Conventional Raw Water Treatment (Drinking Water)</td><td>During operational phase</td></tr>
<tr><td>5.</td><td>Marine Water Quality Monitoring</td><td>Once every three (3) months</td><td>National Marine Water Quality Standards (NMWQS) for Malaysia</td><td>During operational phase</td></tr>
</table></td></tr>
<tr><td>21.</td><td>Monitoring location, parameters and sampling frequency of groundwater and marine water monitoring should be included in the monitoring programme and specified in the EMP including other monitoring programme prior to implementation of any activities at site and submitted to the Department of Environment Johor for approval.</td></tr>
<tr><td>22.</td><td>Any changes in the monitoring location, parameter and frequency should obtain approval from the Department of Environment Johor.</td></tr>
<tr><td colspan="2">G. Air Quality Control and Monitoring</td></tr>
<tr><td>23.</td><td>Any emissions and sampling of gas and impurities from the chimney to the air should be adhered to the emission limits as stated in Third Schedule of the Environmental Quality (Clean</td></tr>
</table>

<table>
<tr><th>No.</th><th>CoA</th></tr>
<tr><td></td><td>Air) regulations 2014.</td></tr>
<tr><td>24.</td><td>Any hazardous substance emission should be prevented and released using the best available practice and the emission limit should follow the technical standard as stated in Fifth Schedule, Environmental Quality (Clean Air) 2014.</td></tr>
<tr><td>25.</td><td>Continuous Emission Monitoring Systems (CEMS) equipment should be installed from the start of operational phase following the guidelines of Volume I: Guidelines for the Installation & Maintenance of Continuous Emission Monitoring Systems (CEMS) for Industrial Premises/ Facilities Version 7.0 of June 2019 and Volume II: Guideline for the Continuous Emission Monitoring Systems – Data Interface System (CEMS-DIS) for Industrial Premises/ facilities Version 7.0 published by the Department of Environment.</td></tr>
<tr><td>26.</td><td>Location of the Continuous Emission Monitoring Systems (CEMS) should obtain approval from the Department of Environment Johor prior to installation.</td></tr>
<tr><td>27.</td><td>Display of the Continuous Emission Monitoring Systems (CEMS) data should always be connected via online to the Department of Environment Johor.</td></tr>
<tr><td>28.</td><td>Air quality monitoring programme should be conducted as follows:
<table>
<tr><th>No.</th><th>Control and Monitoring</th><th>Ambient air emission limit</th><th>Frequency</th><th>Standard</th></tr>
<tr><td>1.</td><td>PM_{10}</td><td>Refer to the application limit for year 2020
40 µg/m^3 (1-year averaging time)
100 µg/m^3 (24 hours averaging time)</td><td>Monthly</td><td>Malaysian Ambient Air Quality Guidelines
Malaysian Ambient Air Quality Standard
(At 25°C and 101.13 kPa)</td></tr>
<tr><td>2.</td><td>$PM_{2.5}$</td><td>15 µg/m^3 (1-year averaging time)
35 µg/m^3 (24 hours averaging time)</td><td>Monthly</td><td>Malaysian Ambient Air Quality Standard</td></tr>
<tr><td>3.</td><td>Sulphur Dioxide (SO_2)</td><td>250 µg/m^3 (1 hour averaging time
80 µg/m^3 (24 hours averaging time)</td><td>Monthly</td><td>Malaysian Ambient Air Quality Standard</td></tr>
<tr><td>4.</td><td>Nitrogen Dioxide (NO_2)</td><td>280 µg/m^3 (1 hour averaging time)
70 µg/m^3 (24 hours averaging time)</td><td>Monthly</td><td>Malaysian Ambient Air Quality Standard</td></tr>
<tr><td>5.</td><td>Ground-Level Ozone (O_3)</td><td>180 µg/m^3 (1 hour averaging time)
100 µg/m^3 (24 hours averaging time)</td><td>Monthly</td><td>Malaysian Ambient Air Quality Standard</td></tr>
<tr><td>6.</td><td>Carbon Dioxide (CO)</td><td>30 µg/m^3 (1 hour averaging time)
10 µg/m^3 (8 hours averaging time)</td><td>Monthly</td><td>Malaysian Ambient Air Quality Standard</td></tr>
</table></td></tr>
<tr><td>29.</td><td>Monitoring location, parameters and sampling frequency of air quality monitoring should be included in the monitoring programme and specified in the EMP including other monitoring programme prior to implementation of any activities at site and submitted to the Department of Environment Johor for approval.</td></tr>
<tr><td>30.</td><td>Maintenance and operation control including air pollution control system should be conducted or operated by certified operator and responsible to ensure compliance of all regulations and standards.</td></tr>
<tr><td>31.</td><td>Performance monitoring should be practiced. Logbook which includes performance monitoring information should follow a format as in document titled “Technical Guidance on Performance</td></tr>
</table>

No.	CoA
	Monitoring of Air Pollution Control Systems" published by the Department of Environment.
32.	All dust and air pollution sources should be equipped with effective pollution control system.
H.	**Noise and Vibration Control and Monitoring**
33.	Noise should be controlled so that it does not exceed the limit as stated in "The Planning Guidelines for Environmental Noise Limits and Control" published by the Department of Environment.
34.	Noise monitoring programme including monitoring location, parameter and sampling frequency should be specified in the EMP and submitted to the Department of Environment, Johor for approval before it is being implemented.
35.	Vibration to the receiving buildings and sensitive receiver, **during construction and operational phase**, should be controlled so that it does not exceed the limit as stated in **Schedule 5 and Schedule 6 of "The Planning Guidelines for Vibration Limits and Control in the Environment"** published by the Department of Environment.
I.	**Waste Management**
	Scheduled Waste
36.	Scheduled Waste as stated in the **First Schedule of the Environmental Quality (Scheduled Waste) Regulations 2005** should be properly managed according to the methods stated in the regulation. Recovery or disposal of scheduled waste can only be done at the Department of Environment licensed premises.
J.	**Domestic Waste**
37.	A suitable and effective management system for domestic waste including biomass and construction waste should be prepared and specified in the EMP.
38.	Disposal of domestic waste including biomass and construction waste into any inland waters is prohibited.
K.	**Overburden/ Un-suitable Material (USM) Management**
39.	A suitable and effective management system for Overburden/ Un-suitable Material (USM) resulting from project activity should be prepared and specified in the EMP.
40.	Disposal of Overburden/ Un-suitable Material (USM) into any inland waters is prohibited. Disposal of Overburden/ Un-suitable Material (USM) as fill material outside of project site should obtain approval from the Approving Local Authority and ensure the control plan or Best Management Practices is implemented.
L.	**Chemicals and Petroleum**
41.	Bund should be constructed around the chemicals and petroleum storage tank. Constructed bund should be able to cater for at least 110% volume of the biggest tank in the bunded area. The tank base should be made of concrete or impervious materials and re-pumping facilities for spill materials should be provided. Chemicals and petroleum storage tank should not be placed in the inland water reserve or Malaysian water set back area.
42.	All transfer points for chemicals, petroleum and scheduled waste should be constructed from concrete and facility to channel and collect spill materials such as collection sump should be provided. Any spillage of chemicals, petroleum and scheduled waste on soil should be managed according to the Contaminated Land Management and Control Guidelines published by DoE.
M.	**Transportation and Storage**
43.	Effective mitigation measures should be conducted during transportation of scheduled waste and chemicals to prevent from spillage that will cause environmental pollution.
44.	E-consignment conditions which are on-line link up system between scheduled waste generator, scheduled waste transport contractor, recoverer and Integrated Facilities, Licensed Premise for Treatment and Disposal of Scheduled Waste (for residue) should be implemented in scheduled waste management.
45.	Storage area for scheduled waste raw material, chemicals, recovered product should comply with the Environmental Quality (Scheduled Wastes) Regulations 2005.
N.	**Control and Prevention**
46.	Standby generator should be installed to supply electrical power to the main equipment such as

No.	CoA
	premise control system and pollution control system.
47.	All pollution control equipment (air, water and noise) should always be maintained properly, spare parts should be made available at any times when it is required, and performance monitoring should be conducted in accordance with the set guidelines.
48.	Any activity at the project site including during the operational phase of the premise should be discontinued **IMMEDIATELY** when there is any occurrence of pollution control equipment failure. Any pollution control system failure should be notified to the Department of Environment, Johor within 24 hours. Resuming of activity at site/ premise will only be permitted after the pollution control equipment has been fully repaired.
49.	Operation and maintenance of the pollution control system (air, industrial effluent, leachate, sewage and scheduled waste) should be conducted and operated by competent person under Section 49A and he/ she is responsible to ensure compliance of regulations and guidelines. Information of the competent person should be submitted to the Department of Environment Johor.
50.	Pollution control system should be installed according to the Best Available Technique (BAT).
51.	**Open burning** of biomass waste, construction waste or any flammable materials is **strictly prohibited** as stated in **Section 29A, Environmental Quality Act 1974.**
52.	Notification board to display the status of water quality, air quality, noise and vibration should be placed at the entrance door of the project site/ premise starting from earthwork, construction, operational and throughout the project lifespan.
53.	A copy of approved Emergency Response Plan (ERP) by Approving Local Authority for the entire premise facilities in case of any accident, emergency or unexpected situation occurs should be submitted to the Department of Environment Johor.
O. Environmental Management Plan	
54.	**Environmental Management Plan (EMP)** should be prepared following the format outlined in Chapter 6 – Post Submission Stage of EIA Report, Environmental Impact Assessment Guidelines in Malaysia (EGIM) published by the Department of Environment. Document related to Pollution Prevention and Mitigation Measures (P2M2) should be included in the EMP and prepared according to Appendix 4 in the same guideline.
55.	A complete EMP should be submitted to the Department of Environment Johor for approval prior to the commencement of the project development. Mitigation and control measures that have been outlined in the EMP should be fully implemented and complied.
56.	EMP should be updated from time to time if there is any changes or amendment on the mitigation and control measures and/ or if there is any recent directive from the Department of Environment Johor.
57.	Project Proponent should inform the Department of Environment Johor, in writing, if the development is entering transition phase/ turn around/ stopped/ delayed or terminated for certain reasons. Therefore, EMP needs be updated with the following: i. Date and schedule of the transition work phase/ scheduled maintenance/ stop/ delay or termination of the project; ii. Works in terms of soil stabilization, contaminated soil recovery, dismantling the equipment, site clearing, environmental management or any suitable restoration measures; and iii. Commitment from Project Proponent or responsible party for the restoration of project site in terms of public safety and environment.
58.	EMP should specify permanent or temporary activities related to project that is located outside or next to the project site which can potentially cause impact to the surrounding.
59.	For compliance of EIA conditions, all environmental mainstreaming tools aspect as outlined in the EIA Guideline in Malaysia (EGIM) and Environmental Mainstreaming Directive (as in Attachment A) should be implemented.
P. Environmental Audit	
60.	Third-party environmental audit under Section 33A, Environmental Quality Act 1974 should be

No.	CoA
	conducted for this project according to the Environmental Audit Guidance Manual published by the Department of Environment.
61.	Appointed auditor should be registered with the Department of Environment and all environmental audit costs are under the responsibility of project proponent. Frequency of audit is as follows: i. **Once every four (4) months** during earthworks and construction phase or as per the directive from the Department of Environment Johor, starting from commencement date until completion of construction activities. (Auditor must have a Certified Erosion Sediment and Stormwater Inspector (CESSWI) or Certified Inspector on Sediment and Erosion Control certificate (CISEC) or any certificate recognized by Director General, Department of Environment; and ii. During operational phase, once (1) a year throughout the entire operational phase (if necessary) or as directed by the Department of Environment Johor.
Q. Reporting	

<table>
<tr><th>No.</th><th>CoA</th></tr>
<tr><td>62.</td><td>The following reports should be submitted to the Department of Environment Johor which includes:
<table>
<tr><th>No.</th><th>Types of report</th><th>Frequency</th><th>Phase</th><th>Remarks</th></tr>
<tr><td>1.</td><td>Project Status Information Form (EIA 1-18 Form)</td><td>Once every 3 months</td><td>Starting from the land disturbing/ operation/ until project completion/ end of operation</td><td></td></tr>
<tr><td>2.</td><td>Compliance of EIA Approval Conditions Form
(EIA 2-08 Form)</td><td>Once every 3 months</td><td>Starting from the land disturbing/ operation/ until project completion/ end of operation</td><td></td></tr>
<tr><td>3.</td><td>Final Discharge of Sedimentation Pond</td><td>Once every 3 months</td><td>Starting from the land disturbing/ operation/ until before operation</td><td></td></tr>
<tr><td>4.</td><td>Water Quality Monitoring
• Industrial Effluent
• Sewage
• River Water
• Groundwater</td><td>Once every 3 months</td><td>Starting from the land disturbing/ operation/ until project completion/ end of operation</td><td></td></tr>
<tr><td>5.</td><td>Air Emission Monitoring</td><td>Refer CAR 2014</td><td>Operational</td><td></td></tr>
<tr><td>6.</td><td>Ambient Air Monitoring</td><td>Once every 3 months</td><td>Starting from the land disturbing/ operation/ until project completion/ end of operation</td><td></td></tr>
<tr><td>7.</td><td>Noise and Vibration Monitoring</td><td>Once every 3 months</td><td>Starting from the land disturbing/ operation/ until project completion/ end of operation</td><td></td></tr>
<tr><td>8.</td><td>Aerial View</td><td>Monthly</td><td>Starting from the land disturbing/ operation/ until project completion/ end of operation</td><td></td></tr>
<tr><td>9.</td><td>Reporting on the Effectiveness of Erosion and Sedimentation Control using ESC Online System</td><td>When rain gauge reading exceeds 12.5 mm/ event</td><td>Starting from the land disturbing/ operation/ until before operation</td><td></td></tr>
</table>
[Note: Analysis of the environmental monitoring parameters should be conducted by an accredited lab from the Laboratory Accreditation Scheme Malaysia by Department of Standard Malaysia]</td></tr>
<tr><td colspan="2">R. Administration</td></tr>
<tr><td>63.</td><td>A copy of the EIA approval letter and EIA approval conditions should be displayed at the project site management office.</td></tr>
<tr><td>64.</td><td>A copy of the EIA approval letter and EIA approval conditions, EMP document, LDP2M2 document and each of the documents related to the EIA conditions of approval should be kept in the project site management office for reference.</td></tr>
<tr><td>65.</td><td>The EIA approval letter and the EIA conditions of approval and each of the documents related to the EIA conditions of approval should be part of the contract document between project proponent and contractor that will conduct activities at the project site.</td></tr>
</table>

No.	CoA
66.	Competent **Environmental Officer (EO)** and will be fully responsible for the matters related to environmental management and implementation of all mitigation measures should be appointed. The officer's **name, position and contact information** should be submitted to the Department of Environment, Johor prior to commencement of any land disturbing. The duties of the officer are: i. Supervising the erosion and sedimentation control works at site as outlined in the LDP2M2 document and Environmental Management Plan (EMP); ii. Updating Daily Site Logbook; iii. Conducting daily inspection of the pollution control measures and Best Management Practices (BMPs) structure, erosion and sedimentation control including perimeter drain, check dam, silt trap, wash trough, slope protection and etc.; iv. Organizing a site meeting every two (2) weeks with the project proponent and contractor; v. Conducting in-situ monitoring for turbidity parameter at the discharge point of the sediment control tools such as silt trap within less than 30 minutes after rainfall. If the rainfalls continue more than 24 hours, monitoring should be conducted once every day. (Failure to comply with this requirement should be recorded with valid and reasonable reasons); vi. All good housekeeping practices based on the 5S concept (sort, clean, set in order, standardize and sustain) should be implemented starting from the commencement of land disturbing activity and throughout the project lifespan; and vii. Implementing duties as detailed out in the EIA Guideline in Malaysia (EGIM) published by the Department of Environment. [Note: EO for erosion and sedimentation control must have a Certified Erosion Sediment and Stormwater Inspector (CESSWI) or Certified Inspector on Sediment and Erosion Control certificate (CISEC) or any certificate recognized by Director General, Department of Environment]
67.	Project proponent should inform in writing to the Department of Environment, Headquarters (EIA report processed in Headquarters) and the Department of Environment, Johor if there is **any transfers of ownership or management of the project** within **30 days** from the date of ownership or management transfer. Any transfers or distribution of ownership or management should include compliance of the EIA approval conditions to the new owner in the sales-purchase/ ownership transfer transaction.
68.	If the project is not implemented within two (2) years from the date of approval, the EIA approval will be voided automatically. An appeal for an extension of EIA report approval can be submitted for the Department's consideration.
69.	Project proponent should comply with additional directive and conditions imposed from time to time.

The EIA approval, Conditions of Approval and English translation of both EIA Approval and CoA are as attached in **Appendix A.**

2.1.11 Guidelines

In Malaysia, guidelines are published to specify further requirement and details based on the regulations. These guidelines are published by relevant authorities such as Department of Environment (DoE) and Department of Occupational Safety and Health (DOSH). The list of guidelines and publisher are as shown in *Table 2.6* below.

Table 2.6: List of Guidelines in Malaysia

Guidelines/ Code of Practice	Publisher	Year of Published
COVID-19: Management Guidelines for Workplaces	MoH	2020
EIA Guidelines for Petrochemical Industries	DoE	2018

Guidelines/ Code of Practice	Publisher	Year of Published
EIA Guidelines for Development in Coastal Areas and Marine Parks	DoE	2017
EIA Guidelines for Development in National and State Parks	DoE	2017
EIA Guidelines for Development in Slopes and Hill Areas	DoE	2017
Environmental Impact Assessment (EIA) Guideline in Malaysia	DoE	2016
Guidelines on the Use of Oil Spill Dispersant in Malaysia – 2nd Revision	DoE	2016
Guidelines on the Disposal of Chemical Wastes from Laboratories – 2nd Edition	DoE	2015
Guidelines on Environmentally Sound Co-Processing of Scheduled Wastes in Cement Industry – 1st Edition	DoE	2015
Guidance Document for Fuel Burning Equipment and Air Pollution Control System	DoE	2014
Guidance Document on Fugitive Emission Control	DoE	2014
Guidance Document on Leak Detection and Repair	DoE	2014
Guidelines for Packaging, Labelling and Storage of Scheduled Wastes in Malaysia	DoE	2014
Guidance for the Industry on the Notification and Registration Scheme of Environmentally Hazardous Substances (EHS) in Malaysia – 2nd Edition	DoE	2012
Guidance Document on Health Impact Assessment in EIA	DoE	2012
Guidelines for Siting and Zoning of Industry and Residential Areas – 2nd Revision	DoE	2012
Guidelines for the Classification of Used Electrical and Electronic Equipment in Malaysia – 2nd Edition	DoE	2010
A Guide for Investors – 11th Edition	DoE	2010
Contaminated Land Management and Control Guidelines No. 1: Malaysian Recommended Site Screening Levels for Contaminated Land	DoE	2009
Contaminated Land Management and Control Guidelines No. 2: Assessing and Reporting Contaminated Sites	DoE	2009
Contaminated Land Management and Control Guidelines No. 3: Remediation of Contaminated Sites	DoE	2009
The Planning Guidelines for Environmental Noise Limits and Control – 2nd Edition	DoE	2007
EIA Guidelines for Risk Assessment	DoE	2004
Storage, Handling and Transportation of Liquefied Petroleum Gases LPG) – Code of Practice – 3rd Revision	DoSM	2013
Guidelines for Asbestos Removal	DOSH	2017
Guidelines for Approval of Hoisting Machine Design	DOSH	2017
Guidelines on Heat Stress Management at	DOSH	2016

Guidelines/ Code of Practice	Publisher	Year of Published
Workplace		
Industry Code of Practice on Chemicals Classification and Hazard Communication	DOSH	2014
Industry Code of Practice on Indoor Air Quality	DOSH	2010
Industry Code of Practice for Safe Working in a Confined Space	DOSH	2010
Guidelines for the Prevention of Falls at Workplace	DOSH	2007
Guidelines on the Use of PPE Against Chemical Hazards	DOSH	2005
Guidelines on Storage of Hazardous Chemicals: A guide for Safe Warehousing of Packaged Hazardous Chemicals	DOSH	2005
Guidelines on First-Aid in the Workplace – 2nd Edition	DOSH	2004
Guidelines on Safety and Health (Notification of Accident, Dangerous Occurrence, Occupational Poisoning and Occupational Disease) Regulations (NADOPOD)	DOSH	2004
Guidelines on Occupational Vibration	DOSH	2003
Guidelines on Occupational Safety and Health for Working with Video Display Units (VDU's) – 1st Edition	DOSH	2003
Guidelines on Occupational Safety and Health for Seating at Work	DOSH	2002
Guidelines on Occupational Safety and Health for Standing at Work	DOSH	2002
Guidelines on the Control of Chemicals Hazardous to Health	DOSH	2001
Guidelines for the Preparation of a Chemical Register	DOSH	2000
Assessment of the Health Risks Arising from the Use of Hazardous Chemicals in the Workplace (A Manual of Recommended Practice 2nd Edition)	DOSH	2000
Guidelines on Occupational Safety and Health in the Office	DOSH	1996

*DoE – Department of Environment

DOSH – Department of Safety and Health

DoSM – Department of Standard Malaysia

MoH – Ministry of Health

2.1.12 Applicable International Convention, Requirements, Guidelines and Other Evaluation Criteria

2.1.12.1 International Finance Corporation's Environmental and Social Sustainability Performance Standards

The IFC Performance Standards offer helpful guidance on the requirements including reference materials and on good sustainability practices to improve project performance. There are eight (8) Performance Standards (PS):

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

2. PS 2: Labour and Working Conditions
3. PS 3: Resource Efficiency and Pollution Prevention
4. PS 4: Community, Health and Safety
5. PS 5: Land Acquisition and Involuntary Resettlement
6. PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
7. PS 7: Indigenous People
8. PS 8: Cultural Heritage

Performance Standards (PS)	Brief Description and Application	PEC Compliance Measures
PS 1: Assessment and Management of Environmental and Social Risks and Impacts	PS 1 underscores the importance of managing the environmental and social performance throughout the life of project. It applies to business activities with environmental and/ or social risks and/ or impacts. The Environmental Social Management Plan (ESMP) is a continuation of the previously conducted impact assessment or Environmental Social and Health Impact Assessment (ESHIA) in which the ESMP should focus on: (i)the measures and actions necessary for the Proponent to address the issues raised in the ESHIA; (ii) to comply with the applicable national standards and regulations; and (iii) to meet the requirements of the applicable Performance Standards.	PEC, through ESC has conducted and produced an ESMP adhering to the IFC's PSs. The ESMP is prepared to comply with the national standards, rules and regulations as well as the requirements of IFC performance standards and EHS guidelines
PS 2: Labour and Working Conditions	PS 2 recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental right of workers e.g., child labour and occupational safety and health. The requirements set out in PS 2 have been in part guided by a number of international convention and instruments, including those of the International Labour Organisation (ILO) and the United Nations (UN). The implementation of the actions necessary to meet the requirements is managed through the proponent's Environmental and Social Management System (ESMS). The ESMS will incorporate the following elements: (i) policy; (ii) identification of risks and impacts; (iii) management	Labour and working conditions have been addressed by PEC's Labour Welfare Procedure as attached in this ESMP report. Furthermore, proponent shall comply with any regulations pertaining to the labour e.g., Employment Act 1955 and Children and Young Persons (Employment) Act 1966.

Performance Standards (PS)	Brief Description and Application	PEC Compliance Measures
	programs; (iv) organisation capacity and competency; (v) emergency preparedness and response; (vi) stakeholder engagement; and (vii) monitoring and review.	
PS 3: Resource Efficiency and Pollution Prevention	PS 3 recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water and land and consume finite resources in a manner that may threaten people and the environment at the local, regional and global levels. During the project life-cycle, proponent will consider ambient conditions and apply technically and financially feasible resource efficiency and pollution prevention principles and technique that are best suited to avoid, or where avoidance is not possible, minimise adverse impacts on human health and the environment.	Chapter 4 of the ESMP detailed out the Environmental and Social Management Plans which include the mitigation measures proposed by the project proponent based on the identified impacts assessment.
PS 4: Community, Health and Safety	PS 4 addresses proponent's responsibility in promoting the health, safety and security of the public as well as to avoid or minimise the risks and impacts to community health, safety and security that may arise from project related activities.	Control of pollution based on environmental and social aspect/ activity and the environmental audit programme which ultimately ensuring health and safety of the involved parties (including the community) are discussed in Chapter 4 of the ESMP report.
PS 5: Land Acquisition and Involuntary Resettlement	PS 5 is related to the land acquisition and resettlements. Proponent is responsible to avoid any involuntary resettlement by establishing a proper ESMP that will include compensation details and grievance mechanism.	The project did not require any acquisition of land as the land is owned by the state of Johor (KEJORA land – KEJORA is a regional development agency setup under the Ministry of Rural and Regional Development which covers the area of Southeast Johor. It was established on 1 June 1972) and hence does not trigger the requirement of PS 5: Land Acquisition and Involuntary Resettlement.

Performance Standards (PS)	Brief Description and Application	PEC Compliance Measures
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	The requirements of this PS are applied to projects (i) located in modified, natural and critical habitats; (ii) that potentially impact on or are dependence on ecosystem service over which the client has direct management control or significant influence; or (iii) that include the production of living natural resources (e.g., agriculture, animal husbandry, fisheries, forestry).	The project site will be handed over to proponent after the site is clear and levelled. Therefore, there will be no flora and fauna left in the project site. The impacts of flora and fauna was described in approved EIA and the ESHIA. Control of pollution based on environmental aspects and its environmental audit programme which ultimately avoiding pollution to surrounding environment are discussed in Chapter 4 of the ESMP report.
PS 7: Indigenous People	This PS applies to communities or groups of Indigenous Peoples who maintain a collective attachment i.e., whose identify as group or community is linked, to distinct habitats or ancestral territories and the natural resources therein. It may also apply to communities or groups that have lost collective attachment to distinct habitats or ancestral territories in the project area, occurring within the concerned group members' lifetime, because of forced severance, conflict, government resettlement programs, dispossession of their lands, natural disasters, or incorporation of such territories into an urban area.	PS 7 is not applicable as it is not located in an area with indigenous people.
PS 8: Cultural Heritage	PS 8 aims to ensure that proponent protect cultural heritage in the course of their project activities. The requirements are based in part on standards set by the Convention on Biological Diversity.	PS 8 is not applicable as it is not located in an area with cultural heritage.

2.1.12.2 International Finance Corporation's Environmental, Health and Safety General Guidelines

This EHS general guideline is a technical document providing approach to managing issues associated with environment such as air, water, noise and land pollution as well as issues related to the health and safety of the workers. This guideline also provides the performance levels and measures in line with the good international industry practice. The General EHS Guidelines are organized as follows:

1. Environmental
    1.1. Air Emission and Ambient Air Quality
    1.2. Energy Conservation
    1.3. Wastewater and Ambient Water Quality
    1.4. Water Conservation
    1.5. Hazardous Material Management
    1.6. Waste Management
    1.7. Noise
    1.8. Contaminated Land
2. Occupational Health and Safety
    2.1. General Facility Design and Operation
    2.2. Communication and Training
    2.3. Physical Hazards
    2.4. Chemical Hazards
    2.5. Biological Hazards
    2.6. Radiological Hazards
    2.7. Personal Protective Equipment (PPE)
    2.8. Special hazard Environments
    2.9. Monitoring
3. Community Health and Safety
    3.1. Water Quality and Availability
    3.2. Structural Safety of Project Infrastructure
    3.3. Life and Fire Safety (L&FS)
    3.4. Traffic Safety
    3.5. Transport of Hazardous Materials
    3.6. Disease Prevention
    3.7. Emergency Preparedness and Resource
4. Construction and Decommissioning
    4.1. Environment
    4.2. Occupational Health & Safety
    4.3. Community Health & Safety

2.1.12.3 International Finance Corporation's Environmental, Health and Safety for Large Volume Petroleum-based Organic Chemicals Manufacturing

The EHS Guidelines include information relevant to Large Volume petroleum-based Organic Chemicals (LVOC) projects and facilities. This document provides a summary of the most significant EHS issues associated with LVOC manufacturing facilities, which occur during the operational phase, along with recommendations for their management. These industry sector EHS guidelines are designed to be used together with the General EHS Guidelines document. The guidelines cover the production of following products:

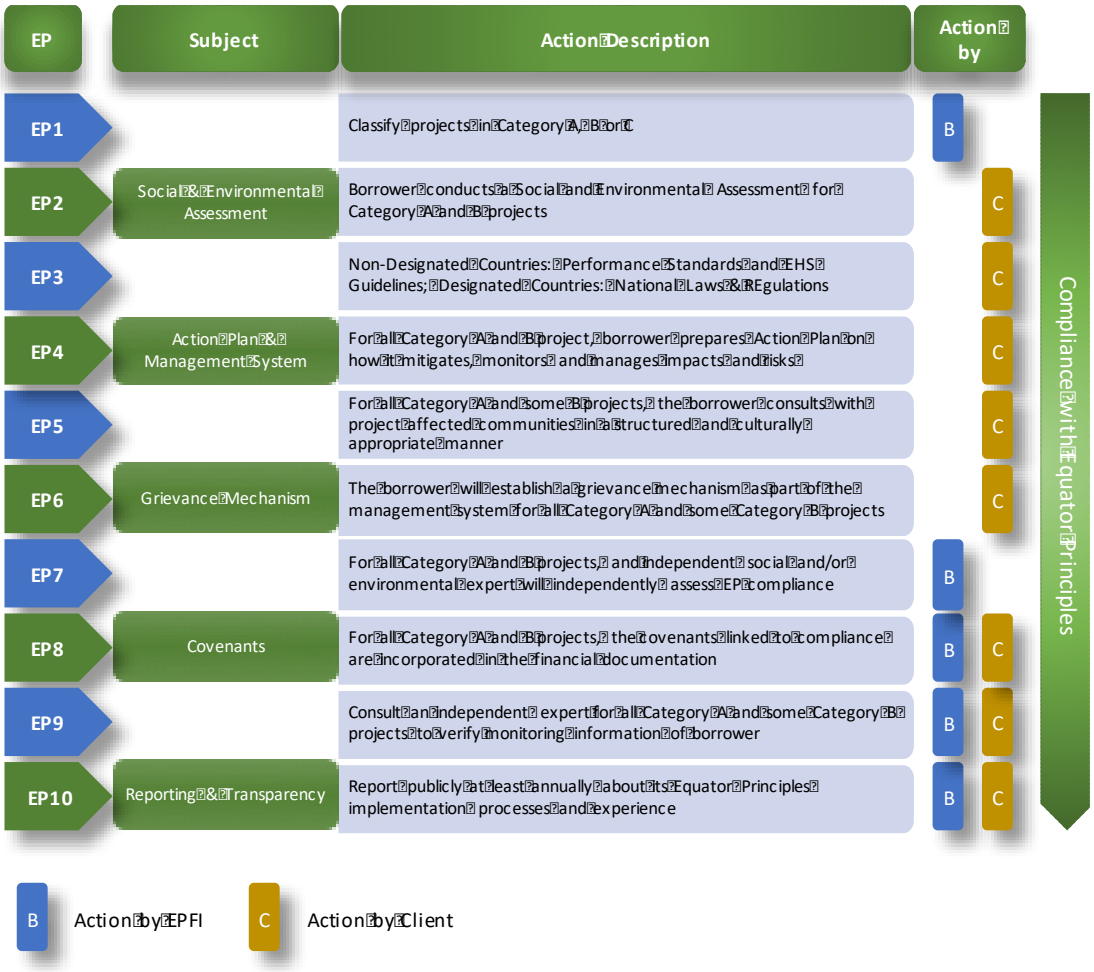
- **Lower Olefins** from virgin naphtha, natural gas and gas oil with special reference to ethylene and propylene and general information about main co-products (C4, C5 streams, pyrolytic gasoline (py-gas)), as valuable feedstock for organic chemical manufacturing;
- **Aromatics** with special reference to the following compound: benzene, toluene and xylenes by extraction or extractive distillation from pyrolytic gasoline (py-gas); ethylbenzene and styrene by dehydrogenation, or oxidation with propylene oxide co-production; and cumene and its oxidation to phenol and acetone;
- **Oxygenated Compounds** with special reference to the following compounds: formaldehyde by methanol oxidation; MTBE (methyl t-butyl ether) from methanol and isobutene; ethylene oxide by ethylene oxidation; and terephthalic acid by oxidation of p-xylene; acrylic esters by propylene oxidation to acrolein and acrylic acid plus acrylic acid esterification;
- **Nitrogenated Compounds** with special reference to the following compounds: acrylonitirite by propylene ammoxidation, with co-production of hydrogen cyanide, caprolactam form cyclohexanone; nitrobenzene by benzene direct nitration; and toluene diisocyanate (TDI) from toluene; and
- **Halogenated Compounds** with special reference to the following compounds: ethylene dichloride (EDC) by ethylene chlorination and production of vinyl chloride (VCM) by dehydrochlorination of EDC as well by ethylene oxychlorination.

2.1.12.4 Equator Principles

The Equator Principles (EP) comprise a group of ten principles voluntarily adopted by the Equator Principle Financial Institutions (EPFIs) in order to ensure that the projects funded by them are developed in a manner that is socially responsible and reflect sound environmental management practices. The EPs are as follows:

- *Principle 1*: Review and Categorisation
- *Principle 2*: Social and Environmental Assessment
- *Principle 3*: Applicable Social and Environmental Standards
- *Principle 4*: Action Plan and Management System
- *Principle 5*: Consultation and Disclosure
- Principle 6: Grievance Mechanism
- *Principle 7*: Independent review
- *Principle 8*: Covenants
- *Principle 9*: Independent Monitoring & Reporting
- *Principle 10*: Reporting & Transparency

The *Figure 2.1* below shows the 10 EPs, the action required to implement them and its related responsible party.



"Client" refers to the EPFI's clients i.e., the borrowers.

Figure 2.1 – 10 Equator Principles

Simply put, EP1 and 7 are the responsibility of the EPFI, while EP2-6 are obligations to be fulfilled by the project proponent. EP8-10 can either be the responsibility of the EPFI or the project proponent or both.

By adhering to the Equator Principles, EPFIs are committed to ensure that its borrowers in Project Finance and related transactions perform an Environmental and Social (E&S) Assessment. In this E&S Assessment, the borrowers have to demonstrate that they meet national laws and regulations and/or the requirements of two international standards set by the International Finance Corporation (IFC):

1) The IFC Performance Standards (PS) on Social and Environmental Sustainability ('Performance Standards').
2) The IFC Industry Specific Environmental, Health and Safety Guidelines ('EHS Guidelines').

As such, the IFC Performance Standards serve as the key to Equator Principles compliance as illustrated in *Figure 2.2* below.

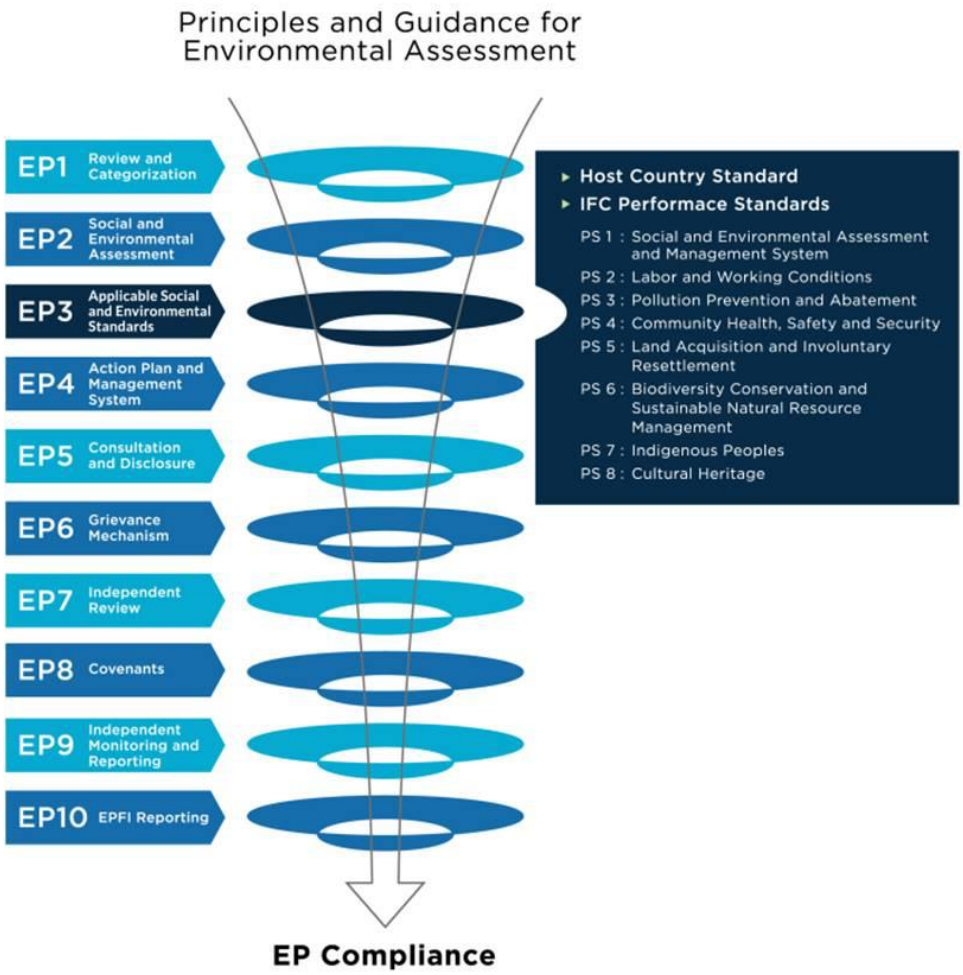


Figure 2.2 – Equator Principles Compliance

The applicability of each of the principles with respect to proposed PEC project is discussed below:

Equator Principle	Brief Description and Application	PEC Compliance Measures
Principle 1: Review and Categorisation	As the project is seeking financing from EPFIs, the project has to be categorized based on the magnitude of its potential impacts and risks in accordance with the environmental and social screening criteria of IFC. The categories are: *Category A* – Projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented; *Category B* – Projects with potential limited adverse environmental and social risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures; and *Category C* – Projects with minimal or no adverse environmental and social risks and/or impacts.	Categorisation conducted by the EPFI. PEC is categorised as "*Category B*" as the project's impacts are generally site specific and while a few of them may be irreversible, the mitigation measure can be readily designed. Furthermore, the project: • Do not affect vulnerable groups; • Do not affect ethnic minorities; • Do not involve involuntary displacement/resettlement; and • Do not affect significant cultural heritage sites.
Principle 2: Social and Environmental Assessment	An ESHIA has to be carried out for the project to addresses relevant social and environmental impacts and risks of the proposed project and also propose mitigation and management measures relevant and appropriate to the nature and scale of the proposed project.	PEC, through ESC has conducted and produced an ESHIA adhering to the IFC's PSs. The ESHIA addresses IFC' PS 1-4 and PS 6, i.e.: • 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 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources The project has not acquired any settlement land and hence does not trigger the requirement of PS 5: Land Acquisition and Involuntary Resettlement. The project is not located in an area with cultural heritage and indigenous people and as such

Equator Principle	Brief Description and Application	PEC Compliance Measures
		PS 7: Indigenous Peoples and PS 8: Cultural Heritage will also not be relevant. The ESMP is conducted to address the issues raised in the ESHIA by outlining the necessary measures and actions including monitoring plan.
Principle 3: Applicable Social and Environmental Standards	This Principle requires the Environment and Social Assessment to refer to the applicable IFC Performance Standards and the Industry Specific EHS Guidelines including the project's overall compliance with, or justified deviation from, the respective Performance Standards and EHS Guidelines.	The ESMP is prepared to comply with the national standards, rules and regulations as well as the requirements of IFC performance standards and EHS guidelines.
Principle 4: Action Plan and Management System	The action plan will describe and prioritise the actions needed to implement mitigation measures, corrective actions and monitoring measures necessary to manage the impacts and risks identified in the Assessment.	Management plan for potential impacts and their monitoring plan are included in Chapter 4 of the ESMP.
Principle 5: Consultation and Disclosure	The project affected communities are required to be consulted in a structured and culturally appropriate manner.	Social Monitoring Plan is detailed out in Chapter 4 the ESMP.
Principle 6: Grievance Mechanism	Proponent is required to establish a grievance mechanism as part of the management system.	Grievance mechanism is discussed in Stakeholder Engagement Plan (SEP) and the grievance mechanism document. The grievance mechanism also broadly described in Chapter 4 of the ESMP.
Principle 7: Independent review	An independent social or environmental expert, not directly associated with the project proponent or ESC, is required to review the Assessment, action plans and consultation process documentation in order to assist EPFI's due diligence, and assess Equator Principles compliance.	The EPFI will appoint an independent reviewer to evaluate and comment on the project proponent's ESMP.
Principle 8: Covenants	The covenants would be a part of the contract documents	E&S Covenants shall be embedded within the contracts

Equator Principle	Brief Description and Application	PEC Compliance Measures
	between project proponent and financing agency as well as contractors and technology suppliers.	drawn between project proponents and the contractors hired for construction activities, technology providers and waste handlers. Periodic reporting to the EPFI may also be required depending on the EPFI's requirements.
Principle 9: Independent Monitoring & Reporting	EPFIs will, for all Category A Projects, and as appropriate, for Category B projects, require appointment of an independent environmental and/or social expert, or require that the borrower retain qualified and experienced external experts to verify its monitoring information which would be shared with EPFIs.	EPFI may appoint its own independent expert or require PEC to retain their E&S experts to assess the continuing environment and social impacts of the project to ensure ongoing monitoring and reporting after Financial Close and over the life of the loan. This requirement is dependent on the EPFI's requirements.
Principle 10: Reporting and Transparency	Reports of the EP implementation must be made publicly available.	PEC will make sure that a summary of the ESMP is made available online for public review.

2.1.12.5 OECD Guidelines for Multinational Enterprises

The Guidelines are recommendations addressed by governments to multinational enterprise which aim to:

- Ensure that the operations of these enterprises are in harmony with government policies;
- Strengthen the basis of mutual confidence between enterprises and the societies in which they operate;
- Help improve the foreign investment climate; and
- Enhance the contribution to sustainable development made by multinational enterprises.

There are 10 policies in OECD Guidelines which are:

1. General Policies

   The general policies contain specific recommendations to enterprises for example enterprises are encouraged to co-operate with governments in the development and implementation of policies and laws. It is also recommended for the enterprises to avoid making efforts to secure exemptions not contemplated in the statutory or regulatory framework related to human rights, environmental, health, safety, labour, taxation and financial incentives.

2. Disclosure

   Enterprises should ensure that timely and accurate information is disclosed on all material matters regarding their activities, structure, financial situation, performance, ownership and governance. The information should be disclosed for the enterprise as a whole, and, where appropriate along business lines or geographic areas. Disclosure policies of enterprises should be tailored to the nature, size and location of the enterprise, with due regard taken of costs, business confidentiality and other competitive concerns.

3. Human Rights

   Enterprises should, within the framework of internationally recognised human rights, the international human rights obligations of the countries in which they operate as well as relevant domestic laws and regulations.

4. Employment and Industrial Relations

   Multinational enterprises, while operating within the jurisdiction of particular countries, may be subject to national and international levels of regulation of employment and industrial relations matter.

5. Environment

   Enterprises should, within the framework of laws, regulations and administrative practices in the countries in which they operate, and in consideration of relevant international agreements, principles, objectives, and standards, take due account of the need to protect the environment, public health and safety, and generally to conduct their activities in a manner contributing to the wider goal of sustainable development.

6. Combating Bribery, Bribe Solicitation and Extortion

   Enterprises should not, directly or indirectly, offer, promise, give, or demand a bribe or other undue advantage to obtain or retain business or other improper advantage. Enterprises should resist the solicitation of bribes and extortion.

7. Consumer Interests

   When dealing with consumers, enterprises should act in accordance with fair business, marketing and advertising practices and should take all reasonable steps to ensure the quality and reliability of the goods and services that they provide.

8. Science and Technology

   In terms of science and technology, enterprises should endeavour to ensure that their activities are compatible with the science and technology policies and plans of the countries in which they operate and as appropriate contribute to the development of local and national innovative capacity.

9. Competition

   The goal of the competition policy is to contribute to overall welfare and economic growth by promoting market conditions in which the nature, quality and price of goods and services are determined by competitive market forces.

10. Taxation

    It is important that enterprises contribute to the public finances of host countries by making timely payment of their tax liabilities. In particular, enterprises should comply with both the letter and spirit of the tax laws and regulations of the countries in which they operate.

3 ORGANISATIONAL STRUCTURE

3.1 Developer Overview

PEC has been established in Malaysia to develop one of the largest and most competitive aromatics plant in the world, to be located in the strategic Pengerang Refinery and Petrochemicals Hub in Johor, Malaysia, at the tip of the Malaysian Peninsula, sharing its attributes as a central trading hub and deep-water port with the city state of Singapore.

- PEC is working with Energy Majors and Traders to establish a world scale investment in Malaysia, focused on converting low sulphur condensates into aromatics, destined to feed the synthetic fibre industries of Asia and China;
- USD 3.8 billion of foreign investment will be deployed to establish a 150,000 bpd condensate splitter and aromatic project a specifically designated Industrial and Petrochemical zone in Johor state, adjacent to Singapore;
- Technology is the latest generation from UOP which is environmentally several steps ahead of existing plants and the PEC plant offers with greater built-in flexibility than others coming on stream;
- This investment will bring US$ 5 billion annual export to the Malaysian economy and creating at least 250 new full-time jobs in Johor, a part of creating 7000 constructions jobs during its building phase of 3.5 years; and
- PEC is the Aromatic Plant of the future, more efficient than previous plants, more cost and space effective, socially and environmentally optimally located and with a clear vision to integrate into future fuel enhancement strategies.

3.1.1 Environmental Policy

PEC's Environmental Policy is shown in *Figure 3.1*.

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

Figure 3.1 – PEC's Environmental Policy

3.1.2 Human Resources and Social Policy

PEC's Human Resources and Social Policy is shown in **Appendix B**.

3.2 Project Main Contractors

3.2.1 Health, Safety and Environmental (HSE) Policies

PEC has appointed Technimont as the main contractor for the development of Pengerang Energy Complex. Technimont's Health, Safety and Environmental (HSE) Policy is shown in **Appendix B**.

3.2.2 Organisational Structure

The organisational structure of PEC's contractor on-site is as shown in *Figure 3.2.* However, the structure was based on the preliminary contractor HSE plan thus it may be changed based on actual/ agreed application and implementation by the contractor.

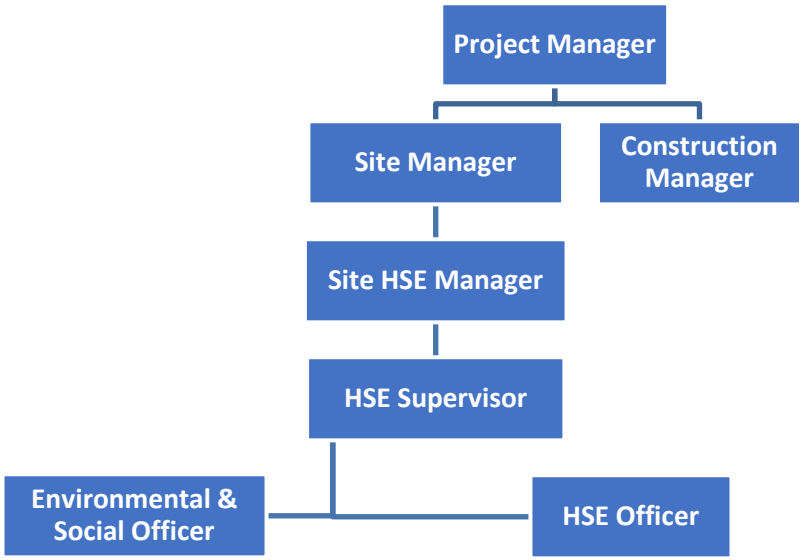


Figure 3.2 – Organisational Structure of PEC's Contractor

The roles and responsibilities of site management and HSE team are as follows:

Project Manager

1. In charge of Project HSE requirements and for the achievement of Project HSE objectives as per HSE Policy and Commitments;
2. Ensure that HSE Management System is implemented throughout all phases of the Project;
3. Ensure that Project personnel take ownership of the HSE Management System;
4. Ensure that suitably competent HSE personnel are assigned to the Project;
5. Ensure that sufficient resources, human and material are allocated for all HSE requirements; and
6. Monitor the project HSE performances.

Site Manager

1. Ensure that HSE Management System is implemented at site;
2. Ensure the implementation of the HSE policy and the HSE Plan on Site;
3. Ensure prompt investigation and reporting in case of incidents;

4. 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;
5. Ensure that all HSE procedures and instructions are well implemented;
6. Participate at the HSE meeting periodically organized by contractor and PEC;
7. 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; and
8. Held and chair the Monthly HSE Committee Meeting.

Construction Manager

1. Assist the Site Manager in planning and implement the HSE Program;
2. Ensure that all facilities are:
    - Built in accordance with construction HSE standards; and
    - Maintained to standards or corrected in order to meet operating and HSE requirements.
3. To perform and co-ordinate construction work in the safest manner;
4. 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;
5. Verify that inspection and audit follow up actions are fully and timely taken;
6. Participate in the investigation of incident and accident; and
7. Promote corrective actions in case unsafe acts or conditions.

Site HSE Manager

1. Assist the site manager in the general supervision of the HSE program;
2. Audit and control of due implementation of HSE Management System;
3. Planning, participating and reporting HSE Audits;
4. Monitor the implementation of the HSE program;
5. Assist Construction Manager, Supervisors and foremen in promoting a Safety prevention spirit within their respective work groups, according to the approved safety programs;
6. Conduct periodical inspection on site, and direct appropriate corrective action;
7. Prepare inspection reports for the Site Manager for his review and action;
8. Conduct the investigation in case of accidents, incidents and near misses, and forward the reports to Site Manager for submission to PEC and-or concerned authorities;
9. Attend with the Project Manager to safety committee meetings;
10. Perform all the remaining miscellaneous work relating to safety, traffic, fire, environment protection and sanitary matters;
11. Collaborate closely with owner's representative with regard to HSE;
12. Provide feedback on performance and assist contractor supervision to plan and coordinate the work to effectively implement all HSE requirements;

13. Verify the adequacy and application of the Site HSE Plan and all related procedures, to the preparing any revisions;
14. To update the HSE documentation during all the construction phases when deemed necessary;
15. 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;
16. 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;
17. To organize, coordinate and directly participate in the HSE Training activities on-site;
18. To organize and participate to all relevant site HSE Meetings, prepare the relevant MOM;
19. To coordinate the PTW procedure;
20. To keep accident records, identifying the areas to which prevention must be addressed;
21. Lead and coordinate the activities off the Site HSE Committee (composed by all contractor and subcontractors HSE Representative);
22. To lead and coordinate the site emergency response team and fire prevention/fighting team, organizing training and emergency drill mock activities;
23. To prepare the HSE section of the construction monthly progress report and other periodical report; and
24. 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

1. Participate in monitoring the HSE activities including auditing, sampling and inspection;
2. Inspect the construction area daily;
3. 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;
4. Participate in the investigation of all incidents, accidents and near misses;
5. Take action and report immediately to the Site HSE Manager in case of dangerous actions and/or situations;
6. To be of constant advisor on the field for any problem related to HSE for all the personnel;
7. To participate to the toolbox meeting held by the foremen and support them during this activity;
8. To verify on daily basis the correct use of PPE by all the personnel;
9. To participate to the Safety committee meeting;
10. To actively participate in the investigation of all incidents, accidents, and near misses; and
11. To ensure that Fire Fighting and Safety equipment is regularly inspected and serviced.

3.2.2.1 Emergency Reporting Flowchart

The reporting flowchart for an emergency or near-misses event, is shown in *Figure 3.3.* However, the sequence of reporting for immediate action when an emergency or near-misses is occurring will follow the protocol set in the Emergency Response Plan (ERP).

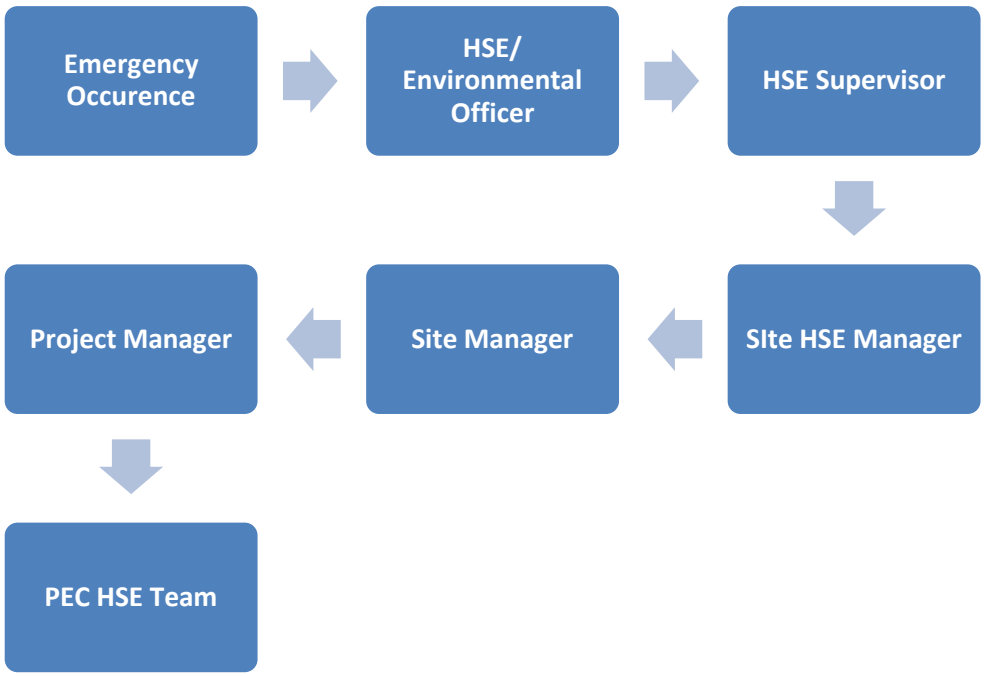


Figure 3.3 – Emergency Reporting Flowchart

4 ENVIRONMENTAL AND SOCIAL REQUIREMENTS

This section details the environmental and social requirements to be implemented during the construction phase to ensure that pollution prevention and mitigation measures are translated into actionable items that safeguard the environment and social as summarised in **Appendix C**.

Sub-sections are organised as follows:

- *Section 4.1* to *4.8* detail out the control of pollution by environmental and social aspect/ activity;
  - Air quality;
  - Noise;
  - Water quality;
  - LD-P2M2;
  - Management of wastes;
  - Traffic;
  - Occupational Safety and Health; and
  - Social.
- *Section 4.9* summarises the environmental audit programme.

This document will act as a live document that shall be amended throughout the construction phase of PEC if required.

4.1 Ambient Air Quality

4.1.1 Introduction

The ambient air quality status is reported in terms of Air Pollution Index (API) where the API categorised as good, moderate, unhealthy, very unhealthy, and hazardous. Based on data from the DoE's Environmental Quality Report 2016, the air quality in Kota Tinggi was considered as "Good". Baseline ambient air quality was conducted to fulfil the requirements of DoE's Environmental Impact Assessment (EIA) submission as well as to further evaluate the ambient air quality in the PEC area prior to start of construction works.

The first round of baseline sampling was conducted from 24th September to 5th October 2018 at eight (8) locations. The results showed that PM_{10} and $PM_{2.5}$ levels were exceeding the Malaysian Ambient Air Quality Standards (MAAQS), and the hydrogen sulphide (H_2S) levels were abnormally high with no source of the pollution identified. As there were doubts over the results, additional baseline sampling was conducted from 10th April 2019 to 12th April 2019 at the same sampling locations, but a different SAMM-accredited laboratory was used for the sampling activities. The results were all below the MAAQS except for $PM_{2.5}$ at station A2. Another round of baseline sampling for the same parameters and locations was conducted from 29th April 2019 to 1st May 2019 to ensure the consistency of the results. The results were all below the MAAQS. Additional sampling for H_2S was conducted on 20th June 2019 and 15th – 17th July 2019 (for H_2S and $PM_{2.5}$). The results for $PM_{2.5}$ were all below the MAAQS while for H_2S, there is no prescribed limit in the MAAQS.

Baseline results will be used to compare the ambient air quality throughout the construction period. Any exceedance of ambient air quality parameters during construction will be included in

the quarterly monitoring report which will be submitted to DoE Johor. Mitigation measures will be conducted based on the monthly ambient air quality results.

4.1.2 Compliance Requirements

This section of the ESMP will only cover the ambient air quality during construction phase. The action plan proposed will be based on the national regulations and guidelines such as:

- Malaysian Ambient Air Quality Standards (MAAQS);
- Environmental Quality (Clean Air) Regulations 2014;
- Conditions of Approval (CoA) of the EIA report for Proposed Pengerang Energy Complex Sdn Bhd, Pengerang Industrial Park, Sub-District of Pengerang, District of Kota Tinggi, Johor Darul Takzim issued by Department of Environment (DoE) Malaysia; and
- Environmental Impact Assessment Guideline in Malaysia: Land-Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2) published by DoE Malaysia.

For this ESMP, the action plan will also consider the international requirement such as International Finance Corporation's Environmental, Health and Safety General Guidelines for ambient air quality during construction.

4.1.3 Potential Impacts and Mitigation Measures

4.1.3.1 Fugitive Dust Emission

Land clearing and cut and fill activities for PEC site is expected to be minimal as the land will be pre-prepared by JCorp. The sources of impact during construction includes:

- Minor earthworks and piling activities;
- Vehicles movements on exposed soil and unpaved roads;
- Materials handling;
- Materials tracked out from the site and deposited on local roads within the industrial estate; and
- Wind erosion from exposed areas and stockpiled construction materials.

These activities may potentially increase the pollutants such as PM_{10} and $PM_{2.5}$. The baseline results indicated that the 24-hour PM_{10} and $PM_{2.5}$ concentrations were in the range of 97 – 278 µg/m^3 and 69 – 139 µg/m^3, respectively. Ambient particulate monitoring results for the study area are therefore above the respective 24-hour guideline levels of 100 µg/m^3 and 35 µg/m^3 for PM_{10} and $PM_{2.5}$ specified under the Malaysian Ambient Air Quality Standard (MAAQS) 2020 Standard. These data indicate that ambient air quality in the project area is already above acceptable levels with respect to suspended particulates.

The industrial park developer will deliver 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:

- Activities that produce significant dust emissions will be monitored during periods of high winds and dust control measures implemented as appropriate;

- Stockpiles of soil and similar materials will be carefully managed to minimise the risk of windblown dust, e.g., water spray dampening of soils and spoil and during delivery and dumping of sand and gravel during periods of dry weather;
- Where possible, drop heights for material transfer activities, e.g., unloading of friable materials, will be minimised and carefully managed;
- On-site and access roads will be well maintained through mechanical means (sweeping or vacuuming) or damping with water and access road will be resurfaced;
- Trucks transporting potentially dusty materials will use secure load covers extending over the tail and side boards;
- Vehicle speeds on unsurfaced roads will be limited to 30 km/hr;
- Ambient air quality monitoring should be conducted on monthly basis during construction phase;
- 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; and
- 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.

4.1.3.2 Exhaust Emission

Diesel-burned construction vehicles and equipment may contribute to a significant portion of air pollution such as CO and particulate matters as well as greenhouse gas. Based on the study conducted by H. Fan, the factors affecting the exhaust emissions of construction vehicle and equipment are:

1. Equipment and conditions
    - Year;
    - Model;
    - Size and engine power;
    - Overall condition;
    - Engine rebuild; and
    - Fuel quality.
2. Equipment maintenance
    - Routine maintenance;
    - Major maintenance;
    - Running repair; and
    - Tire/ track condition.
3. Operating conditions

- Job nature;
- Jobsite conditions;
- Environmental conditions; and
- Altitude.

4. Equipment operations
   - Idling and control;
   - Operator skills;
   - Equipment selection and deployment; and
   - Equipment operation planning.

Exhaust emissions from construction vehicles and equipment can be effectively controlled by adherence to strict procedural controls and working practices. The adoption of emission control strategy must therefore be incorporated into the project implementation plan to control the emissions to within acceptable levels. Implementation of the following mitigation measures may potentially reduce exhaust emissions:

- 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;
- Vehicles and equipment should be regularly maintained to ensure optimum conditions during operation of the vehicles and equipment;
- Idling of engines shall be discouraged;
- 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; and
- 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.

4.1.4 Monitoring and Reporting

Ambient air quality monitoring should be conducted during construction phase. Parameters, frequency, and emission limits of the monitoring will be based on the EIA Conditions of Approval (CoA) No. 28 issued by Department of Environment (DoE) Malaysia on 28th November 2019. Parameter, frequency, and emission limits are as shown in *Table 4.1* below.

Table 4.1: Parameters, Frequency and Limits

No.	Control and Monitoring	Emission Limit	Frequency	Standard
1.	PM_{10}	Refer to the application limit for year 2020 • 40 µg/m_3 (1-year averaging time) • 100 µg/m_3 (24 hours averaging	Monthly	Malaysian Ambient Air Quality Guidelines Malaysian

No.	Control and Monitoring	Emission Limit	Frequency	Standard
		time)		Ambient Air Quality Standard (at 25°C and 101.13 kPa)
2.	$PM_{2.5}$	• 15 µg/m_3 (1-year averaging time) • 35 µg/m_3 (24 hours averaging time)		
3.	Sulphur Dioxide (SO_2)	• 250 µg/m_3 (1 hour averaging time • 80 µg/m_3 (24 hours averaging time)		
4.	Nitrogen Dioxide (NO_2)	• 280 µg/m_3 (1 hour averaging time) • 70 µg/m_3 (24 hours averaging time)		
5.	Ground-Level Ozone (O_3)	• 180 µg/m_3 (1 hour averaging time) • 100 µg/m_3 (24 hours averaging time)		
6.	Carbon Dioxide (CO)	• 30 µg/m_3 (1 hour averaging time) • 10 µg/m_3 (8 hours averaging time)		

Note: This info is based on the EIA Conditions of Approval No. 28

Sampling and analysis of the ambient air quality parameters should be analyzed at an accredited lab from the Laboratory Accreditation Scheme Malaysia (SAMM). Location of the sampling points for air quality monitoring are as shown in *Figure 4.1.*

The EIA Conditions of Approval No. 62 stated that report for ambient air quality monitoring should be submitted to DoE Johor on a quarterly basis. Reports should be kept and made available for review during the third-party audit.

Data from Air Quality Monitoring Station (AQMS) at Kampung Lepau will be obtained from DoE and will be utilised to compare against the monitoring conducted during the construction phase.

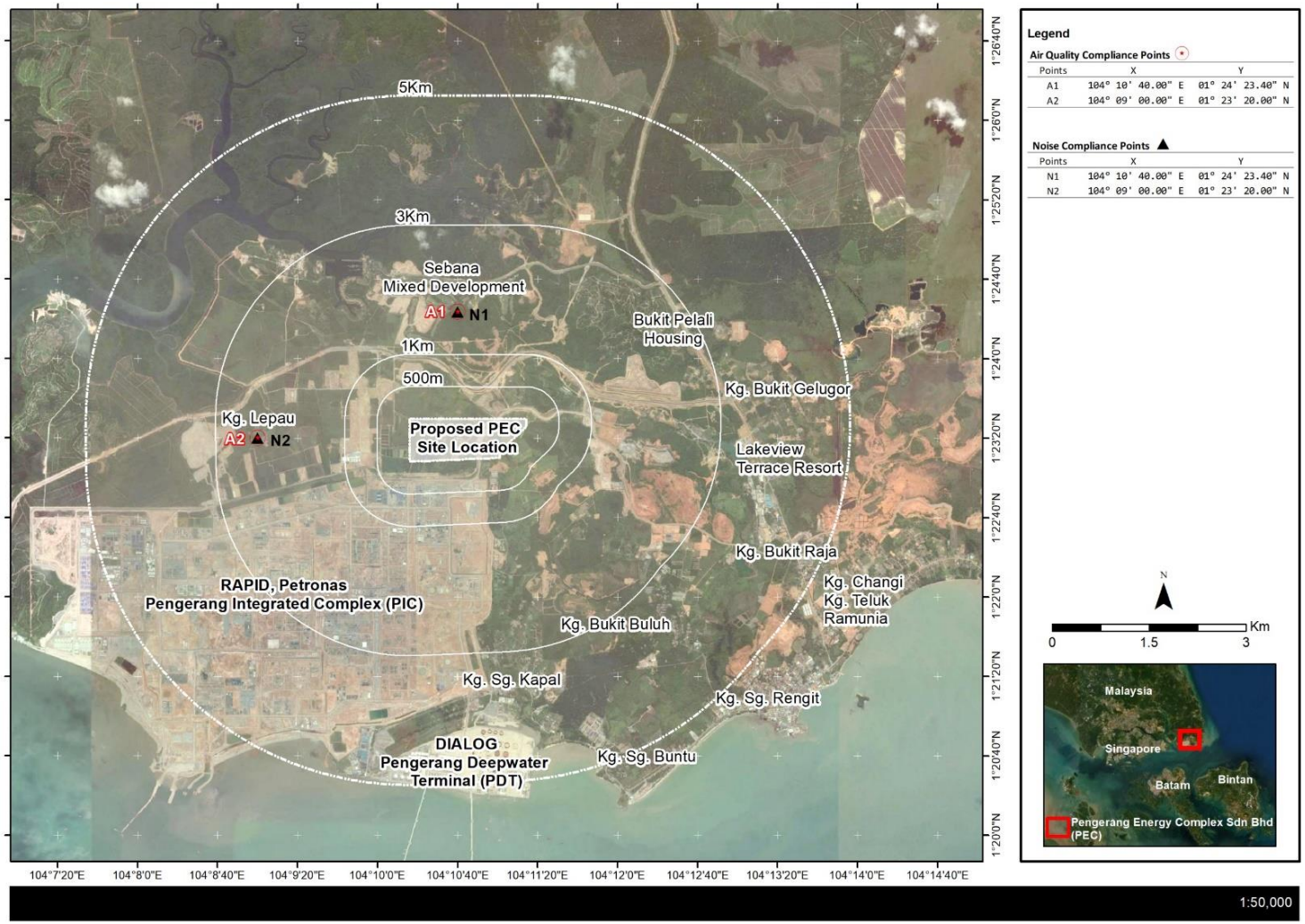


Figure 4.1 – Location of Ambient Air Sampling Points

4.2 Control of Environmental Noise

4.2.1 Introduction

The assessment of the ambient noise level of the surrounding area of PEC was conducted during the preparation of PEC ESHIA. The baseline environmental noise level sampling was carried out in October 2018 and a total of six (6) sampling points were identified. The results of the sampling were compared with the maximum permissible sound level set in the Planning Guidelines for Environmental Noise Limits and Control.

The results showed that the existing baseline already exceeded the maximum sound level of 50dB and 40dB for day time and night time, respectively. The nearest identified noise sensitive receivers to the proposed PEC are Kg. Lepau and Sebana Mixed Development, which are located 1.5 km and 1.6 km away, respectively. Background noise levels at these locations were found to be on average dBA in the daytime and 51 dBA to 56 dBA at night-time for L_{90} during the baseline noise survey. Based on field observations, the possible high noise sources in the site surrounding are from the construction works and vehicles, road traffic flow and occasional plant noise from the RAPID project site.

The baseline noise level at these receptors is shown in *Table 4.2.*

Table 4.2: Baseline Noise Levels at Sensitive Receptors

Location	Baseline Level (dBA)			Maximum Permissible Noise Limits for Residential Receivers	
	L_{eq}	L_{90}	L_{Max}	L_{90}	L_{Max}
Day-time (0700-2200)					
N1: Sebana Mixed Development	63.4	56.5	88.7	60.0	90.0
N2: Kg. Lepau	63.4	56.7	102.7	60.0	90.0
Night time (2200-0700)					
N1: Sebana Mixed Development	57.6	51.0	89.5	55.0	85.0
N2: Kg. Lepau	58.6	56.3	97.6	55.0	85.0

As part of the framework of the Noise Management Plan, the results from the baseline noise sampling will be utilised in assessing the ambient noise level throughout the construction period. Any exceedance of ambient noise level during the construction phase will be included in the quarterly monitoring report which will be submitted to DoE Johor. Mitigation measures will be conducted based on the monthly ambient air quality results.

4.2.2 Compliance Requirements

This section of the ESMP will only cover the ambient noise quality during construction phase. For the development of the Noise Management Plan, the following legislation and guidelines were reviewed:

- Environmental Quality Act 1974;
- Conditions of Approval (CoA) of the EIA report for Proposed Pengerang Energy Complex Sdn Bhd, Pengerang Industrial Park, Sub-District of Pengerang, District of Kota Tinggi, Johor Darul Takzim published by Department of Environment (DoE) Malaysia;

- Environmental Impact Assessment Guideline in Malaysia: Land-Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2) published by DoE Malaysia;
- Factories and Machinery Act 1967 (Act 139) published by DOSH Malaysia; and
- The Planning Guidelines for Environmental Noise Limits and Control 2007 published by DoE Malaysia.

For this ESMP, the action plan will also consider the international requirement such as International Finance Corporation's Environmental, Health and Safety General Guidelines for ambient noise quality during construction.

4.2.3 Potential Impacts and Mitigation Measures

The construction of PEC facility has the potential to result in adverse noise pollution to ambient noise level of the surrounding area. The identified potential sources of noise pollution during construction are as follows:

1. Noise generated from construction tools and machineries such as:
   - Piling rig;
   - Air compressors;
   - Excavator;
   - Welding machines;
   - Lorries;
   - Generators;
   - Cranes; and
   - Compactors.
2. Noise generated due to the increases of vehicle entering and exiting the Project site.

The elevated noise level generated from these sources may lead to an adverse impact to the surrounding ambient noise level which will consequently affect the general wellbeing of the public as well as the workers on-site.

In order to control the impact of elevated noise level, the following mitigation measures are proposed:

1. Exhaust mufflers will be employed on engine-powered construction plant;
2. Good practice procedures such as turning off equipment when not in use;
3. Noise prevention and mitigation measures such as silencer, relocation of equipment, replacement with lower noise level, and personal protective equipment, etc. should be applied where predicted or measured noise impacts from the facility or operations exceed the applicable noise level guideline;
4. Mobile plant and other vehicles will be driven responsibly and below 30 km/hr within the construction-site; and
5. Night-time construction activities will normally be restricted to relatively quiet activities.

4.2.4 Monitoring and Reporting

In order to ensure that the construction activities of PEC will be conducted in compliance with the regulation requirements, ambient noise monitoring will be conducted throughout the

construction phase. Location of the sampling points for noise monitoring are shown in *Figure 4.2.* The sampling location for vibration will located at the same location as noise sampling.

The ambient noise limit will be based on "The Planning Guidelines for Environmental Noise Limits and Control' as stated in the EIA Conditions of Approval (CoA) No. 33 and 34 while the Vibration Limit will be based on Schedule 5 and Schedule 6 of the "The Planning Guidelines for Vibration Limits and Control in the Environment" as issued by Department of Environment (DoE) Malaysia on 28th November 2019. The compliance monitoring programme that will be implemented for ambient noise and vibration are as shown in *Table 4.3* and *Table 4.4*.

Table 4.3: Parameter, Frequency and Noise Limit of Noise Sampling

Receiving Land Use Category	Noise Parameter	Limit			Frequency	Standard
		Day Time 7.00 am – 7.00 pm	Evening 7.00 pm – 10.00 pm	Night Time 10.00 pm – 7.00 pm		
Residential	L_{90}	60 dBA	55 dBA	*(Note 1)	Monthly	Schedule 6: Maximum Permissible Sound Levels (Percentile L_n and L_{max}) of Construction, Maintenance and Demolition Work by Receiving Land Use
	L_{10}	75 dBA	70 dBA	*		
	L_{max}	90 dBA	85 dBA	*		

Notes:

**1. At these times the maximum permissible levels as stipulated in the Schedule 1 for the respective residential density type shall apply. This may mean that no noisy construction work can take place during these hours.*

Table 4.4: Frequency and Vibration Limit of Vibration Sampling

Receiving Land Use Category	Limit		Frequency	Standard
	Day Time 7.00 am – 10.00 pm	Night Time 10.00 pm – 7.00 am		
Residential	Curve 2 to Curve 4	Curve 2	Monthly	Schedule 5: Recommended Limits for Human Response and Annoyance from Steady State Vibrations
	Curve 8 to Curve 16	Curve 4	Monthly	Schedule 6: Recommended Limits for Human Response and Annoyance from Short Term Vibrations

The EIA Conditions of Approval No. 62 stated that report for ambient noise and vibration monitoring should be submitted to DoE Johor on a quarterly basis. Furthermore, the monitoring reports should be kept and made available for review during the third-party audit.

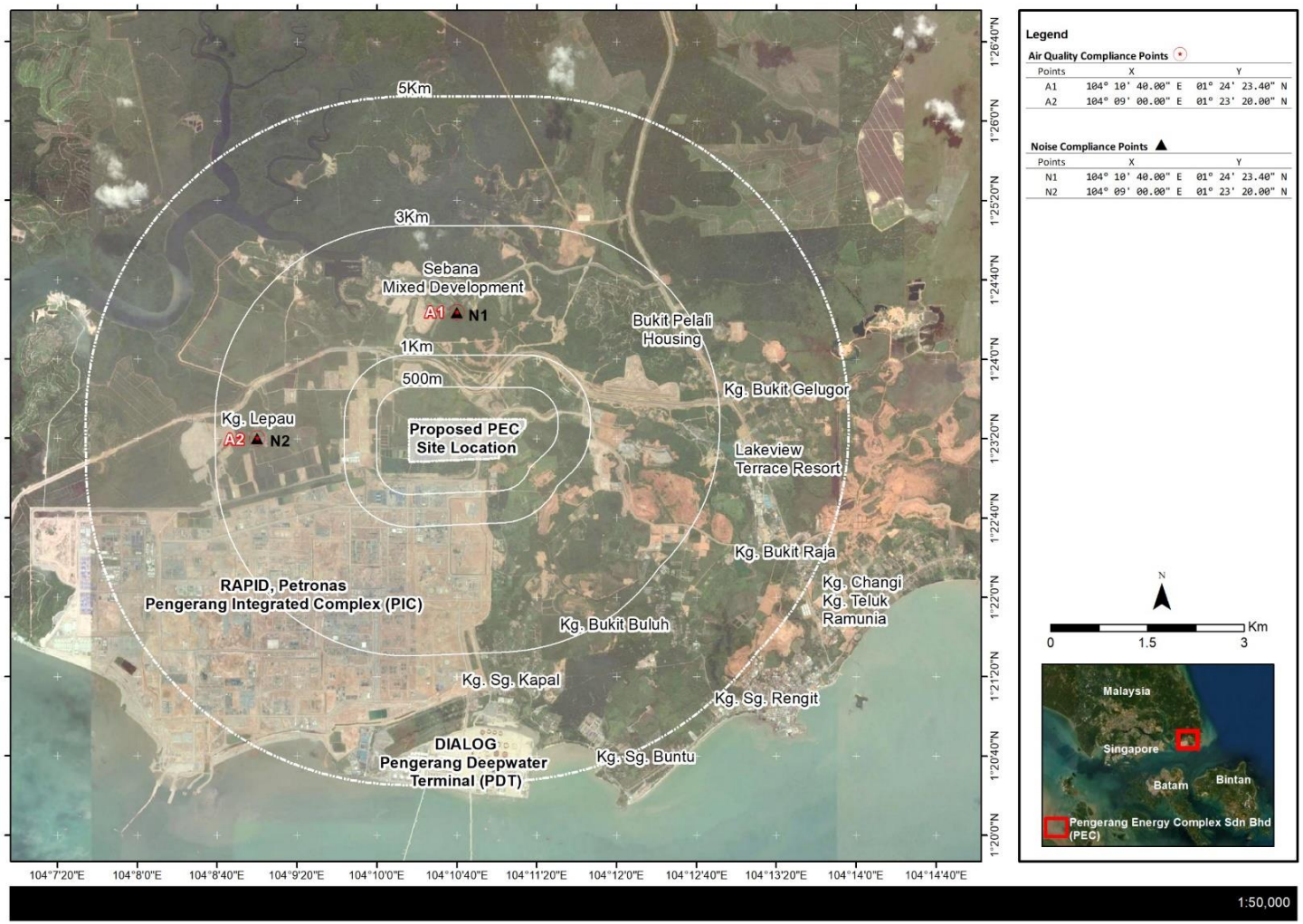


Figure 4.2 – Location of Noise and Vibration Sampling Points

4.3 Surface Water Quality

4.3.1 Introduction

The PEC site is located within the Sg. Lepau sub-catchment and is part of the Sg. Santi river basin. Sg. Lepau flows to the southern boundary of the site and exits west and northwest before draining to mangroves and Sg. Santi near its estuary and on to the Singapore Straits. There are no water intake points or water treatment plants located along Sg. Lepau or Sg. Santi. The nearest water intake point to the project site is located at the Sungai Lebam water treatment plant (1^{o} 32' 30''N, 104^{o}12'13''E) approximately 17.3 km northeast of the project site in another river catchment. Historical water quality data of Sg. Santi from 2015 to 2017 was sourced from the DoE Water Division indicates that the average yearly water quality index (WQI) from 2015 to 2017 was 82, 80 and 81, respectively, which is Class II status of the National Water Quality Standards (NWQS).

Baseline water quality was conducted to fulfil the requirements of DoE's Environmental Impact Assessment (EIA) submission as well as to further evaluate the water quality in the PEC area prior to start of construction works. The baseline water sampling was conducted in October 2018 at six (6) sampling points. Samples were analysed for Conductivity, pH, Salinity, Temperature, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Turbidity, Colour, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Ammonia as N, Total Coliform, Dissolved Oxygen (DO) and Total Faecal Coliform.

Results were compared against the National Water Quality Standards (NWQS). The results for all sampling points were generally within Class II of the NWQS, except for total coliform count. Possible sources of contamination along Sg. Lepau are runoff from oil palm plantations and from Kg. Lepau. At Sg. Santi, aquaculture farms were noted along the river which can cause contamination from various pharmaceutical products, anti-fouling paints, and fish food used in aquaculture farming.

Baseline results will be used to compare the water quality throughout the construction period. Any exceedance of water quality parameters during construction will be included in the quarterly monitoring report which will be submitted to DoE Johor. Mitigation measures will be conducted based on the monthly water quality results.

4.3.2 Compliance Requirements

This section of the ESMP covers the water quality during construction phase. The action plan proposed below based on the national regulations and guidelines such as:

- National Water Quality Standards (NWQS);
- Environmental Quality Act 1974;
- Conditions of Approval (CoA) of the EIA report for Proposed Pengerang Energy Complex Sdn Bhd, Pengerang Industrial Park, Sub-District of Pengerang, District of Kota Tinggi, Johor Darul Takzim publsihed by Department of Environment (DoE) Malaysia; and
- Environmental Impact Assessment Guideline in Malaysia: Land-Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2) published by DoE Malaysia.

For this ESMP, the action plan will also consider the international requirement such as International Finance Corporation's Environmental, Health and Safety General Guidelines for water quality during construction.

4.3.3 Potential Impacts and Mitigation Measures

4.3.3.1 Construction Activities

Construction activities for this PEC site would be minimal as the site will be handed over to the project proponent as levelled platform. Besides, the surrounding Project site will be equipped with drainage facilities prior to the construction works as it is included in the overall development of PIP by JCorp. Surface run-off from the drain will be channelled to the retention pond next to the site at the western boundary of PIP before being released to Sg. Lepau which subsequently flows to Sg. Santi.

Nevertheless, some minor activities such as piling works and drainage will contribute to the increasing of suspended solids in the waterways. The potential impacts during construction includes:

- Elevated suspended solids and organics content in construction-site rainfall run-off and drainage;
- Entrainment of debris and refuse in stormwater run-off from work site areas may result in fouling of receiving water bodies; and
- Spillages of liquids such as lubricating oils, diesel and hydraulic fluids that are likely to affect water quality if they enter surrounding water bodies or permeate into the ground.

A proper drainage system will be constructed by JCorp prior to the commencement of construction works for PEC site. A minimal mitigation measures are needed to maintain the existing NWQS Class II water quality which include:

- Provision of temporary site drainage and run-off control systems; settlement ponds and silt fences;
- Provision of check dams in the drain to help reduce the concentration of the sediments/ silts;
- Regular maintenance of the permanent drainage is required to ensure the discharge water quality;
- Work scheduling (to avoid heavy rainfall periods);
- Construction materials that block or obstruct drainage channels should be removed;
- Removal of debris/garbage accidentally entering drainage channels;
- Provision of refuse traps on drain channel outfalls;
- Controls on the on-site storage of hazardous materials;
- Segregation of wastewater streams to ensure compatibility with selected treatment options (e.g., septic system which can only accept domestic sewage);
- Segregation and pre-treatment of oil and grease containing effluents (e.g., use of a grease trap) prior to discharge into sewer systems;
- Any spillage from fuel storage tank shall be contained within the containment bund of 110% capacity of the largest tank. The storage containers or tanks must be covered at all times; and
- Water quality monitoring shall be conducted upon commencement of construction works.

4.3.3.2 Sewage Effluent

Estimations to the effluent and solid waste during the construction is based on the peak number of 7,000 workers. Therefore, the estimated requirement of water for workers is 420,000 L/day (based on 60 L/person/day). With the assumption that 80% of the water requirement volume may be discharged through the sewers i.e., through the use of toilets, the total wastewater generated from daily uses is estimated at 336,000 L/day.

For effluents associated with human activity, the principal concern is to ensure that no contamination of surface or groundwater resources occurs. This can be easily achieved by the provision of temporary chemical toilet facilities for the construction workforce. Regular maintenance of the temporary toilets is required to ensure the wastewater is treated prior to discharging into any drainage system or river.

4.3.4 Monitoring and Reporting

Surface run-off and river water quality monitoring should be conducted during construction phase. Parameters, frequency, and discharge limits of the monitoring will be based on the EIA Conditions of Approval (CoA) No. 20 issued by Department of Environment (DoE) Malaysia on 28th November 2019. Parameter, frequency, and discharge limits are as shown in *Table 4.5* below.

Table 4.5: Parameters, Frequency and Limits

No.	Control and Monitoring	Discharge Limit	Frequency	Standard
1.	Surface run-off discharge	• Total Suspended Solids <50 mg/L; or • Turbidity <250 Nephelometric Turbidity Unit (NTU)	Quarterly	CoA No. 20
2.	River water quality	Class II		National Water Quality Standards (NWQS)

Note: This info is based on the EIA Conditions of Approval No. 20

Sampling and analysis of the surface run-off and river water quality parameters should be analyzed at an accredited lab from the Laboratory Accreditation Scheme Malaysia (SAMM). Location of the sampling points for water quality monitoring are shown in *Figure 4.3.*

The EIA Conditions of Approval No. 62 stated that report for surface water quality monitoring should be submitted to DoE Johor on a quarterly basis. Reports should be kept and made available for review during the third-party audit.

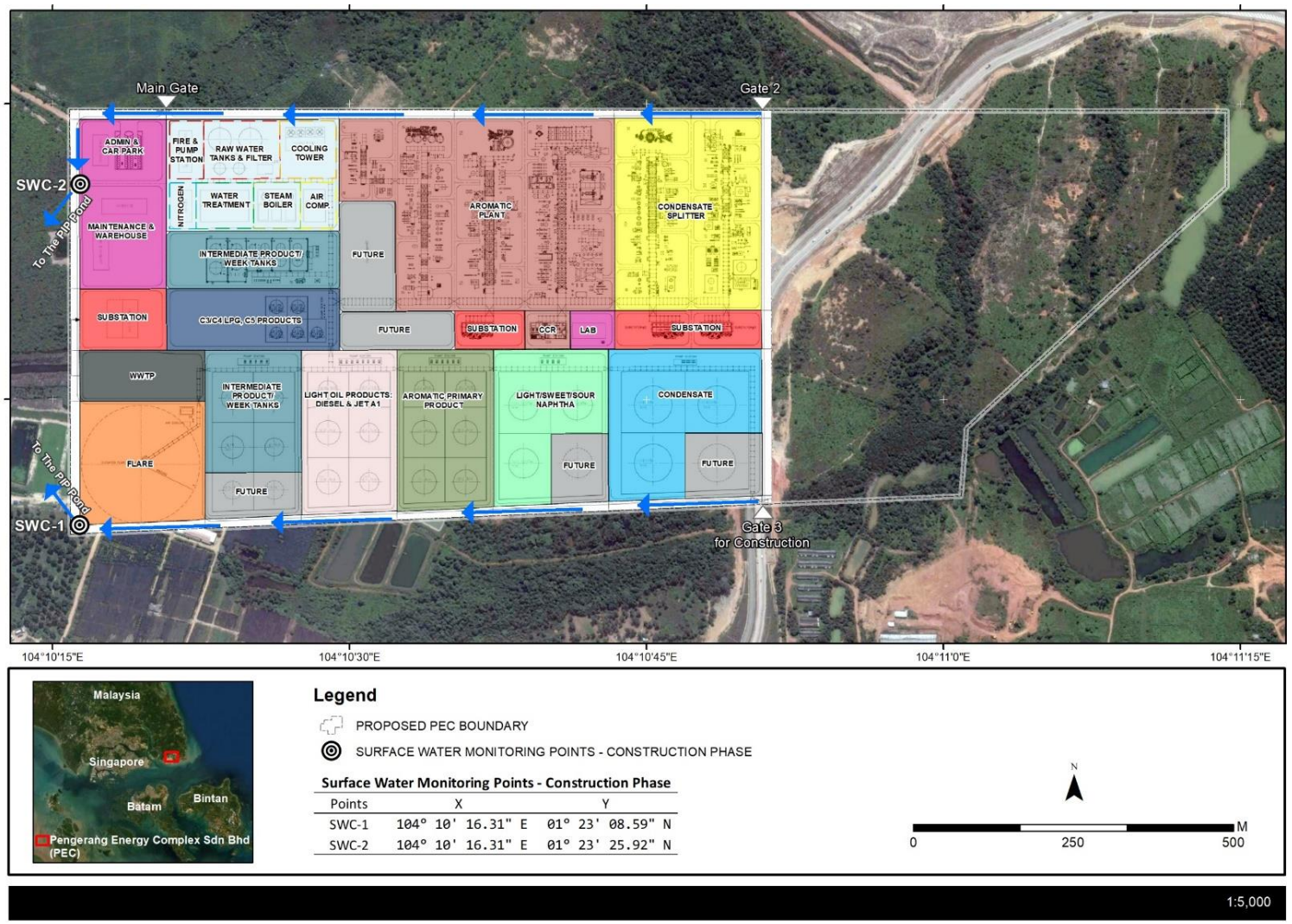


Figure 4.3 – Location of Surface Water Sampling Points During Construction

4.4 Land Disturbing-Pollution Prevention and Mitigation Measures (LD-P2M2)

4.4.1 Introduction

The construction of PEC will be conducted in two (2) phases namely Phase 1 and Phase 2. Phase 1 involves the development of the process areas, utilities and administration buildings, while Phase 2 will be reserved for future expansion. Phase 1 covers the western area of PEC site with an area of approximately 172 acres.

The construction activities during construction phase of PEC will involves minimal earthwork as the industrial park developer will deliver the Project Site at the required platform and therefore, the risk of impact of soil erosion on the surrounding environment is expected to be minimal. However, soil erosion may still occur due to other construction related activities and the risk of the impact should not be completely diminished.

This subsection will summarise the potential impact, mitigation measures as well as the environmental requirements regarding the LD-P2M2 that needs to be fulfilled by PEC in order ensure compliance with the regulations.

4.4.2 Compliance Requirements of LD-P2M2 Management Plan

This section covers the implementation of LD-P2M2 during construction phase. The action plans proposed are based on the national regulations and guidelines such as:

- Environmental Quality Act 1974;
- Conditions of Approval (CoA) of the EIA report for Proposed Pengerang Energy Complex Sdn Bhd, Pengerang Industrial Park, Sub-District of Pengerang, District of Kota Tinggi, Johor Darul Takzim publsihed by Department of Environment (DoE) Malaysia; and
- Environmental Impact Assessment Guideline in Malaysia: Land-Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2) published by DoE Malaysia.

4.4.3 Potential Impacts and Mitigation Measures

The land clearing and earthwork activities during the site preparation phase can lead to the considerable soil erosion and sediment delivery into the receiving water body. This will potentially deteriorate the water quality downstream of the project site. However, as stipulated in JCorp's EIA for the PIP, the site will be handed over as a platformed level land after site clearing and earthworks are conducted by JCorp's contractors and therefore, site clearing activities during the construction of PEC will be minimal.

Nevertheless, soil erosion would still potentially occur at the proposed Project site as it would be left bare without any turfing or paved surfaces. Furthermore, construction activities such as earthwork and trenching may potentially leads to the increase of sediment load into the storm drains. Therefore, in order to minimise the negative impacts of erosion and sedimentation during the construction phase of PEC, these mitigation measures will be implemented on both Phase 1 and Phase 2:

1. Exposed site should be kept to a minimum during construction;
2. Completed areas should be hard surfaced/ re-vegetated as soon as possible;
3. Temporary drainage with appropriate capacity to be provided prior to the site clearing activities;

4. Soil stabilisation technique to be implemented where turfing, paving and engineering measures to protect from erosion;
5. Temporary measures such as plastic sheets should be used to protect the exposed slopes; and
6. Ensure proper housekeeping and cleanliness of the site throughout the construction period.

Additionally, an Erosion and Sediment Control Plan (ESCP) will be prepared by qualified engineer according to the requirements under the Urban Stormwater Management Manual for Malaysia (MSMA) 2nd Edition 2012 and to be submitted to the Department of Irrigation and Drainage for approval, prior to construction. The design of the drainage system will be designed to achieve the "zero contribution to peak discharge" concept and will include the following LD-P2M2 features:

1. Perimeter Earth Drain
    - Perimeter earth drain will be constructed along the boundary of the site to channel any surface runoff from PEC site into PIP's drainage system.
2. Check Dam
    - Two (2) check dams will be constructed before each drainage outlet points to reduce flow velocity of the surface runoff. Check dam is a vertical barrier commonly constructed using stone, gravel-filled sand bags, masonry, logs, woven-wire and brush fills. Check Dam will reduce the flow velocity by disrupting the flow and dissipates the energy of the flowing water.
3. Sediment Basin
    - Sediment basin will be constructed at the northwest boundary of the site. Adequate safety precautions must be provided by restricting access to the site or access to the basin with suitable fencing. A stable emergency spillway will be installed to safely convey flows to prevent on-site flooding.
4. Drainage Outlet Structure
    - Two (2) drainage outlet structures will be constructed at the northwest and southwest boundary of the site. Drainage Outlet Structure is commonly constructed using rocks, or grouted riprap and will be placed at the end of PEC's perimeter earth drain. The outlet structure will absorb the flow energy and further reduce the flow velocity of the surface runoff.
5. Silt Fence
    - Silt fence will be utilised and placed along the boundary of the site before the perimeter earth drain. Silt fence is a temporary sediment barrier made of porous fabric and commonly attached to supporting wooden or metal post. The silt fence will act as a linear barrier that will ponds surface runoff allowing the sediments to settle and thus, preventing the soil from disturbed land from being washed off into the perimeter earth drain.
6. Wash trough for construction vehicles

The location of each proposed LD-P2M2 is shown in *Figure 4.4* (note that the locations are only approximations. Actual locations will be confirmed during the preparation of the ESCP).

Figure 4.4 – Proposed LD-P2M2

Source: PEC and Google Earth Image, 2016

4.4.4 Monitoring and Reporting

4.4.4.1 Daily Inspection of LD-P2M2 Control Measures

The purpose of this inspection is to ensure that all implemented control measures are effective. The inspection will be conducted by Environmental Officer (EO). The observation made by the EO during the inspection will be recorded and documented for future reference.

4.4.4.2 DoE Conditional of Approval Requirements

PEC is required to fulfilled the following requirements as stated in the EIA Conditions of Approval (CoA) item No. 10 – 19. The requirements are as follows:

1. Surface run-off control, erosion control and sedimentation control should be implemented effectively and maintain as outlined in the Environmental Management Plan (EMP) and comply with the Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2) document.
2. Schedule for earthwork activities should be adjusted and implemented in phases to reduce erosion and sedimentation problem. Development of each project phase requires notification to the Department of Environment Johor **three (3) months** prior to the commencement of each phase.
3. Inspection and maintenance of all Best Management Practices (BMPs) components should be implemented on a daily basis and maintained as necessary. Inspection and maintenance activities should be recorded.
4. If the rainfall reading is at 12.5 mm or more at a time, report via ESC Online should be submitted within 24 hours.
5. Access and construction road(s) should be constructed as per the road alignment as specified in the LDP2M2 drawing.
6. Tyres of machinery and vehicles exiting the project site should be cleaned before entering public road.
7. Areas with potential erosion and sedimentation problem including areas with space, workspace and mitigation area constraints should utilize BMPs for erosion and sedimentation control.
8. Location and method for disposal of any wastes, for example over burden soil and slurry from the construction activities, requires approval from Local Authority and to be specified in the EMP. The wastes should be placed at a minimum of 20 metres from any inland water reserve.
9. Any activity related to river or tributaries diversion including working in the river/ tributary is **prohibited** unless approval is obtained from the related agency.
10. All exposed and undeveloped areas should be covered utilising BMPs to ensure erosion and sedimentation control.

The EIA Conditions of Approval No. 62 stated that report of monitoring of the effectiveness of Erosion and Sedimentation Control should be submitted to DoE Johor through the ESC Online System when the rainfall reading gauge is at or exceed 12.5 mm within the first 24 hours. Furthermore, the monitoring reports should be kept and made available for review during the third-party audit.

The summary of the LD-P2M2 compliance monitoring and inspection programmes is shown in **Appendix C.**

4.5 Management of Wastes

Construction-sites will produce a significant number of wastes as a result of the construction works and workers activities on-site. For this project, it is expected to produce different types of wastes throughout the construction period. The type of wastes are:

1. General refuse
    - Food wastes;
    - Paper wastes;
    - Packaging (plastic bags, plastic sheets etc.); and
    - Plastic/ tin cans and containers.
2. Construction wastes
    - Timber-based materials;
    - Metal-based materials;
    - Soil from earthworks activities such as trenching and piping;
    - Bricks; and
    - Asphalt and concrete/ mortar and solvent-based products.
3. Scheduled/ hazardous wastes
    - Scrap batteries;
    - Used engine oil from oil change-outs;
    - Spent hydraulic fluids;
    - Used air, oil and fuel filters from vehicles and equipment;
    - Spent mineral oils and cleaning fluids for vehicles and equipment maintenance;
    - Spent solvents from equipment cleaning; and
    - Off-specification coating products and paints.

4.5.1 Compliance Requirements

This section of the ESMP covers the impacts and mitigation measures of wastes during construction phase. The action plans proposed are based on the national regulations and guidelines such as:

- Environmental Quality (Scheduled Wastes) Regulations 2005;
- Conditions of Approval (CoA) of the EIA report for Proposed Pengerang Energy Complex Sdn Bhd, Pengerang Industrial Park, Sub-District of Pengerang, District of Kota Tinggi, Johor Darul Takzim issued by Department of Environment (DoE) Malaysia;
- Guidelines for Packaging, Labelling and Storage of Scheduled Wastes in Malaysia published by DoE Malaysia; and
- Environmental Impact Assessment Guideline in Malaysia: Land-Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2) published by DoE Malaysia.

For this ESMP, the action plan will also consider the international requirement such as International Finance Corporation's Environmental, Health and Safety General Guidelines for waste management during construction.

4.5.2 Potential Impacts and Mitigation Measures

4.5.2.1 General Refuse/ Domestic Waste

General refuse includes food wastes, paper wastes, packaging (plastic bags, plastic sheeting etc.), and plastic/ tin cans and containers. Based on a projection of 1.42 kg/ person/day, solid waste generated from the workers' domestic activities, is estimated to be 9.94 tonnes/day. The storage and handling of such waste have the potential to give rise to a variety of adverse impacts. These include:

- Odour nuisance, visual impacts and attraction of pests and disease vectors if the waste is not collected regularly (i.e., daily);
- General fouling of the environment by windblown refuse; and
- Fouling of drainage channels and surface water resources as a result of refuse washed off-site in stormwater run-off or inappropriate waste disposal procedures.

The disposal of these types of waste at sites other than approved dumpsites can also lead to similar impacts at the disposal sites.

Following are the management of general refuse generated on-site:

- Where possible wastes will be recovered or recycled on-site;
- Suitable waste containers will be provided at the places of waste generation to facilitate safe and environmentally sound temporary storage;
- Domestic wastes are to be collected regularly and disposed at a licensed landfill;
- Waste shall be secured against wind-blown and animal foraging;
- Littering shall be prohibited; and
- Burning of domestic waste is strictly prohibited.

4.5.2.2 Construction Waste

Wastes generated by the construction activities are likely to generate various non-hazardous wastes such as the following:

- Construction materials such as concrete and broken rocks;
- Excavated materials such as soil; and
- General waste such as food, paper and other packaging materials.

The storage, handling, transport and disposal of these wastes have the potential to result in visual, water, dust and noise impacts in the event of inappropriate management methods. Potential impacts include:

- Contamination of soil and groundwater resources as a result of inappropriate waste storage, handling and disposal procedures;
- Fouling of drainage channels and surface water resources as a result of refuse washed off-site in stormwater run-off or as a result of inappropriate waste disposal procedures; and
- General fouling of the environment by windblown refuse.

Management of construction wastes generated on-site are as follows:

- A Solid Waste Management Plan will be prepared;

- External companies capable of recovering or recycling wastes, that cannot be handled on-site, will be contracted for waste removal whenever practicable;
- All wastes will be segregated by type ensuring that incompatible wastes are stored separately;
- Design a reuse planning for any possible materials such as cut off bricks and timber as supported data to supply chain;
- Good procurement/ supply chain planning, planning efficient working schedule, and conduct good storing and efficient warehouse management;
- Apply good workmanship with doable and efficient supervision based on efficient working schedule;
- Collecting all solid waste in designated compartment in proper method and timing.
- Disposed seepage in proper manner;
- Constructing proper drainage to flow storm water; and
- Applying good housekeeping in all activities.

4.5.2.3 Scheduled Waste

Scheduled wastes can pose serious environmental and health/ safety hazards unless they are handled, stored, transported and disposed of in an appropriate manner. Potential hazards may include:

- Toxic/ adverse health effects on the workforce/ exposed off-site populations;
- Toxic effects on aquatic organisms and adverse impacts on surface water quality, soil and groundwater in the event of materials mismanagement or an accidental release;
- Contamination to soil and groundwater due to leaks or spills on unpaved ground;
- Contamination to surface water bodies due to leaks or spills into drains and waterways; and
- Potential fire hazard.

The generation of waste during the construction period of PEC may have significant impacts on the wellbeing of the personnel on-site as well as to the surrounding area if not managed or controlled properly. Therefore, a good waste management system shall be implemented in order to reduce the impacts of waste generation and ensure good housekeeping protocols.

In general, control measures that can be implemented to reduce the impacts are as follows:

- All wastes will be properly segregated by type to ensure that incompatible wastes are stored separately;
- Recyclable waste will be recovered and recycle on-site.
- Third-party waste management companies will be engaged for recovering and recycling waste that cannot be handled on-site;
- Ensure that the waste storage facilities are capable of containing the predicted waste volume in a manner that is unlikely to cause damage to the environment nor cause any harm on the wellbeing on the personnel on-site;

- Wastes that will be disposed off-site will be fully documented in which the details of the waste, types, quantity, recipient, location of disposal will be recorded prior leaving the site; and
- Wastes that will be disposed off-site will only be handled and transferred by parties that are licensed to transport and/or treat or dispose the waste in accordance to Malaysia Regulations.

4.5.3 Monitoring and Reporting

Monitoring activities associated with the management of wastes shall be conducted which include:

- Regular visual inspection of all waste collection equipment and storage areas;
- Regular assessment of waste segregation and collection practices;
- Tracking of waste generation trends by type and amount of waste generated;
- Keeping all the waste generation data for review; and
- For scheduled wastes, E-consignment conditions which are online link up system between scheduled waste generator, scheduled waste transport contractor, recoverer and Integrated Facilities, Licensed Premise for Treatment and Disposal of Scheduled Waste (for residue) should be implemented in scheduled waste management.

4.6 Traffic Management Plan

4.6.1 Introduction

The purpose of this Traffic Management Plan is to provide a clear and concise outline for the management of vehicular movement from PEC activities during the construction phase, as well as the management of the mitigation measures that will be implemented to minimise the adverse potential impact that may arise from the increase of project-related traffic.

PEC acknowledges that the effective management of its project-related traffic during the construction phase is crucial in ensuring the safety of both its employees and the public, as well as to ensure optimum productivity in its day-to-day activities. As such, PEC is committed in ensuring compliance with the local regulation and guidelines that is related to the project-related traffic.

For the development of the Traffic Management Plan (TMP), the following legislation and guidelines were reviewed:

- Road Transport Act 1987;
- Factories and Machinery Act 1967;
- Factories and Machinery (Building Operations and Works of Engineering Construction) (Safety) Regulations 1986; and
- Guidelines for Public Safety and Health at Construction sites.

Road Transport Act 1987

This Act provides the details on the traffic regulation and its enforcement in Malaysia. The objectives of the Act are as follows:

1. To make provision for the regulation of motor vehicles and of traffic on roads and other matters with respect to roads and vehicles;

2. To make provision for the protection of third parties against risks arising out of the use of motor vehicles;
3. To make provision for the co-ordination and control of means of and facilities for transport; and
4. To make provision for the co-ordination and control of means of and facilities for construction and adaptation of motor vehicles.

Factories and Machineries Act 1967

The purpose of this Act is to provide legislative framework regarding the matters related to the safety, health and welfare of personnel, as well as the registration and inspection of machinery in various industrial sectors.

Factories and Machinery (Building Operations and Works of Engineering Construction) (Safety) Regulations 1986

Section 18 (2)(a) and (b) of this regulation stated that:

1. All vehicles used at construction worksites must be roadworthy and registered with the appropriate authority in accordance with the Road Traffic Ordinance 1958 [Ord. 48 of 1958].
2. No person shall drive a vehicle of any class or description in a construction worksite unless he is the holder of a driving license authorising him to drive a vehicle of that class or description.

Guidelines for Public Safety and Health at Construction sites

The purpose of this guideline is to provide guidance to project proponent on how best available practices can be implemented during the construction phase of a project to minimise the risk of accidents to the workers on-site as well as to the public.

Section 12 of the Guideline provides the framework of best practices that can be applied by project proponent during the construction phase. The summary of the guidelines that are related to the project are as follows:

1. All utilised vehicles at the construction-sites must be in the working condition as per the requirements of the Road Transport Department of Malaysia.
2. All drivers must possess the driving licenses that authorize him to operate a vehicle of that class or description.
3. The movement vehicles must strictly adhere to the traffic regulation
4. The design of traffic control should include various safety measures such as designated loading and unloading area, scheduled movement of vehicles to and from the site, and the implementation of barricades, and warning signages and lights when necessary.

4.6.2 Compliance Requirements

This Traffic Management Plan only applicable to all traffic-related aspects during the construction phase of PEC.

4.6.3 Project Site Accessibility

The existing road that provides access to PEC site is the State Road J52 that links to Federal Route 92 and transverses northwest to Kota Tinggi. During the construction phase, the only ingress and egress location of the project site is at the southern portion of the project site (located near

RAPID's Gate 3). Gate 3 will be utilising the same existing road (Unnamed Road) and can be accessed through the roundabout on State Road J52. The site access route is shown in *Figure 4.5.*

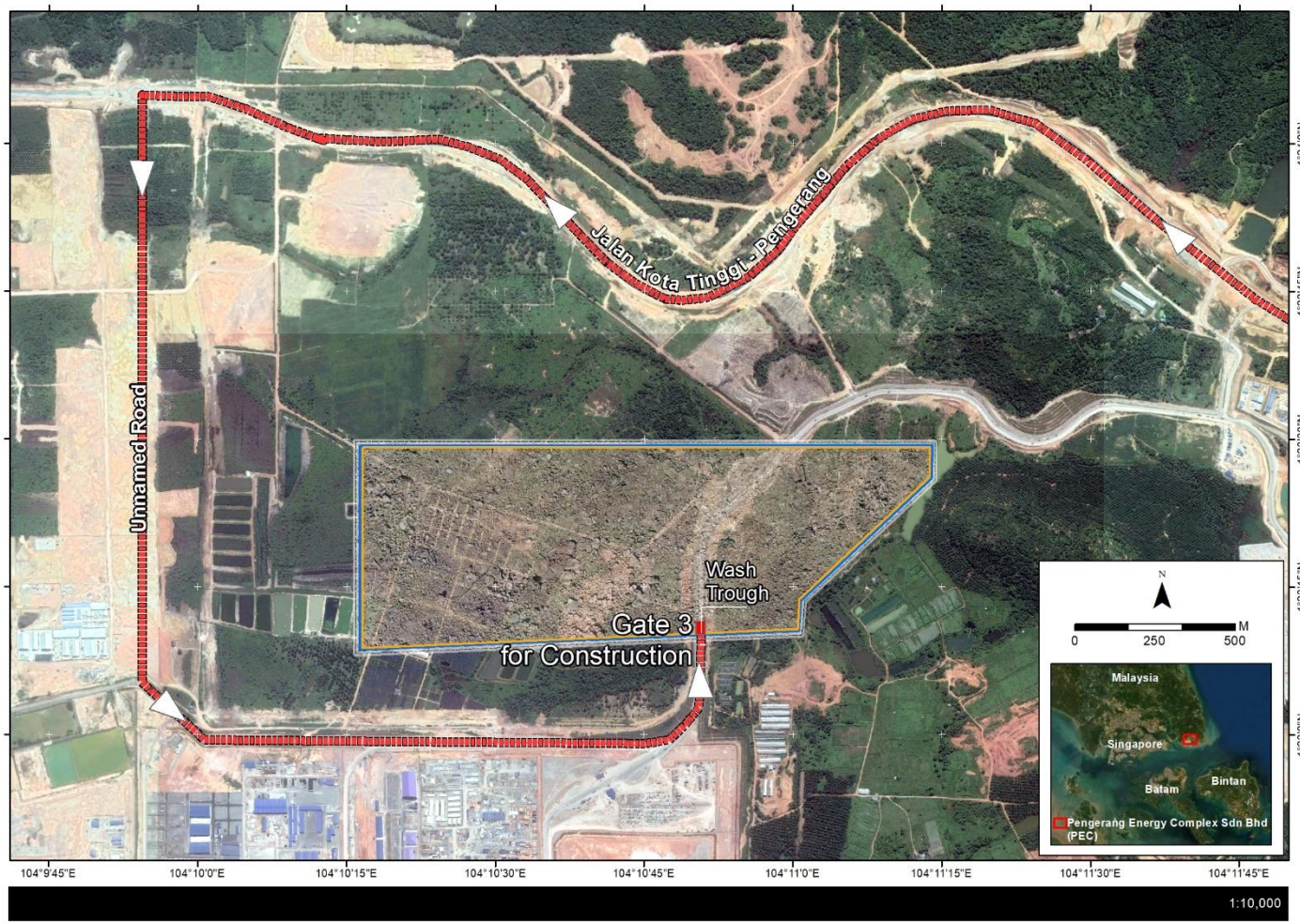


Figure 4.5 – Access Route to PEC Site

4.6.4 Anticipated Movement of Vehicles

During the construction phase, the peak anticipated workforce size during the construction phase is 7,000 workers. It is estimated that about 3,500 workers will be on-site at a time (based on two (2) working shifts). 1,000 workers are expected to be travelling in light vehicles and the other 2,500 workers will be travelling in buses provided by PEC from the worker's quarters to the PEC site. According to *Pusat Pemeriksaan Kenderaan Berkomputer* (PUSPAKOM), the maximum limit of passenger per bus is 44 passengers, and it is estimated that 50 buses will be utilised during this period.

4.6.5 Site Entry Requirement

In order to enter PEC site, all personnel are required to meet the following requirements:

- Completion of PEC Safety and Health Induction; and
- Completion of Site Delivery Drivers Induction (Transport Contractors Only).

4.6.6 Speed Limit

All personnel must adhere to the following speed limit within the site:

- Site entry/exit: 20 km/hr;
- Drop-off and Pick-up Area: 5 km/hr;
- Loading and Unloading Area: 5 km/hr
- Site Office area and carpark: 5km/hr;
- Main car park: 10 km/hr; and
- Access roads: 30 km/hr.

4.6.7 Construction and Excavation Activities

The traffic routes within the PEC site must be established away from any construction activities which include excavation, trenches and bore holes. Any excavated area must be cordoned off and barricaded when unattended to prevent inadvertent access by vehicles or pedestrians.

4.6.8 Usage of Mobile Phones

The usage of mobile while operating a vehicle is strictly prohibited. Any personnel who are found to be in non-compliance with this requirement will be reprimanded and subjected to disciplinary action or removal of access to the site.

4.6.9 Movement of Vehicles Within PEC Site

Information required based on the Best Practices on Occupational Safety and Health in Construction Industry 2019 – Section 5.5.7 for the development of Traffic Management Plan are as follows:

1. Location of site office and facilities during the construction phase;
2. Location of general waste storage and scheduled waste storage;
3. Designated travel paths for vehicles including entry and exit points;
4. Designated travel path for pedestrian;
5. Location of traffic control measure for each expected interaction including drawing of layout of barrier, walkways, signs and general arrangements to warn and guide traffic around, past or through the workplace or temporary hazard;

6. Designated area for loading and unloading of construction materials;
7. Designated area for collection for general and scheduled waste collection;
8. Designated area for pick-up and drop off area for personnel; and
9. Travel route during the event of an emergency.

4.6.10 Roles and Responsibilities

The organisational structure in implementing the Traffic Management Plan is as shown in *Figure 4.6.*

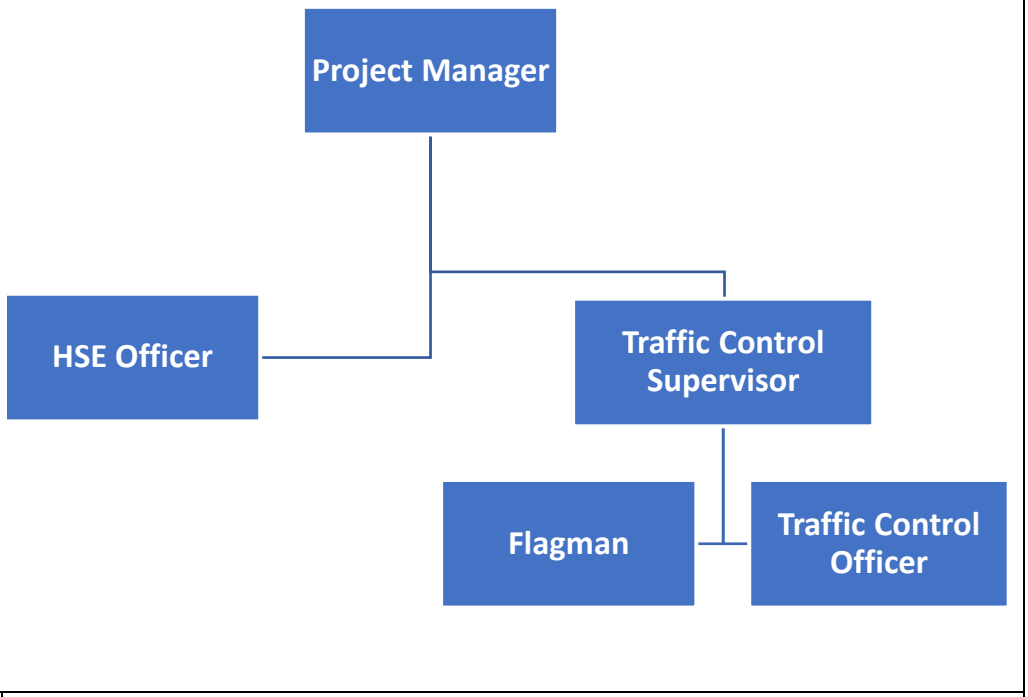


Figure 4.6 – Organisational Structure of Traffic Management Plan

The roles and responsibilities for Traffic Management Team are as follows:

Project Manager

- Support Traffic Management Personnel by providing provision and resources for the implementation of the traffic management plan.

HSE Officer

- Conduct health and safety assessments on relevant activities related to traffic management; and
- Implement the Traffic Management Plan by coordinating with Traffic Control Supervisor.

Traffic Control Supervisor

- Implement the Traffic Management Plan by coordinating with Traffic Control Supervisor;
- Ensure that all personnel in Traffic Management Team are well versed in procedures and safe work procedures in conducting daily duties in relation to the traffic management plan;
- Coordinate daily traffic monitoring programmes with traffic officer and flagman; and

- Conduct daily inspection of Traffic Management Personnel to ensure that each personnel are equipped with the appropriate equipment and clothing.

Traffic Control Officer

- Ensure that only authorized personnel and inspected vehicles are allowed to enter PEC site;
- Ensure that all personnel within PEC site adhere to the established traffic regulation; and
- Monitor the traffic flow within and outside of PEC site.

Flagman

- Assist in directing the traffic during peak hours or during the event of road congestion; and
- Assist traffic officer in monitoring the traffic flow.

4.6.11 Key Issues, Impacts and Mitigation Measures

4.6.11.1 Increase of Number of Vehicles

The construction of PEC will involve the mobilizing of various vehicles for the purpose of both transporting the workers as well as the construction materials. The impact of increased number of vehicles within and outside of PEC construction-site are as follows:

- Traffic congestion along the access route of PEC and Route J52; and
- Traffic congestion within the PEC construction-site.

In order to mitigate the potential risk of traffic congestion, the following mitigation measures are proposed:

- Vehicles arriving at site and leaving site should be suitably scheduled to minimise congestion occurring on public road leading to the site;
- Vehicles used at worksites must be inspected regularly to ensure that it is in great working condition to avoid any potential break down that may lead to road congestion. It is suggested that PEC to provide a workshop in which the periodic inspection could be conducted.
- Workforce is to be transported with bus or minibus to reduce the amount vehicles travelling to the site;
- Allocation of designated pathway equipped with barriers for pedestrians;
- Allocation of traffic control officer and flagman at each identified congested points or intersection within the site to control the movement of traffic and pedestrians;
- Provision of adequate traffic control signages and barriers;
- Provision of adequate traffic control measures such as reflector mirrors, sensors, alarms, and streetlight at every intersection and pedestrian crossing areas;
- Provision of adequate parking areas to limit number of vehicles within the site; and
- Designated drop-off and pick-up area of personnel and designated loading and unloading area must be located close to the entry gate to prevent vehicles crossing the site.

4.6.11.2 Safety and Health Issues Related to Traffic

The improper management of traffic may cause severe impact to the safety of the personnel on-site as well as the public which will consequently leads to severe setbacks to the project progress. The potential impacts on the general wellbeing of personnel on-site and the public are as follows:

- Increased risk in accident involving vehicles and pedestrians within the PEC construction-site;
- Increased risk in accident involving project related vehicles within the PEC construction-site; and
- Increased risk in road accident involving PEC utilised vehicles and the public along the site access route.

These are the proposed mitigation measures in order to minimise the potential impact of traffic-related issues:

- Vehicles arriving at site should be suitably scheduled to minimise the number of vehicles entering the site at a time;
- Allocation of designated pathway equipped with barriers for pedestrians;
- Provision of adequate traffic control signages and barriers;
- Provision of adequate traffic control measures such as reflector mirrors, sensors, alarms, and streetlight at every intersection and pedestrian crossing areas;
- Designated drop-off and pick-up area of personnel and designated loading and unloading area must be located close to the entry gate to prevent vehicles crossing the site; and
- Allocation of traffic control officer and flagman at each identified congested points or intersection within the site to control the movement of traffic and pedestrians.

Traffic control officers play an important role in ensuring the safety of vehicles and pedestrians alike as well as maintaining the safe traffic flow within the construction-site. Based on the Best Practices on Occupational Safety and Health in Construction Industry 2019 – Section 5.5.8, traffic control officers and flagman on-duty must be equipped with the followings:

- High-visibility or reflective clothing or vest;
- High visibility flag or LED hand-held traffic control light;
- Whistle; and
- Walkie-talkie

Traffic control measures such as high visibility traffic cone, barrier and signages must also be placed at the traffic control points on which the traffic officers and flagman will be stationed at.

Additionally, the traffic control officers and Flagman must be properly trained in the following communication method to ensure good line of communication in conducting its duty.

- Radio communication;
- Line of sight communication e.g.; hand signals or cap lamp light signals; and
- Verbal commands and confirmation of warnings and signals.

4.6.11.3 Noise

During the construction phase of PEC, Road J52 will be heavily utilised as it serves as the main access route to the construction site. During this period, vehicles particularly heavy vehicles such

as lorries and trucks are expected to increase in number and therefore will potentially increase the ambient noise level of the area. The potential impact of elevated noise level from the movement of vehicles are:

- Public disturbance to the residential areas especially to the residents of Kg. Lepau and Sebana Mixed Development which are located within the 5 km radius of the project site; and
- Health hazards especially to the workers on-site who may potentially experience symptoms of hypertension, hearing loss and sleep disturbances as side effects.

However, the impact of elevated noise due to movement of vehicles can be properly mitigated by implementing good practices on-site as prescribed in Best Practices on Occupational Safety and Health in Construction Industry 2019 – Section 5.5.4. The mitigation measures that are to be implemented are as follows:

- Vehicles will be driven responsibly and below 30 km/h within the construction-site;
- Vehicles are to be turned off when not in use and will not be left in idle;
- Vehicles arriving at site and leaving site should be suitably scheduled to minimise the movement of vehicles during the night time; and
- Protective equipment such as ear-muff shall be provided to traffic control officers that are on duty.

4.6.11.4 Fugitive Dust Emission

The construction of PEC facility will see an increase in the number and movement of vehicles in the area surrounding the PEC site. This may lead to adverse impact on the air quality of the immediate surrounding area due to the generation of fugitive dust which will consequently affects the public health of local population as well as the workers on-site.

The impact of fugitive dust emission generated from the movement of vehicles can be properly mitigated by implementing control measures as stated in the Best Practices on Occupational Safety and Health in Construction Industry 2019 – Section 5.5.4. The mitigation measures are as follows:

- On-site and access roads will be well maintained through mechanical means (sweeping or vacuuming) or damping with water and access road will be resurfaced;
- Trucks transporting potentially dusty materials will use secure load covers extending over the tail and side boards;
- Vehicle speeds on unsurfaced roads will be limited to 30 km/hr; and
- Provision of wash trough for construction vehicles entering and exiting the site.

4.6.12 Compliance Monitoring and Inspection Programmes

As part of the framework in the Traffic Management Plan, various traffic compliance monitoring and inspection programs will be established. These are to ensure full compliance besides prioritizing safe working environment of PEC during the construction phase as well as to ensure the effectiveness of the traffic management plan.

4.6.12.1 Periodic Vehicle and Driver Inspection

The main purpose of this inspection is to safeguard all vehicles that are being utilised during the construction of PEC are in safe working condition and road worthy as per requirements of the

Road Transport Department of Malaysia. Addition to that, the driver of the vehicle shall possess appropriate documentation and qualification to work on-site.

The inspection will be conducted when the vehicle first enters the site by traffic officers and HSE officers which will involve inspections of all heavy vehicles such as trucks and lorries. During the inspections, the condition will be inspected by a competent person and the details will be examined by the HSE officers. Each driver is required to produce the following documents:

- Valid Identification Card (IC);
- Valid Driving License;
- Valid CIDB Green Card;
- Valid vehicles documentation which includes:
    - Vehicle grant;
    - Insurance;
    - Road Tax; and
    - PUSPAKOM Inspection Certificate

The record of the inspection of each vehicle will be documented and kept by the HSE officers for references. The driver that has been inspected will be issued with clearance pass and clearance sticker to be placed on the vehicle to indicate that the vehicles have been certified safe to use. Follow-up inspection to renew the authorization clearance pass will be conducted every six (6) months.

4.6.12.2 Vehicle Entry Inspection

The purpose of this inspection is to ensure that all drivers that are involve in the construction phase of PEC possess the appropriate documentations and are authorized to enter the site.

The inspection will be conducted at the entry gate of the site by the traffic officers. During the inspection, the driver must produce the following documentations:

- Valid Identification Card (IC);
- Valid Driving License;
- Valid Authorize Entry Documentation;
- Valid Vehicle Documentation; and
- Valid Cargo Documentation (if vehicle is carrying cargo).

During the inspection, the driver of the vehicle will also have to produce the authorization pass that were given by HSE officers during the vehicle inspection to the Traffic Officers. This is to ensure that only authorized person and vehicles that have been inspected are allowed to enter the site. Vehicles that have not been inspected will be directed to the workshop for detailed vehicle inspection.

4.6.12.3 Daily Traffic Monitoring

The purpose of this monitoring programme is to ensure the smooth flow traffic within and around the PEC site. The monitoring activities will be conducted daily by the traffic officers. Under this monitoring programme, several traffic control posts will be established and placed at each identified congested point along the access route and within the PEC site. These control post will be manned by a Flagman and Traffic Officer during the peak hours (7 am – 9 am, 5 – pm – 6 pm) to monitor the flow of traffic and assist in the directing the traffic if necessary. Each station traffic

officer will be equipped with radio equipment to establish a line of communication with the Traffic Supervisor. The proposed location for the traffic control posts are:

- Entry Point from J52 in PEC main access route;
- Entry gate of PEC; and
- Any intersection within the PEC internal route.

The summary of the traffic compliance monitoring and inspection programmes is shown in **Appendix C.**

4.7 Occupational Safety and Health Management Plan

4.7.1 Introduction

This section presents the Occupational Safety and Health Management Plant for the document of Environmental and Social Management Plan (ESMP) for the proposed project entitled Proposed Pengerang Energy Complex (PEC), Pengerang Industrial Park, Mukim Pengerang, Daerah Kota Tinggi, Johor Darul Takzim.

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 16.7 kilometric tonnes per day (kMtpd), of aromatic petrochemicals and oil products, which will be processed from 6.324 MMtpa of condensate feedstock.

The technology provider for this project has been carefully selected for developing the proposed project. UOP of America has been identified as the only supplier who is able to supply the complete package by providing a single integrated advanced technology, encompassing condensate splitter process, catalytic reforming, product purification and the conversion of toluene to benzene and xylene, whilst ensuring economic attractiveness and environmental performance.

4.7.2 Compliance Requirements

Occupational Safety and Health (OSH) management is one of the vital constituents of Petrochemicals industry activities because most of the operational conditions, chemicals and end products (hydrocarbons and other compounds) associated with petrochemicals refinery production are well-known to pose serious safety and health threats to the workers.

In general, the scope of this safety and health management plan can be summarised as follows:

- To identify the potential hazards associated with work related construction activities;
- To identify possible on-site conditions that may be unsafe to the public while the construction will be on going and subsequent operational stages; and
- To provide safety and health plan to address those situations and to assist all concerned in complying with applicable standards as identified in this document or during subsequent site inspections

4.7.3 Main Issues on Occupational Safety and Health (OSH) in Construction

This section will be structured to reflect the above-mentioned scope based on the “Best Practice on Safety and Health in Construction Industry 2019” published by Department of Safety and Health (DOSH). These best practices comprise of 25 issues that cover the range from the sub-structure to finishing works including piling works, pile cap foundation, main building structural

works, interior decoration, steel structure construction and installation etc.; all aspects of building construction activities and temporary protective provisional system enhancing safety to provide safe and healthy workplace environment. Each preventive measure mentioned in the best practices conspicuously quote the statutory references relates Malaysian OSH Acts and Standards.

4.7.3.1 Main Entrance, Fence and Security Post

The main entrance in construction-site is to control the movement of visitors, workers, and vehicles. The fencing and the security post to ensure safety of the workers and the project site while keeping the public outside the construction-site. The main entrance or exit shall be used at all points of construction access and egress. Hoarding is the temporary fencing structure is required or needed for storage area, safety, and for public restriction on construction-sites.

The construction main entrance safety and health issues are including:

- Slips, trips and falls;
- Dirt or mud can be tracked onto public roads; and
- Run-off dirty water flowing out of the construction access through the sediment trapping device before discharge.

Some of the precaution actions can be taken are putting signage on the fencing perimeter need to warn intruders of the safety risk at those areas. Security post are generally placed at the entrance as checkpoints for monitoring, observations and maintaining access control into construction-site. In addition to reduce of sediment by simple friction of vehicle tires on the gravel pad, a vehicle washing station can be established at the site entrance. Wash stations, if used on a routine basis, remove a substantial amount of sediment from vehicles before they leave the site to avoid carrying the mud and dirt to the public road. The construction-site should have a good drainage system to ensure smooth water flow drainage, no stagnant water on the ground and to avoid the overflow run-off out of the construction-site.

This section is referred to Factory and Machinery Act 1967 (Act 139): Regulation 10 in Building Operations and Work of Engineering Construction (BOWEC) (safety) Regulation 1986; Regulation 7 of Factories and Machinery (Safety, Health and Welfare) Regulations, 1970; and in Section 15 in Occupational Safety and Health Act (OSHA) 1994.

4.7.3.2 Workspace

Every construction site usually provides a temporary administrative facility for workers to do their work. It is recommended that practical workspace i.e., cabin as site offices. The offices must be located on the “Green zone” which is nearby to the site area but isolated from the construction site to avoid any accidents.

However, some common potential risks related to workspaces such as falling objects, electric shock, fire or explosion incidents and flooding are identified. Therefore, the office must be isolated from tower crane operation radius and machinery to protect from falling object. To avoid from electric shock and from any kind of explosion, the office area must keep a safe distance from the overhead electric lines and from the high voltage transmission lines. The office should not be constructed in low laying area and should have a good drainage system to prevent stagnant water on the ground and to avoid flooding.

Legal requirement that referred to this section are as follows:

- Section 15 and Section 17 of OSHA 514; and
- Regulation no. 6; 7; 9; 24 (1) & (2) ;25;29;30;31; and 34 in Safety Health and Welfare

4.7.3.3 Overhead Protection Shelter

A single-story roofed structured is used for storage, workshop, or even protection against falling object or rain in the construction-site. Two typed commonly used in the construction site are rebar fabrication yard and wood fabrication yard.

The legal requirement followed in this section are:

- OSHA 514, Section 15 and Section 24;
- FMA 139 in
  a) Safety Health and Welfare Regulation 1970: Regulation 5; 6; 7; 20; 22; 23; 31 and 32;
  b) BOWEC: Regulation 6; 10(2); 20; 21, 119 and 122.

Rebar fabrication is one of the crucial activities in construction activity. Activities in rebar yard require a lot of material handling and hoisting. The potential hazards and the way to reduce the risks in *Table 4.6* below.

Table 4.6: HIRARC for Rebar Yard

Key Issues	Potential Risk	Effect	Risk Control/ Recovery Measure	Action by
Hoisting material	Improper lifting	Fatal, fracture, contusion	• Conduct Toolbox meeting before start working; • Only trained and competent Riggers, Signalman and Tower Crane Operator allowed to perform the task; and • Wear appropriate PPE including glove.	• SHO • SSS • Site Supervisor
	Moving load	Fatal, fracture, contusion	• Use tag lines to control the load; • Barricade loading and unloading area to prevent unauthorized personal into danger zone; and • Refresh training for signalman, rigger, and operator.	• Site Supervisor
	Falling object	Fatal, fracture, contusion	• All component brought up to height shall assemble immediately to prevent it from dropping accidently, and do not place any loose component unattended.	• Site S
Rebar fabrication	Sharp object	Cut, bruise	• Provide worker with hand glove and safety goggle; and	• Site Supervisor
	Caught between object	Contusion, bruise, cut, amputation	• To hoist or stack material properly and keep bodily parts away from moving load such to stationary object.	• Site Supervisor
Material handling	Awkward	Slip disc,	• Lift materials within personal	• Site

Key Issues	Potential Risk	Effect	Risk Control/ Recovery Measure	Action by
	body position while loading material	back pain, muscle spasm	capacity follow manual lifting procedure; and • Adopt two (2) man or more if lifting load beyond personal capacity.	Supervisor
	Sharp object	Cut, bruise	• Keep bodily part away from moving load.	• Site Supervisor

4.7.3.4 Traffic Management

Traffic management on-site is important to ensure safety and efficient vehicles movements. Vehicles including powered mobile plant moving in and around workplace, reversing, loading, and unloading are often linked with death and injuries to workers.

Hazards related to traffic at the construction-site commonly involved pedestrian safety and reversing vehicles movement. Thus, it is essential that separate traffic route between the pedestrian and vehicles use with clearly marked walkways to be provided. Vehicles are prohibited being used in pedestrian space and vice versa. Securing vehicle operating by installing pedestrian barriers, traffic control barricade, chains, tape, or billboard. Providing clear sign and lit the crossing points where walkways across roadway so pedestrian and driver see each other clearly.

The duty of employer includes implementing control measure to prevent people being injured by moving vehicles at the workplace. The duty of employer is to provide necessary information, training, instruction or supervision (flagman) to protect all persons from risks to their safety and health. The workers must have necessary training, qualification, or license to operate the vehicle. Where needed ensure competent person with necessary training or qualified person to operate powered mobile plant.

Legal requirement for this section is specified as follows:

- Section 15 of OSHA 514;
- FMA 139 in Safety Health and Welfare Regulation 1970: Regulation 7; 11 and 19;
- BOWEC: Regulation 10; 18; 20;58; 59; 60; and 61;
- FMA 139 in Person in Charge: Regulation 13; 19; and 20.

4.7.3.5 Fire Safety and Water Supply

Water for construction can be anything from welfare, sanitary use and wash hands, to storage enough water, and to keep processes running such as concrete mixing. For general use and production use, general water supply is required to be used to ensure the water quality. For fire emergency use on-site, general water supply or natural sources i.e., river water and rainwater can be used. However, the water source must be stable and reliable, meeting the water requirement for firefighting.

Fire risk can be defined as the product of the probability of occurrence of a fire to be expected in each process or procedure, and the consequence or extent of damage to be expected on the occurrence of fire. The main fire risks under management control are:

- electrical faults such hot work, smoking, temporary lighting and lamps, arson, and lightning; and

- fuel hazards such combustible building components, flammable gases and liquids and waste materials.

Therefore, certain measures should be taken to minimise the fire risk such as a suitable and sufficient Fire Risk Assessment (FRA) should be undertaken and maintained throughout construction work, provide emergency response plan including fire protection equipment and fire safety plan including escape routes on construction sites.

Adequate water supplies should be made available for firefighting; these should be made available as part of site mobilization and reviewed at appropriate times throughout the works. Appropriate fire extinguishers (e.g., CO_2) should be within the vicinity of distribution panels and other items of electrical equipment. Clear signs relating to fire safety issues must be installed and maintained in prominent locations.

Legal Requirements in this section are as follows:

- Regulation 15; 16; 17; 21; 22; 36; and 37 in Safety, Health and Welfare Regulations 1970, FMA 139;
- BOWEC 1986: Regulation 12; 16; 21; 22; 23;
- Act 341: BOMBA Service Act 1988; and
- Act 581: Water Supply Act 1998.

4.7.3.6 Site Clearance

Clearing and excavation are a part of the main activities which are carried out in preparing site for construction projects. A proper planning by providing the necessary measures to protect the cleared area from erosion are among others; ensure the site is in condition of free of existing obstruction i.e.,, natural unused or none schedule of contouring earth level and native growth plantation; dumping debris or waste on the projection schedule project site and to be demarcates from the open public usage.

Potential hazards related to land clearing activities are soil erosions and heavy machineries in used. Site drainage to be complied to prevent run-off and flooding on-site which could cause damage to the site working access.

Before filling commences the contractor shall make available for inspection, by the superintendent, the foundation of the embankment. Borrow pits will not be permitted on-site unless written approval is obtained from the superintendent. All personnel entry shall be registered and safety briefing shall be conducted. Permit-to-work systems to be implemented for all tasks before executing any works on-site.

This section followed the legal requirement as in FMA 139 in BOWEC 1986: Regulation 10; 17; 18; 22; Part XII; Part XIII; and Part XVI.

4.7.3.7 Piling Work

Pile foundations are used extensively for the support of buildings, bridges, and other structures to safely transfer structural loads to the ground and to avoid excess settlement or lateral movement. There are two (2) types of common piles used in construction which is Geotechnical pile and Structural pile types.

Major potential hazards related to piling works are noise and vibrations. Noise level can be controlled by complying to guidelines requirements, or by the working rules. The type of pile and method of installation is to be such that any vibration, shock caused does not damage to any surrounding structures, services or cause any legally actionable disturbance.

Piling works shall be commenced after the completion of site clearance and designated route access on-site. Demarcate the activities area with barricade and signages only for authorise personnel to entrance.

Pile driving equipment shall be handled by competent person. Stand-on supervision require to ensure all activities and sequence to be proceed in proper and safely manner. Designated person related to the piling activities must confirm all working procedures comply with the standard requirement practices.

Legal requirements in this section are referred to the Factories and Machineries Act 1967 (Act 139) in BOWEC (Safety) 1986: Regulation 124; 125; 126; 127; 128; 129; 130; 131; 132; 133; and 134.

4.7.3.8 Excavation Work

Excavation is a process of moving earth, rock or other materials with tools, equipment, or explosives. It includes earthwork, trenching, wall shafts, tunnelling and underground. Excavation has several important applications including exploration, environmental restoration, mining, and construction. Excavation is used in construction to create building foundations, reservoirs, and roads. Some of the different processes used in excavation include trenching, digging, and dredging and site development.

Excavation work should be carefully planned before work starts so it can be carried out safely. Planning involves identifying the hazards, assessing the risks, and determining appropriate control measures in consultation with all relevant persons involved in the work including the principal contractor, excavation contractor, designers and mobile plant operators. If the excavation work is or involves high risk construction work, the employer must prepare a Standard Working Procedure (SWP) before the high-risk construction work starts.

If excavation work is planned without shoring, the continuing safety of the excavation will depend on the conditions arising during construction. If the conditions during construction are not as expected, or if conditions change during the work (e.g., different soils, heavy rain/flooding) take immediate action to protect workers, other people, and property. No matter how deep an excavation is, if there is a risk of collapse, put controls in place to prevent this. Involve a competent person when selecting what ground collapse controls to apply.

Several legal requirements are referred in this section:

- Section 15 and Section 24 of OSHA 514;
- FMA 139 in Safety Health and Welfare Regulation 1970: Regulation 7; 8; 9; 19; 20; and 32
- Building Operations and Work of Engineering Construction Regulation 1986: Regulation 6; 8; 9; 10; 11; 13; 14; 15; 18;19; 20; 21; and Part XII;
- Noise Exposure Regulation 2019; and
- Guidelines on Occupational Safety and Health in Construction Industry (Excavation Work) 2017.

4.7.3.9 Sewage and Drainage

A sanitary sewer is an underground carriage system specifically for transporting sewage from particularly a construction site covered in these best practices, through pipes to treatment facilities or disposal. Sanitary sewers are part of an overall system called a sewage system or sewerage. Sewage may be treated to control water pollution before discharge to surface waters.

Working near or in a manhole inherits potential dangers which may result in serious accidents. The common ones include falls/slips, fire or explosion, oxygen depletion, gas poisoning, heat stress, drowning, asphyxiation arising from gas, fume, vapor and entrapment by free flowing solid. Amongst which, dangers involving gases are easily overlooked or neglected, leading to serious casualties.

A series of mitigation measures should be applied during the construction of sewage to avoid the potential risk of slips, trips and fall at work such as:

- Trenches must be adequately supported, free from boulders and tree roots must be taken out;
- Muddy ground, water and soft areas in the trench base must be removed;
- Materials, spoil and equipment must be stored safety and plant should be operated within a safe working distance; and
- The trench must be adequately protected from slips, trips, falls, site traffic and have a safe means of access and egress.

For sewer adoption and diversion works, construction must comply with the drawings agreed by Department of Work, Malaysia. It is recommended that site copy of the agreed drawings is available to those carrying out construction to avoid any mistakes or deviation from specification.

Working in a confined space can caused serious injury if not properly performed by competent personnel. All confined spaces shall be clearly identified, documented, and labelled. It includes any equipment that constitutes a confined space in the workplace. The document should contain the particulars of the types of confined spaces and their services. For the equipment record, it is important to also include its type and identification number.

It is critical to identify and evaluate each confined space to determine whether it has chemical or physical hazards and not to assume that a confined space is hazard-free. Different chemical and physical hazards may be introduced through various work activities inside the confined space. When a confined space is known to contain hazardous contaminants, it is crucial to purge the space adequately before any entry. It is also important to note that purging and ventilation do not exclude the need for gas testing by authorized gas tester. Purging of a confined space is conducted before any entry and the purpose is to remove any existing contaminants by displacing the hazardous atmosphere with another medium such as air, water, steam, or inert gases. Do not enter any confined space when adequate ventilation is absent. As such, it is important to provide an adequate and effective ventilation to always maintain the contaminants concentration level as low as possible, and the level of oxygen within safe range. Besides that, it is important to ensure that all employees are given suitable and appropriate training to carry out the workplace task. This will include emergency procedures and if required training in the use of breathing apparatus.

Legal requirements referred in this section are Building Operations and Work of Engineering Construction Regulation 1986, Indah Water “Typical Civil and Structural Engineering Specification for Sewerage Works (Sewers, Force Mains, Pipe laying, Manholes and Appurtenances)”, Standard Specifications for Building Works 2005 (Soil Drainage), Environmental Quality Act 1974: Section 29 and Industry Code of Practice for Safe Working In A Confined Space 2010.

4.7.3.10 Foundation

A foundation work in construction is the element of an architectural structure which connects it to the ground and transfers loads from the structure to the ground. Foundations are generally considered either shallow or deep. Foundation is a part of a structural system that supports and anchors the superstructure of a building and transmits its loads directly to the earth. Foundation

is important as they increase the stability of the structure as a whole and prevent overturn, to secure the level surface and firm bed for building operations and to prevent the lateral movement of the supporting materials.

The typical potential hazards that are related to foundation works are excavation hazard, falls and falling objects, hazardous atmosphere in an excavation, natural hazards and weather, overhead services, site safety, vibration and hazardous noise, manual handling task, and ground stability hazards.

A combination of controls may need to be used and to make sure controls prevent anyone being harmed, so far as is reasonably practicable. The recommended control is as *Table 4.7* below:

Table 4.7: Recommended Mitigation Measures for Foundation Work at Construction site

Work Activity	Mitigation Measures
Foundation Works	• Determine any underground installations such as sewers, power cables, telephone lines, and water and gas services prior to commencement of excavation; • Special precautions must be taken to avoid damage to the underground services, e.g., not to use excavator if at around the depth of the services; • Excavations and trenches of 1.5 meters or more in depth shall be sloped, stepped in an approved manner or provide adequate shoring to prevent soil cave in or collapse; • Ladders shall be provided in excavations and trenches of 1.2 metres or more in depth to ensure safe entry and exit. A ladder or run of ladder between any two successive landings shall not exceed 9 metres. Ladders shall be extended from the trench bottom to at least 1.0 meters above the ground level; • Excavated or other materials shall be stored at least 1000mm away from the edge of any excavation; • Excavated trench shall be inspected daily by designated person; • All trenches exceeding 4 meters in depth, shoring, sheet piling or any other soil support systems shall be designed and drawing of a Professional Engineer; • Adequate barricades shall guard at open sides of excavations where a person may fall from a height of more than 1.5 meters and suitable warning signs in placed where they can be seen; • Power machines used for excavating shall be positioned so that the operator is on the side away from the bank; • Ramps and runways entering excavations shall be wide enough for men and vehicles. They shall be substantially constructed and properly braced and supported and shall be provided with guardrails. When inclined over one-in-eight (1:8) walkways shall be properly secured; • Workmen engaged in scaling, sloping or trimming works should use safety ropes; and • Road crossings or designated temporary passage crossing trench shall place a steel plate of adequate thickness over the entire trench prior to allow passing of load trucks or construction vehicles traffic.
Road Works	• Adequate warning signs should be provided at approaches at least 50 meters from the working area; • Adequate detours should be provided when road is under repair or is not passable;

Work Activity	Mitigation Measures
	• Blasting areas should be cleared within a safe distance and adequate warning signals shall be used; and • Railings may be provided on deep embankments and narrow portions.
Piling Works	• All pile-driving equipment should be inspected daily by a designated person before the start of work in accordance of daily checklist and every defect shall be immediately corrected before pile-driving commences; • Every piling frame and its attachments must be thoroughly examined by an approved person at least once in every twelve months; • The operator of every pile driver must be protected from falling objects, steam, cinders and water by a substantial covering; • The operator must carry out daily inspection of piling machine in accordance of daily operator's piling equipment checklist before commencement of work on each day; • The preparation of the piles must be done at a safe distance from the driving operation. During the hoisting of piles, all persons not actually engaged in operating the equipment and handling the piles must be kept out of the area; • When the pile driver is not in use, the hammer must be choked or blocked in the leads or lowered to the ground; • A ladder extending from the bottom of the leads to the overhead sheaves shall be permanently attached to the structure supporting the leads; • Where a structural tower supports the leads, suitable working platforms of adequate strength shall be provided on levels of the leads at which it is necessary for men to work. Such platforms should be provided with a safety railing and toe-board on all sides, except on the hammer or lead side of the platform. Where such platform cannot be provided, a safety belt shall be provided; and • All concrete piles must have attained the required strength before being hoisted or being subject to piling stresses.
Pile Testing	• The testing of piles must be conducted under the direct supervision of a designated person; • Reasonably practicable measures must be taken to warn persons not to approach within 50 metres of a pile under test; • To carryout inspection in accordance of test pile operation checklist; • Before placing or advancing a pile driver, the ground shall be inspected by a designated person and, where necessary for firm and level footing, timber shall be placed; and • After placing or advancing a pile driver, inspection and correction of the footing shall be made, when necessary, to maintain stability.

Relevant Safe Operation Procedure (SOP) deems required to assist in developing and controlling to any potential to cause harm to persons, construction site, materials or the environment as identified from the results of risk assessment.

Legal requirements referred in this section are Factory and Machinery Act 139 Regulations (FMA) Part XII Sect. 111 to 118, Part XIV Sect. 124 to 134, DOSH guidelines on trenching for construction safety (2000) and Guidelines on Occupational Safety and Health in Construction Industry (Excavation Work) 2017.

4.7.3.11 Material Loading Platform

Loading platforms are essential for bringing materials into and out of a building on a work site. Loading platforms consist of a cantilevered platform extends from the building on one half and the other half going into the building with columns that are secured to the floor and roof of the building. Material Loading Platform is a temporary platform which is used to loading/unloading material.

Potential hazards that associated with material loading platform are workers fall from height, platform collapse, tripping hazard and falling objects.

It is the responsibility of the main contractor to provide and maintain loading platforms. Recommended mitigation measures during design and construction, positioning and loading, load test, notices and rules, training, and inspection activities are as below:

Table 4.8: Recommended Mitigation Measures for Material Loading Platform at Construction site

Project Activities	Mitigation Measures
Design and Construction	• The loading platform design must be approved and endorse by a Professional Engineer; • Suitable edge protection must be provided to the edges where persons and/or materials can fall; • Any loading platform gates must provide ridged edge protection. Cantilever loading platform installation shall have constructed plan through PE approval design and comply with all the specifications. Cantilever loading platform designed with SWL of maximum 800kg; • Cantilever loading platform must connect with building structure; • Cantilever loading platform height is 3m. If the change of storey height or the cantilever length changes greatly, the calculation should be recalculating; • The construction-site prohibits the use of steel tubular cantilever loading platform, tool type loading platform installed at the opening of the frame, must strengthen the frame structure; and • Recommended that cantilever loading platform, to according to the actual situation of workplace but an obligation to have PE approval design.
Positioning and Loading	• The location of loading platforms should be decided by the main contractor; • Locate loading platforms so that they do not create a snag hazard for the site tower cranes; • Load material such that it does not exceed the guardrail height; and • Loading activity shall be performed in the presence of competent banksman.
Test/Certification	• Material loading platform shall be tested through PE approved design for each interval of every three months; • Loading platforms must also be tested whenever modified or relocated; and • Clearly display Safe Working Load (SWL) of each loading platform at both side of cantilever loading platform.
Installation and dismantle	• The upper pull point of the dismantle platform must be located

Project Activities	Mitigation Measures
	on the building, cannot set up on the scaffold and other construction equipment. Each steel rope must be embedded with a hanging ring, which is subjected to single force; • Installation should be slightly higher than the outer side of the platform; • All channel connection use welding, weld height is not less than 8mm, and weld should be full. Ensure the I-beam upper surface was in the same level; • All horizontal members and vertical posts are fully welded; • After the cantilever dismantle platform is finished, the platform welding quality must be checked and accepted; • The area under the loading platform shall be barricaded appropriately; • Display adequate warning signs & notices for the safe use of platforms; and • All notices and warning signs must be in national language (Malay Language) and then with other language that understood by the workforce.

Legal requirements referred in this section are Safe Working Load (SWL) designed and endorsed by Professional Engineer, Factory and Machinery Act 139 (FMA) Regulation 4, 21, Section 10, Section 26, FMA (Building Operations and Works of Engineering Construction) (Safety) Regulations 1986 and Guidelines for Public Safety and Health at Construction-sites (Removal of Debris).

4.7.3.12 Scaffold

Scaffold is one of the important elements in construction to facilitate the flow of building construction progress by providing temporary working platform, building perimeter protection, false work or formwork shoring support, and others that requires for building construction activities.

Scaffolding activities are subjected to legal requirements in Factory and Machinery Act (Building Operations and Works of Engineering Construction) (BOWEC) (Safety) Regulations 1986. Part X: Scaffold of the Regulations outlined the legal provisions on scaffolding activities in construction industry.

Based on the scaffolding activities, these are potential risks which may pose danger to the workers at the work area:

- workers fall from height;
- scaffold collapse;
- tripping hazard; and
- falling objects.

The project proponent shall ensure that mitigation measures are taken to minimize potential risks from scaffolding activities such as:

- Scaffold must be inspected by competent person at least every seven days and at other times in certain circumstances as required in the “Inspection of Scaffolds” of the Factories and Machinery Act (BOWEC) Regulations 1986. Checks should also be carried out to ensure the scaffolds are properly stored, constructed and dismantled;

- Always practice good housekeeping;
- Ensure proper materials handling and barricade working area (within 2m radius); and
- Safety harness must be worn and hook at the strong point when working at heights.

4.7.3.13 Concrete Work

Concrete is known as a very strong and versatile moldable construction material. It consists of cement, water, sand and aggregate (e.g., gravel or crushed rock) mixed with water. The cement and water form a paste or gel which coats the sand and aggregate. When the cement has chemically reacted with the water (hydrated), it hardens and binds the whole mix together. The initial hardening reaction usually occurs within few hours and it takes some weeks for concrete to reach full hardness and strength.

This section will cover the workflow of concreting, determine the hazard when doing concrete work and control measures for the hazards. Legal requirements that need to be adhered to when doing concrete works are:

- Section 15 and Section 24 of the Occupational Safety and Health Act (OSHA) 1994;
- OSH (Use and Standards of Exposure of Chemicals Hazardous to Health) (USECHH) Regulations 2000;
- Regulation 6, 7 ,8, 12 ,23 ,32 ,36 of the Factory and Machinery (FM) (Safety Health and Welfare Regulations) 1970;
- Mineral Dust Regulations 1989; and
- Regulation 10-12, 15, 18, 19, 22, 23, Part III and Part IV of the Factory and Machinery (BOWEC) Regulations 1986

Potential risks identified when doing concrete work and its control measures are summarized in *Table 4.9* below.

Table 4.9: Potential Risks and Control Measures for Concrete Work

Potential Risks	Control Measures
Falling at height on the edge of formwork frames during erection	• Install edge protection on frames; and • Erecting framework must be approved by qualified designer.
Falling objects while stripping formwork	• Formwork supervisor to supervise during erection of falsework; and • Prepare Safe Work Method Statement (SWMS) for stripping operation.
Awkward posture during pouring of concrete Repetitive handling of materials	• Suitable PPE worn by personnel during pouring of concrete; • Formwork drawings to clearly identify the maximum (pre-pour) point loadings; and • Not exceed the maximum loading weight specified by an engineer.
Floor collapse	• Protect personnel using personal fall arrest system
Exposure to silica	• Adequate training provided for employees

Potential Risks	Control Measures
	to understand the risk of exposure to silica; and • Suitable PPE usage for the affected workers to minimize the exposure level such as N-95 respirators.
Striking against object when doing cement pumping	• Ensure clear pathway for the hose by looking out hoses that may running underneath ladders and scaffolds

4.7.3.14 Fall Protection and Working at Heights

The following Section discussed on working at height, protection against floor opening, building edges and object dropping from height. Standardized protection system is important to safeguard workers in construction-site against unsafe conditions.

Legal requirements that stipulated the provision for fall protection and working at heights in construction industry are as below:

Main Act/Regulations/Guidelines	Applicable Provision
Occupational Safety and Health Act 1994	• Section 15: General duties of employers and self-employed person to their employees; • Section 17: General duties of employers and self-employed person to other than their employees; and • Section 24: General duties of employees at work place.
FM (Safety Health and Welfare) Regulations 1970	• Regulation 7: Access to work place; • Regulation 8: Openings generally to be fenced; • Regulation 9: Stairway; • Regulation 10: Fixed ladder; and • Regulation 12: Working at height
FM (BOWEC) Regulations 1986	• Regulation 10(1): Access to workplace; • Regulation 15(1): Protective equipment; • Regulation 44 & 45: Construction of catch platform; • Regulation 50-55: Safety belts and safety nets; and • Regulation 62-71: Ladders and step ladders
Guidelines for the Prevention of Falls at Workplace 2007	

Among activities that are being carried out in the construction site require working at heights. This involves ascending/descending of ladders, carrying at height level with assistance of scaffolding and scissor lift, and elevated working platform by the use of temporary working platform. The potential risks are mainly: -

- Fall from height; and
- Falling of objects such as tools/equipment/material on personnel working below.

Thus, it is paramount that the project proponent, take responsibility to ensure the personnel working at heights are familiar with the safety requirements.

The following safety requirements shall be given due consideration and the contractor and sub-contractor are responsible to ensure that these requirements are strictly adhered to:

a) All personnel are to wear safety harness and lanyard shall be used to anchor securely the lifeline or to any rigid point of structure while working at height of more than 2 metres.

b) Temporary means of access using ladder shall be provided, where permanent means of access/egress is unavailable.

c) Climbing/descending over structures, equipment and beams is prohibited, it has to achieve by use of ladder, scissor lift or scaffolding.

d) Ladder shall be inspected for broken, missing, damaged or defective rungs at least once a week.

e) Tool bags are to be used when carrying tools, accessories, and other items required for carrying out task at height level. The tool bag has to be slung over the shoulder when ascending or descending the ladders.

f) Tools and accessories, etc., shall be lifted, lowered or shifted to and from elevated workplaces by using a rope or other safe means of lifting/lowering practices.

g) A proper scaffolding must be erected to facilitate the task where permanent working platform is not provided on the elevation where work is to be done.

h) During progress of work, the affected area at below or at floor/ground level directly below the work area shall be cordoned off effectively by the use of warning tape and detail a person standby at the barricaded area to caution passers-by of the activities at height.

i) All tools, articles, and other items brought to the work area shall be removed from the places of work and the area shall be cleared off of all unwanted items. Under any circumstances, no loose items are to be left at height level, it has to be brought down immediately upon completion of work.

j) Implement a safety monitoring system means a fall protection system designated for recognizing and warning employees of fall hazards

4.7.3.15 Mechanical and Electrical Work

Mechanical and electrical (M&E) works are one of the essential parts in building construction, where personnel working in this area of work are at the high risks of getting injured or exposed to hazardous substances that are dangerous to health if precautions are taken lightly.

The legal requirements that applicable for carrying out mechanical and electrical work in building constructions are:

- Electricity Supply Act 1990;
- FM (BOWEC) Regulations 1986;
    - Regulation 16: Electrical Hazard
    - Regulation 25: Ventilation
- OSH (Use and Standards of Exposure of Chemicals Hazardous to Health) Regulations 2000

Mechanical Safety

In the aspect of building construction and design, mechanical part of building construction includes:

a) Plumbing system

b) Mechanical Ventilation and Air Conditioning (MVAC) System

c) Sprinklers

These mechanical works have its hazards that pose potential risks to the workers working in that area. The project proponent must take necessary mitigation measures in ensuring that the risks are minimized or eliminated if possible. *Table 4.10* below summarized the potential risks and control measures for mechanical works.

Table 4.10: Potential risks and Control Measures for Mechanical Works in Construction-site

Mechanical work	Potential risks	Control Measures
Plumbing	Exposure of hazardous substances such as lead, sulphur dioxide, mould, adhesive solvent and other toxic	• Ensure that SDSs is available and display at the place of work • Read chemical labels and refer SDSs prior starting the work • Always wear proper PPE when handling chemicals
	Proximity to flammable or combustible material	• Avoid doing any hot work nearby which can cause explosion and fire • Hot work permit to apply when doing welding activity • Use PVC product in a well-ventilated room • Ensure emergency response equipment are available and nearby the work area
	Awkward position or performing awkward manual task which increased risk of musculoskeletal injuries	Working using “buddy system” where two men working can reduce time of exposure to awkward position
	Lifting heavy or awkward object	Install piping support from machinery such as pulley system or genie lift heavy lifting
	Slips, trips and fall especially when working at wet environment	Ladder shall be inspected for broken, missing, damaged or defective rungs at least once a week.
	Burn from grinding, cutting and hot work done	• Avoid doing any hot work nearby which can cause explosion and fire • Hot work permit to apply when doing welding activity • Ensure emergency response equipment are available and nearby the work area

Mechanical work	Potential risks	Control Measures
Mechanical Ventilation and Air Conditioning System (MVAC)	Designing MVAC system	• All AHU rooms and fan rooms will be at negative pressure, so the door leading to them must open outwards and be airtight • Safe access and egress for MVAC system for maintenance purposes
	Hot work during ducting fabrication and bracketing which include cutting, grinding, and drilling	• Avoid doing any hot work nearby which can cause explosion and fire • Hot work permit to apply when doing welding activity • Ensure emergency response equipment are available and nearby the work area
	Usage of chemical and glue when insulate ducting part	• Review SDSs before start working • Using appropriate PPE and storage of chemicals
	Ergonomic issue when doing hoisting ducting part to the ceiling	Use support machinery such as genie lift to lift heavy parts

4.7.3.16 Electrical Safety

The electrical works characterized for the circuit or route of which electricity flows and offers resistance to the current. Potential risks and suitable control measures in construction activities are summarized in *Table 4.11* below.

Table 4.11: Potential Risks and Control Measure for Electrical Works in Construction site

Potential risk	Control measures

• Electric shock • Lighting • Fire • Electrostatic	• Provide isolation to parts of equipment that has potential to release charges; • Provides effective earthling to isolate metals that can charge electricity in case of failure of the main isolator; • Consider mechanism of protection against electricity such as circuit protector, isolating switch, equipment maintenance and repair, earthling, etc.; • Ensure all electric equipment used must have a fuse and circuit breaker that is suitable to prevent from overloading; • Usage of industrial socket; • Inspect tools, equipment and electrical fitting for damage or wear prior to each use. Repair or replace damaged equipment immediately; • Damaged power tools must be reported, remove immediately and tag as “unsafe” until rectification done; • All distribution box (DB) must be lock at all times to avoid non-authorized adjustment; • Use proper PPE for electrical jobs; • Always use ladder made of wood or other non-conductive materials when working with or near electricity or power lines; • Ensure adequate warning sign to make sure worker aware of electrical hazard; and • Installation of electrical system must be done by certified person.

4.7.3.17 Plastering and Brick Work

Plasterwork refers to construction or ornamentation done with plaster, such as a layer of plaster on an interior or exterior wall structure, or plaster decorative mouldings on ceilings or walls. The process of creating plasterwork, called plastering or rendering, has been used in building construction.

These are legal requirements that project proponent must adhere to when doing plastering and brick works:

- Regulation 26 of FMA (Safety, Health and Welfare) Regulations 1970; and
- Regulation 11 and 15 of FMA (BOWEC) Regulations 1986.

Following are hazards identified when doing plastering and brick works in construction-sites:

a) Trip and fall from height;

b) Dust from mixing of cement;

c) Drop of materials; and

d) Repetitive movement.

In response to the hazards identified above, these are control measures that shall be considered by the project proponent in minimizing the potential risks to the workers:

a) Plaster work shall wear correct type of safety shoe, body harness and glove before start work

b) Brick layer shall wear a safety helmet and gloves to protect hands from bruise or cement corrosiveness
c) Provide all working platforms with guardrails or edge protection and access
d) Housekeeping shall be made regularly every day after the end of work
e) Ensure all work to be carried out under the direction of experience supervisor
f) All operators and driver must be equipped with valid driver/operator licenses or permit from relevant government agency
g) All machineries/equipment at site shall be inspected by machinery supervisor prior to use
h) Carried out periodic maintenance for all equipment and machineries
i) Only authorized signalman shall be assigned together with licensed operator/driver.

4.7.3.18 Painting Work

The common methods of application of painting in construction industry are by means of brush/roller or spraying. In spray painting, the paint fluid is first 'automized' or broken into small droplets before applying it to the surface to be coated. Normally, paints are thinned by the addition of solvents to reduce its viscosity. Nearly all solvents have flash points below ambient temperature. During painting, solvent vapours are being continuously liberated to the surrounding atmosphere which can cause explosion in the presence of an ignition source. Thus, when painting is carried out inside confined spaces, ensure that the spaces are well-ventilated and all ignition sources are removed.

Other than that, fibber floor coasting application of epoxy resin is equally hazardous as spray painting processes due to its toxicity, flammability and it is more volatile which can rapidly vaporize upon exposure to air. Ventilation of entire area of the floor coating activity is important to dilute the contamination to a sustainable safe level throughout the curing period.

It is important to note that, spray painting and fibre coating use of epoxy resin can only be carried out upon obtaining a permit for the same. A painting permit is also required for brush or roller painting inside confined space.

Legal provisions of Occupational Safety and Health in relation to the painting work are as below:

- Occupational Safety and Health Act 1994;
    a) Classification, Labelling and Safety Data Sheet of Hazardous Chemical (CLASS) Regulations 2013;
    b) Use and Standards of Exposure of Chemical Hazardous to Health (USECHH) (CHRA Report) Regulations 2000;
    c) Section 15(2) (c): Information, instruction, training and supervision;
    d) Section 24: General duties of employees at work;
- Factories and Machineries Act 1967;
    a) Regulation 12 of Safety, Health and Welfare Regulations 1970; and
    b) BOWEC Regulations, 1986.

Potential hazards and control measures associated to painting works are tabulated below. The project proponent shall ensure that the legal requirements are to adhere to at all times during the process to minimize the risk of injuries.

Table 4.12: Potential Risks and Control Measures for Painting Work in Construction-site

Potential risk	Control measures
• Trip and fall from height • Fire explosion • Drop of materials • Spill of paint • Repetitive movement	• Painting worker shall wear correct types of safety shoe, body harness, glove and mask (as recommended in CHRA report) before start work; • Safety Data Sheet (SDS) for the paint, solvents and etc., in use are display at the storage and work area; • Storage of material are properly labelled on both the material and storage area to indicate the material status at all times; • Ensure adequate fire extinguisher being placed and provided within the painting vicinity; • Appropriate signboards are noticeably displayed at storage area including the space where the process is intended to take place; • Supply sufficient forced and exhausts ventilation; • No hot work being conducted in the space and area of process; and • Adequate ventilation must be maintained during the curing period.

4.7.3.19 Window frame and glass installation

Window is an opening in a wall, door, roof, or vehicle that allows the passage of light, sound and air. This section will discuss on safe work environment and accident prevention for window frame and glass installation activities during construction phase.

First of all, legal requirements that need to be complied with when doing this installation activity are:

- FM (BOWEC) Regulations 1986
    - Regulation 8: Slipping hazards;
    - Regulation 9: Tripping and cutting hazards;
    - Regulation 13: Eye protection; and
    - Regulation 16: Electrical hazards.

Hazards that are identified in relation to the installation work are:

- Falling from height;
- Struck by falling object;
- Caught in between objects;
- Electrical shocks; and
- Hand, foot and body injury.

Window installation workers must wear correct type of PPE such as safety shoe, body harness and glove before starting to work.

Control measures that shall be considered when doing the window frame and glass installation in order to minimize the risk of injuries are outlined as below:

a) To ensure safe working process and legal provisions are adhere to during the activity, a competent and experienced site safety supervisor will be appointed to manage and oversee the works;

b) Suitable and adequate training for all operatives that use power tools and only competent person shall be permitted to operate such tools;

c) Workers who are expose to the work shall receive training and awareness on safe manual handling techniques and asbestos; and

d) All external working areas immediately below and around where the windows are to be replaced are to be securely fenced off at ground level using Her as fencing to prevent any unauthorized persons entering the working area. Warning sign will be erected to advise and inform others of the hazard.

4.7.3.20 Roofing Work

Roofing work is one of important aspects in construction-site in terms of controlling or minimizing potential hazards that could rise from the work. It is crucial for employers (or project proponent) to communicate among themselves in providing the best and practical integrated fall protection method for all persons working on the roof. Main objective is to make the work less hazardous and more ergonomic to the workers.

This Section is applicable to work that are carried out from 2 metres or more in height, in place of work. It is consisting of responsibilities of employer and employees under the Factories and Machineries Act (FMA) 1967 and Occupational Safety and Health Act (OSHA) 1994. Relevant sections of the Act and Regulations, namely are:

- OSHA 1994;
    a) Section 15: General duties of employers and self-employed person to their employee
    b) Section 15(2) (c): …" Information, instruction, training and supervision…"
    c) Section 17: General duties of employers and self-employed persons to persons other than their employees.
    d) Section 20: General duties of manufacturers, etc. as regards plant for use of work.
    e) Section 24: General duties of employees at work.
- FMA 1967
    a) Regulation 12: Working at Height of Safety, Health and Welfare Regulations, 1970
    b) BOWEC Regulations 1986

The potential risks identified when doing roofing work and its control measures are tabulated below. It is recommended that the project proponent to ensure that measures taken as per legal requirements stated above and based on control hierarchy in ensuring safe working environment for the workers.

Table 4.13: Potential Risks and Recommended Control Measures for Roofing Work in Construction site

Potential risk	Control measures
• Brittle roofing such as skylights or translucent sheets	• Workers shall wear correct type of footwear to grip the roof surface e.g., natural rubber, flexible-soled shoes; • Fall-arrest system shall be used for areas that do not

Potential risk	Control measures
• Roof surface, slippery surface from roll form dress, paint finishes or dew or rain • Roof pitch and projections such as pipework and flashings • Any roof opening/penetration larger than 600mm by 600mm • Any roof edge	have a fall-protection barrier; • Edge-protection system, travel-restriction system or fall-protection system shall be used for surface that have a fall-protection barrier; • Fall-protection system to be used for all roof area that do not have a fall-protection barrier or secure footing; • Bump rail not to be used on a roof of greater than 5-degree pitch. Instead, use edge protection (guardrail system or scaffolding), travel restriction systems or a fall-arrest system; • Treat all roofs as brittle until a close inspection reveals otherwise; • Permanent perimeter protection and access ladders should be fitted to roofs that need regular cleaning or maintenance and that provide secure footing; • Safety mesh, strong covers or guardrails should be fitted to suspected areas of any skylights or brittle roofs; • Danger signs to be fixed at points of access to the roof; • Provide safe access to all roof areas where work is carried out e.g. use ladder towers instead of ladders. It must be secured to prevent displacement sideways and slipping out from base; • Full edge protection at eaves level provided for work on sloping roofs; • Workers to wear leather gloves while moving sheets or bundles that will reduce cut and slash injuries; • Provide fall protection where roofing material is brittle, corroded, and no fall-protection barrier available. Area with parts of roof is brittle i.e. skylights, it should be treated with secure covers or guardrails; and • Internal gutters should be 450mm wide where people walk along or fall protection shall be provided.

4.7.3.21 Personal Protective Equipment (PPE)

PPE is clothing or equipment that are designed to protect the wearer (employee, contractors or visitors) against workplace hazards. It should be considered as the last method of control when hazard cannot be eliminated or where the risk cannot be controlled using other methods from the hierarchy of controls. PPE is the least effective control measure because the hazards and risks are still present. Besides that, there are also issue of proper fit and design for different individuals.

This Section describes the requirement and practices for the management of PPE to assist in correct selection, supply, use, replacement, maintenance, training, instruction and storage.

In Malaysia, usage of PPE is stipulated in legal requirements under the Occupational Safety and Health Act 1994, Factories and Machineries Act 1967 and specific requirements for construction falls under the BOWEC Regulations 1986. Refer *Table 4.14* below for details of legal requirements for PPE usage in construction-sites.

Table 4.14: PPE Legal requirements for Construction-site

Main Act/Regulations/Guidelines	Applicable Provision
Occupational Safety and Health Act 1994	• Section 15: General duties of employers and self-employed person to their employees • Section 24(1) (c): General duties of employees at work place; to wear or use at all times any protective equipment or clothing provided by the employer for the purpose of preventing risks to his safety and health.
Factories and Machinery Act (FMA) 1967	• Section 24 Where in any factory persons are exposed to a wet or dusty process, to noise, to heat or to any poisonous, corrosive or other injurious substance which is liable to cause bodily injury to those persons the Minister may prescribe the provision and maintenance for use of those persons suitable and adequate personal protective clothing and appliances including where necessary googles, gloves, leggings, caps, foot-wear and protective ointment or lotion.
FM (Safety Health and Welfare) Regulations 1970	• Regulation 12: Working at Height; where any person is required to work at a place which he will be liable to fall a distance of more than 10 feet, means shall be provided to ensure his safety and such means shall where practicably include the use of safety belts or ropes. • Regulation 32 – Working, clothes, personal protective clothing and appliance. Follow all requirements under this Regulations.
FM (BOWEC) Regulations 1986	• Regulation 13: Eye Protection; Suitable eye protection equipment shall be provided by the employer and shall be used by employees while engaged in welding or cutting operations or in chipping, cutting or grinding any material from which particles may fly, or while engaged in any other operation which may endanger the eyes. • Regulation 14: Respirators; where these regulations require respirators to be provided, the employer shall provide and the employee shall use a respirator suitable for the type of operation for which it is to be used. The employer shall maintain such respirator in good repair and shall furnish the means for its continued efficient working condition; and he shall provide regular inspection, cleansing and sterilisation of such equipment when not in use shall be stored in closed containers. • Regulation 15: Protective Apparel; All applicable under these Regulations and sub-regulation 15(1), (2), (3) and (4).

Main Act/Regulations/Guidelines	Applicable Provision
	• Regulation 24: Use of Safety Helmet; all persons who are performing any work or services in a worksite shall wear safety helmets. • Regulation 50: Safety Belts; Safety belts, life lines and all devices for the attachment of life lines shall be adequate strength and of a type approved by the Chief Inspector. • Regulation 51: Attachment required; all applicable under this regulation and sub-regulation 51(1), (2), (3), and (4). • Regulation 52: Instruction in using safety belt; Every employee who is provided with a safety belt shall be instructed in the proper method of wearing and using it, as well as attaching it to the life line. • Regulation 53: Protection of Life Lines; Padding, wrapping or similar means shall be provided to protect every life line from contact with edges or objects which may cut out or severely abrade it. • Regulation 54: Inspection of Safety Belt; ○ Every safety belt and every life line shall be inspected by designated persons before use by an employee ○ No employer shall suffer or permit an employee to use a safety belt or life line which shows any indication of wear, damage or deterioration likely to affect its strength and no such belt or life line shall be kept on the worksite.

Types of PPE and its function and requirements are discussed further in the following sub-sections.

Head Protection (Safety Helmet)

Requirements of safety helmet in construction-site:

- Use safety helmet that is approved by SIRIM and has identification markings such as company's name;
- Safety helmet is not required to worn in the canteen, rest area, driver's cab, office area and any other areas where exemption is granted;
- Safety helmet with face shield attachment must be used by welder;
- The shell or suspension on safety helmet not to be altered or modified;
- Bump cap is not advisable to be worn on-site; and
- Safety helmet that was issued must be documented and records to be maintained.

Eye Protection (Safety Glass)

Requirements for safety glass at construction-site:

- Work such as welding, cutting, chipping, grinding, chemical splashes and other works that particles or fragments may fly and risk injury to the eyes must use eye protection;

- Minimum requirement for safety glass is Z287+;
- Persons engaged in the above works must wear the appropriate googles, safety spectacles and face shield;
- Person engaged in electric arc welding, cutting or other similar operation must wear welder's shield; and
- Issuance of safety glass must be documented and records to be maintained.

Hearing Protection

Requirements on hearing protection at construction site:

- Person carrying out work which generates noise above 82 dBA must wear ear protection during working;
- Person working in area where noise level exceeds 82 dBA must also wear ear protector;
- Ear protectors must be made available by subcontractor for use in areas with noise level above 82 dBA;
- For noise levels exceeding 115 dBA, ear muff must be worn;
- Person-in-charge of the work or area shall determine the noise level through measurements; and
- Issue of hearing protector must be documented and records be maintained.

Respiratory Protection

Requirement of respiratory protection at construction site:

- Respirators must be used if dangerous fumes are liable to be present or supply of air is inadequate or likely to be reducing to be inadequate for sustaining life;
- Mask must be worn for processes that generate dust, gas, or vapour;
- Respirator must examine at least once a month by competent person;
- Respirators must be maintained regularly and stored as specified by manufacturer; and
- Issue of respirator must be documented and records maintained.

Hand Protection (Glove)

Requirements on hand protection at construction site:

- Gloves must be selected accordingly to the type of hazards;
- Suitable gloves must be used to protect hands against chemical, mechanical, thermal, electrical, radiation and biological hazards;
- PVC gloves must be worn when handling corrosive substances;
- Discarded and contaminated gloves must be destroyed;
- Gloves must be maintained regularly and stored in a designated area;
- During work with any rotating machinery, no gloves are allowed; and
- Issue of gloves must be documented and records be maintained.

Fall Protection

Requirements for fall protection at construction site:

- Workers at height and elevation of 3 meters on temporary platform must be secured by safety harness with proper attachment;

- Safety harness must be securely attached to anchorage and shall not be longer than it required;
- Safety harness must be fitted with two receptacles and bolt bag when climbing on temporary structure;
- Bolt bag belt fitting must be sufficient to enable the climber to carry all loose equipment and have both hand free for climbing;
- Padding, wrapping or similar means must be used to protect every lifeline from contact with edges and objects which may cause abrasions, cut or severely damage the lifeline;
- Damage safety harness of lifeline must not be used;
- Safety harness must be cleaned and examined with safety harness checklist; and
- Issue of safety harness must be documented and records be maintained

Foot Protection

Requirements for foot protection at construction-site:

- Safety shoes must be worn at site;
- Water proof safety shoes must be worn when working in water, wet concrete or other wet footing;
- Safety shoes must be properly worn and maintained; and
- Issued of safety shoes must be documented and records be maintained.

Safety Reflector Vest: High Visibility for Safety

Requirements for safety reflector at construction site:

- Safety reflector vest must be worn at site;
- Safety reflector vest is keeping an employee visible in working conditions with less-than-optimal lighting;
- Safety reflector vest must be properly worn and maintained; and
- Issued of safety reflector vest must be documented and records be maintained.

4.7.3.22 Signage, Tags and Bulletin Boards

Safety colour and safety signs are equally important aspects in occupational safety and health at construction site. The purpose of this system is mainly to draw attention to objects and situations that could affect or effect health or safety. However, the use of this system does not replace the need for appropriate accident prevention measures.

The safety signages and tags are requirements under law and regulations in Malaysia as following:

- Occupational Safety and Health Act (OSHA) 1994
    - Classification, Labelling and Safety Data Sheet Regulations 2013
- Factories and Machinery Act (FMA) 1967
    - Building Operations and Works of Engineering Construction (BOWEC) (Safety) Regulations 1986
        - Regulation 23: *Numbering and Marking of Floor*; each floor of every building under construction shall be appropriately number and marked at the landing at every floor of every staircase or other means of access.

- Regulation 48: *Danger Sign*; A simple but effective warning notice in the national language shall be placed in a conspicuous position at the discharge end of every chute to warn employees and public.

The safety colours that are used and the meanings that shall be assigned to them are summarized in *Table 4.15* below together with the examples of the use. Detailed information on the placement and graphic can be referred to *Chapter 22 of "Best Practices on Occupational Safety and Health in Construction Industry 2019"* published by DOSH.

Table 4.15: Safety Colours and Contrasting Colours

Safety Colour	Meaning purposes	Example of use	Contrasting colour (if required)	Symbol Colour
Red	Stop prohibition	• Stop signs • Identification and colour of emergency • Shutdown devices • Prohibition signs	White	Black
Yellow	Caution, risk of danger	• Identification of hazards (fire, radiation, explosion, chemical, etc.) • Warning signs • Identification of thresholds, dangerous passages, obstacles	Black	Black
Blue	Mandatory	• Obligation to wear personal safety equipment (PPE) • Mandatory signs	White	White
Green	Safe condition	• Identification of safety showers, first-aid posts and rescue points • Emergency exit signs	White	White

If identification is required of places where there is a risk of collision, falling, stumbling, falling objects or where there are steps, holes in floors or similar hazards, the following combination of fluorescent orange-red or safety colour yellow and in either case black shall be used.

4.7.3.23 Facilities

General facilities and utilities provisional in order to compliment basic necessity for administrative staff and works in construction site shall be provided by the project proponent. It is also important that these facilities are compliance with the stipulated legal requirements to ensure standardization and comfort of workers in using the facilities which can create a safe working environment for them.

Applicable legal requirements that relate to the arrangement of facilities in construction-sites are listed below:

- Factory and Machinery Act (FMA) Safety, Health and Welfare Regulations
  - Regulation 24 – Use of Safety helmet;
  - Regulation 29 – Inspection and supervision of concrete work;

- Regulation 30 – Beam, floor and roof;
- Regulation 31 – Stripping;
- Regulation 33(3) – Placing of structural means;
- Regulation 37 – Permanent flooring; and
- Regulation 38 – Temporary flooring.

Potential risks and control measures associated to setting up temporary site office and living quarters are tabulated below.

Table 4.16: Potential Risks and Control Measures for Setting Up Facilities at Construction site

Potential risk	Control measures
• Falling from height • Electrocution whilst handling electrical tools • Struck by falling objects • Caught in between object	• Working at height more than 3 meters to erect scaffold for safe foot hold platform and workers to wear safety harness and hook to nearby rigid points; • Electrical tools shall be inspected prior to usage, industrial socket to be adopted; • Loose tools to be secure properly to prevent drop off accidentally from height and steel frames to be stack properly to avoid toppling; • Protruding sharp edges to be protected from accidental contact; and • Keep bodily parts away from moving objects towards stationary objects and use tagline control load upon hoist or lowering by crane.

Office

1. The office shall be set up inclusively with (offices, conference/meeting room), parking lot, first aid room, rubbish garbage with designated collection points and together with security guard's post.
2. The office area should be arranged centrally according to the terrain conditions. The office area should be set up separately from the construction area and shall not under the tower crane radius zone that simply corresponds isolation measures, and posted with relevant signboards to guide the public and construction workers of the office area.
3. The specific size of the office shall take into account the actual number of peoples to accommodate the office.
4. First aid room shall be set up in a single unit at least 10 square meters.
5. Toilet to be set up as requirement of FMA 1967 on ratio of every 1:25 workers. The toilets shall adopt self-punching toilets, with good ventilation and lighting facilities. Set up a wash basin and a faucet.
6. Adequate air conditioning units shall be installing for all the office units.
7. First aid room shall be equipped with full first-aid kit, medical oxygen, stretchers, single bed and other associated emergency equipment.
8. All office units window is installed with stainless grill and curtain.
9. Drinking water fountains shall be provided adequately at strategic location.

10. Adequate portable fire extinguisher shall be provided to the office area within vicinity of each office units.

Living Quarters

1. Living quarters should consider to isolate from the construction operation zone shall correspond isolation measures. The temporary housing shall maintain the safety distance from overhead electric power lines.
2. The surrounding environment must consider safety condition such as soil collapses, low lying water areas and avoid excavation ground areas.
3. Shall not set up in the radius of tower cranes.
4. The centralise garbage point shall be 15 meters away from the living quarters.
5. It is ideal to link with existing traffic lines to facilitate the workers to go and back from work.
6. Provided with roads, smooth supply of water and electricity.
7. The living area must have drainage system that allows water flows freely without stagnant.
8. Each living unit shall have window for natural ventilation.
9. Cooking is prohibited in the living quarters; the cooking facility buildings are to be detached from main living units at least 15 meters away.
10. The living area should have emergency lane for BOMBA access, the width at least 4 meters and height clearance should not be less than 4 meters.
11. Storage of flammable materials shall be 15 meters away from living quarters.
12. Corresponding group of temporary living quarter buildings shall not exceed more than 10 unit and the distance between each building not less than 4 meters and the distance between groups of building not less than 8 meters.
13. The living quarters shall not exceed two floors.
14. Portable fire extinguishers shall be provided adequately. The ground floor surface shall be concrete with cement screening finish flooring and 1st floor surface with plywood 20mm thickness covering and on top of it with PVC carpets laying.
15. Toilets and bathrooms in the living areas should be divided into 2 types which are male and female.
16. Number of cubicles shall correspond to adapt number of people in the living area.
    - Sanitary unit with; i) water closet and ii) bath unit for every ratio of 1:15 workers.
    - Sanitary unit with; i) isolated bath unit and ii) with urinal for every ratio of 1:25 workers.

    Detailed information on other requirements for living quarters, refer to the *Garis Panduan Penetapan Standard Minimum Penginapan Pekerja Asing, 2018.*

First Aid Room

1. First aid station shall be on scale of project the basis, total number of workforces.

2. To provide first aid facilities such as first aid kit box and stretcher. (Please refer to Regulation 38 (2)(i) Welfare, FMA 1967, Fourth Schedule)
3. Single bedding for temporary recuperation for casualty upon waiting for ambulance arrival.

Drainage Facilities

1. A good drainage system in construction-site shall ensure smooth water flow with no water stagnant on the ground.
2. It is prohibited to discharge waste oil, poisonous and harmful substances directly into the drainage system.
3. Reasonable sedimentation tank, sedimentation without treatment shall be set up that no direct discharge into the municipal drainage network.
4. Sediments in sedimentation treatment tank over the capacity of 1/3 should be cleaned regularly.

Vehicle Washing Bay

1. Vehicle wash tank with high pressure flushing device shall be constructed.
2. It shall be divided into two (2) different sections according to dissimilar situations, where one for vehicles in and out of office and living area and the other is for vehicles entering the construction area.
3. The wash bay shall be positioned at the exit of the gate.

Road and Vehicle Parking

1. The construction site road should be hardened; parts of temporary roads should lead to different directions to achieve certain location practically and economically.
2. A single side drainage to set up along the road side.

Safety Mirror

Safety mirror is to be provided as a self-check tool to remind workers, contractors or visitors donning correct PPE when entering the construction site.

Rest Area Cum Smoking Zone

Rest area can be utilized as smoking zone at construction site for workers. It shall be provided with rubbish bin and fire extinguisher. Appropriate signboards indicating rest area and smoking zone need to be provided. Normally, one area will be designated for each site without corresponding to the size of the project.

4.7.3.24 Machinery and Equipment

Misuse of machinery, equipment and portable hand tools could contribute to accidents in construction-site. Extra care and precautions need to be exercised while operating these machineries and equipment thus certain procedures requires authority approvals for installation, operation and dismantling.

Legal requirements stipulated for use of machineries and portable hand tools are listed below:

- Section 15 of OSHA 1994
- FMA 1967

- Section 19 – Certificate of fitness
- Section 36 – Installation of machinery
- Section 37 – Application of registration

- BOWEC Regulations 1986
  - Regulation 147 – General requirement
  - Regulation 148 – Hand tools
  - Regulation 149 – Electric power-operated tools

Table 4.17 below summarized the recommended control measures for operation of power tools and heavy machinery at construction-site.

Table 4.17: Recommended Control Measures for Operation of Power Tools and Heavy Machinery

Types of Machinery	Control measures	Other requirements
Power tools	• Electrical equipment to be industrial type socket; • The guarding on rotating parts should be intact; • No person shall permit to operate statutory machineries (e.g., tower cranes, passenger hoist, gondola and compressor) without competency certificates; • No electrical cables lay in water or on wet floor; • Routine preventive maintenance for electrical tools; and • Exposed rotating couplings on pumps shall be adequately guarded	• Ensure compressor have a valid PMT certificate of fitness issued by DOSH Malaysia
Heavy Machinery	• Establish proper communication tools to commence lifting operation; • Pre-operation inspection checklist being carryout prior to operate the sky-lift and scissor lift; • Operator wear safety harness and hook the lanyard scissor lift cage rail; • Not exceed safe working load; • Installation and dismantling of tower crane supervise by competent person for tower crane whom holds valid competency certificates issued by DOSH Malaysia; • Implement “Project Site Intelligent System” to ensure safe operation of tower crane; • Oil containment tray of sufficient size provided to contain oil spillage in	• Mobile and crawler crane must be operated by competent person who hold a valid competence certificate issued by DOSH Malaysia. • Must have valid PMA certificate of fitness issued by DOSH Malaysia • Training required for rigger and signalman to sling, rig and direct the load. • Sky-lift and scissor lift to have a valid PMA certificate of fitness issued by DOSH

Types of Machinery	Control measures	Other requirements
	generator; • Portable fire extinguisher at nearby each generator; and • Store flammable substances or material 3 meters away from generator.	Malaysia. • Design and material for new tower crane shall be approved by DOSH Putrajaya and installation and dismantling shall receive approval letter by DOSH. • The foundation base of tower crane shall be inspected and approved by DOSH prior to cast concrete. • Generators exceed 100KVA shall notify and obtain approval from DoE

4.7.3.25 Housekeeping

Effective housekeeping can help control or eliminate workplace hazards. Poor housekeeping practices frequently contribute to incidents. Housekeeping is not just cleanliness but keeping the work areas neat and orderly, maintaining halls and floors free of slip and trips hazards, removing waste materials and other fire hazard materials. It also requires paying attention to important details such as layout of the whole workplace, aisle marking, the adequacy of storage facilities and maintenance. Good housekeeping is also basic part of incident and fire prevention.

To achieve effective housekeeping, it should be done on daily basis as it is an on-going operation.

Listed below are applicable legal provisions in relation to housekeeping where the project proponent must adhere to:

- Factory and Machinery Act (FMA) 1967
  - Safety Health and Welfare Regulation 1970

    Regulation 6: Floor

    Regulation 7: Access to workplace

    Regulation 8: Opening generally to be fence

    Regulation 11: Catwalk, runway or gangway

    Regulation 12: Working at height

    Regulation 14: Dangerous liquid

    Regulation 15: Containers for volatile inflammable substances

    Regulation 19: Object on inclines

    Regulation 20: Stacking of material

    Regulation 23: Cleanliness

    Regulation 24: Space between each person

    Regulation 36: Washing facilities

Regulation 37: Sanitary convenience

- Building Operations and Works of Engineering Construction 1986

Regulation 8: Slipping hazards

Regulation 9: Tripping and cutting hazards

Regulation 10: Access to workplace

Regulation 11: Dust and gases

Regulation 12: Corrosive substance

Regulation 15: Protective apparel

Regulation 16: Electrical hazard

Regulation 17: Power driven saws

Regulation 20: Illumination of passageways

Regulation 21: Storage of materials and equipment

Regulation 22: Disposal of debris

Regulation 25: Site safety supervisor

Regulation 26: Contractor's safety supervisor

Regulation 27: Safety committee

Part V: Cleaning, repairing and maintenance of roof, gutters, windows, louvers and ventilators

Part VII: Chutes, safety belts and nets

Part XIII: Material handling and storage, use and disposal

Table 4.18 below outline the potential risks for poor housekeeping and control measures to be taken into consideration by project proponent in ensuring the safe working environment for the workers.

Table 4.18: Potential Risks and Control Measures for Housekeeping at Construction-site

Potential risk	Control measures
• Slips, trips and fall	• No items stack along the walkways or passageways • Put away or elevate the electrical cords and water or air hoses • Put away tools and keep drawers closed
• Spills	• Clean up spill immediately • Repair any leaks as soon as possible • Sweep up debris
• Machine safety	• Inspect all machines and ensure that all guards are in place before use • Keep area around machines clear • Put away tools • Clean machine regularly
• Fire	• All flammable or combustible liquids are labelled and in closed containers • Keep away flammable or combustible materials from ignition sources

Potential risk	Control measures
	• Keep electrical equipment clean • Inspect electrical cords before use
• Blockage on exit routes	• Emergency exits free of any blockage • Keep clear of evacuation routes • Check that fire extinguishers are well-maintained and accessible • Ensure electrical panels can be opened

4.7.3.26 Health Issue

Prolonging workers careers is major challenge for industries where physical work demands are high such as in construction. Insight into health problems at worksite, and effective measures are helpful for prolonging working career of construction workers.

Applicable legal provisions and requirements of occupational health in construction-site are as below:

- Occupational Safety and Health Act 514:
  - Section 15: General duties of employers and self-employed person to their employees.
  - Section 24: General duties of employees
  - Regulation 2000: Use and Standards of Exposure of Chemicals Hazardous to Health (USECHH)
- Factory and Machinery Act 139:
  - Safety Health and Welfare Regulation 1970

    Regulation 14: Dangerous liquid

    Regulation 23: Cleanliness

    Regulation 25: Air cleanliness

    Regulation 28: Temperature

    Regulation 31: Work bench

    Regulation 32: Working cloth, personal protective clothing

    Regulation 34: Drinking water

    Regulation 36: Washing facilities

    Regulation 38: First aid

    Regulation 39: Duty of occupier
- Mineral Dust Regulation 1989
- Occupational Safety and Health (Noise Exposure) 2019
- Guidelines on Ergonomic Risk Assessment 2017
- Guidelines for Manual Handling 2018

The potential risks of occupational diseases and control measures are summarized in *Table 4.19* below.

Table 4.19: Potential Risks, Symptoms and Control Measures of Occupational Diseases at Construction site

Types of Occupational Diseases	Risk Factors	Prevention and Control
Heat Stress	• Expose to high temperature, humidity, direct sun exposure, no breeze or wind for long time • Heavy physical labour • Low liquid intake and dehydrated • No recent exposure to hot workplaces • Waterproof clothing	To follow Guidelines on Heat Stress Management at Workplace, 2016 by DOSH which guided the following: • Control Measures According to Risk Decision • Identification of heat stress using Heat Stress Screening Checklist • Control of heat stress measurement, and heat stress monitoring. • Acclimatisation to prevent heat stress
Lung disease	• Smoking can decrease our defence mechanism toward an infection and worsen the occupational lung disease • Long exposure to toxin, mineral dust, chemical and fibre • Workers not wearing or using proper PPE when dealing with the exposure	• Preventing further exposed if diagnosed • Advise worker not to smoke or do at least one medical check-up a year to ensure healthy • Ensure workers are aware of their health risk when dealing with chemical and SDS must be provided and explain to workers • Provide worker with proper PPE such as facemasks or respirators when known to be exposed with dust, chemical, toxin or fibre
Disease caused by noise	• Prolong exposure to noise more than 82dB for more than 8 hours period • Exposure to noise more than 115dB at any time • Workers not wearing or using proper PPE when dealing with the exposure	• Identification of excessive noise where daily noise exposure level exceeding 82dB (A), max SPL exceed 115dB (A) or peak SPL exceed 140dB (A) • Identify of excessive noise not more than one year after previous identification, or if there's any changes in machinery, control measures and process • Carry out noise risk assessment for employees exposed to excessive noise by Noise Risk

Types of Occupational Diseases	Risk Factors	Prevention and Control
		Assessor every 5 years • Provide necessary information, training and supervision for employees that exposed to excessive noise at least once a year • Reduce noise exposure exceeding limit (NEL) • Provide personal hearing protector for employees exposed to NEL • Provides hearing protection zone • Appoint audiometric testing centre to carry out audiometric test for employees exposed to NEL • Conduct baseline audiometric within 3 months after the employee return to work
Disease caused by vibration	• Users of the types of equipment below and similar equipment often be exposed above the exposure limit value: - chainsaws - grinders - hand-fed equipment, e.g., pedestal linishers, grinders, mops - impact drills - scaling hammers including needle scalers; - pedestrian controlled equipment including mowers, floor saws, floor polishers; - powered hammers for chipping, demolition, road breaking, etc. - sanders and polishers; - hand-held saws for concrete, metal, ground clearance etc.	• Reference: Guidelines on Occupational Vibration 2003
Ergonomic disease	• *Exerting excessive force* – Lifting heavy object or people, pushing or pulling heavy load, manually pouring materials or maintaining control of equipment and tools.	• Identification the type of manual handling risk factor by walkthrough survey, interview and document review. • Implement musculoskeletal

Types of Occupational Diseases	Risk Factors	Prevention and Control
	• *Performing the same task repetitively* – Performing the same motion or series of motions continually or frequently for extended period of time. • *Working in awkward posture or being in the same posture for long periods of time* – Using positions that place stress on the body, such as prolonged or repetitive reaching above shoulder height, kneeling, looking up for a long time, twisting torso while lifting and etc. • *Localized pressure into the body part* – Pressing the body or part of body against hard or sharp edges or using the hand as a hammer. • *Cold temperature* – In combination with any one of the above risk factors may increase potential having MSD. • *Vibration* – Vibration can cause damaged to the small capillaries, nerve ending and blood vessel. Using power hand tools such as drills, hacker and grinder can cause loss of sensory for period of time if prolong exposure. • *Combination of several risk factor*.	discomfort survey questionnaire. • Conduct Initial Manual Handling Risk Assessment by Ergonomic Trained Person which provides recommended weight value for manual handling activities and helps employers to identify high risk manual handling activities. • Implement Manual Handling Risk Management Programme in controlling manual handling related hazards which consist of three elements; leadership elements, organizational elements and operational elements.
Skin disease	• Poor Hygiene – Poor hygiene such as sharing towel, poor housekeeping and bad sanitation system can cause an infection of the skin. • *Working with chemical* – Chemical can kill good bacteria on the skin. Without the good bacteria on the skin, defence mechanism will be reduced lead to infection of the skin. • *Diabetes* – Poor blood circulation and elevated blood sugar levels prevent the white blood cells from effectively fighting the infection. • *Irritant substance* – Irritant	• Eliminating the use of the hazardous chemical or substituting it with safer alternatives when possible. • Educate workers with the SDS of the chemical they using. • Remind worker to regularly wash their hand after done with the activity • Redesigning work processes to prevent splashes or other contact with harmful materials. • Supervisor to ensure housekeeping must be done before, during and after work is done. Hired general workers

Types of Occupational Diseases	Risk Factors	Prevention and Control
	substance such as cement, abrasive hand cleaner, saw dust, solvent, dirt, fibreglass, heat and sweating and etc. • *Mechanical trauma* - Recurring rubbing or increased pressure can thicken the inflamed skin with "crazy-paving pattern" (lichenification) and callosity. • *Temperature* - Sweat stagnation can cause miliarias, which are small and itchy rashes. Overlapping skin surfaces can become sodden, ending up in intertrigo; which is an infectious inflammation of body folds.	for housekeeping. • Schedule at least once a week for general housekeeping to ensure workplace areas are clean. • Employers should supplement them with proper personal protective equipment (PPE). Often this means choosing the right gloves and respirators for the task or chemical involved.

4.7.4 Safety and Health Personnel Requirement

Health and safety are a multi-step process which includes the workers at the site, nearby people, supervisors, managers etc. Effective management of activities and competent site supervision are essence in maintaining healthy and safe conditions. In construction activities especially, greater the risk, greater the degree of hazard control and supervision is required.

To provide a way for management and worker to meet regularly to discuss workplace safety and health issues a Safety and Health Committee is required to be formed. With more than 100 employees, PEC's Safety and Health Committee must at least have 4 representatives from both the employees and the management.

In the implementation, competent safety and health personnel should conduct the following prior to the work:

- Risk Identification and developing risks management strategy;
- Ensure training – site specific and job-specific;
- Ensure workers has access to PPEs; and
- Observe, inspect and report the implementation of the safe working method on-site.

4.7.4.1 Safety and Health Officer

Under section 29 (3) of the Occupational Safety and Health Act of 1994, the safety and health officer shall be employed exclusively for the purpose to ensure due observance at the place of work. The Occupational Safety and Health (Safety and Health Officer) Regulations 1997 came into force on August 22, 1997. This regulation is intended to ensure that the employers under the class or type of industry specified in the Occupational Safety and Health (Safety and Health Officer) Regulations 1997 employ a safety and health officer for the purpose of managing matters relating to workplace safety and health.

For construction-site, appointment of Safety and Health Officer is encouraged to ensure compliance and safe working environment on-site but it is mandatory for any work of engineering construction where the total contract price of the project exceeds RM 20,000,000.

4.7.4.2 First-Aider

As stated in Regulations 38 of the Factories and Machinery Act 1967, it is mandatory to appoint first-aider if there are more than 20 people/ workers on-site. The recognized first-aid course are Basic Life Support and Basic Trauma Life Support. The refresher training for this competency is once in every three (3) years. On top of that, it is best to train workers on basic first aid in case of an emergency. First aid kits and equipment must also be provided and placed in easily accessible areas in the construction-site.

4.7.4.3 Site Safety Supervisor

Under Regulation 25(1) of the Factories and Machinery (Building Operations and Works of Engineering Construction (Safety)) Regulations 1986, the main contractor shall appoint a site safety supervisor for the safety supervision on construction activities within the site. It is also stated in the regulations that the site safety supervisor must be a person who is competent to perform the duties specified in sub-regulation (3) and (4).

4.7.4.4 Fire Safety Officer, Fire Warden, and Certified Fire Watcher

Fire safety officer, fire warden and certified fire watcher during construction period are encouraged to be provided by the Contractor to ensure the effectiveness of fire hazard prevention and fire hazard control. Fire Safety Officer is to be provided to plan and conduct by any means necessary any fire prevention method/ work. In the occurrence of hazard, fire warden will take the responsibility to prepare and conduct emergency response. Certified Fire watcher would be assigned to conduct a supervision to the works that are classified as hot work which involving chemicals or conditions that can lead to potential hazard.

4.8 Health and Social Aspects

The key Issues and impact and mitigation measures related to health and social aspects of the projects are presented in the following sections.

4.8.1 Control of Infectious Diseases

4.8.1.1 Decrease environmental sanitation

During the construction phase, PEC is estimated to employ over 7,000 local and foreign workers. As a result of labour recruitment and mobilization, the present of workers onsite and offsite the project can increase public health concern, especially decreasing environmental sanitation. The indicator of good management plan in mitigating decreasing environmental sanitation are as follow:

- No community complaints around the project due to decreasing environmental sanitation (liquid waste, solid waste, etc.); and
- Implementation of the program to improve the health status of the environment around the project area.

In order to mitigate the potential risk of decreasing environmental sanitation, the following mitigation measures are proposed:

- Provision of adequate sanitary, toilets and clean water, and trash boxes facilities for workers and employees;
- Carry out induction and counselling about environmental sanitation on a regular basis to the workforce;
- Collect and conduct temporary domestic wastewater treatment (WWTP) that are placed on project site;
- Provision of adequate domestic solid waste shelters in the appropriate quantities of waste (organic / biodegradable and non-organic / non- decomposable). Sorting of the type of waste according to its nature and recycle it;
- For the waste that cannot be recycle, the management of domestic waste (organic and non-organic) conduct coordination with local authority to dispose the waste in local landfill; and
- Install information about keeping clean environment and place the trash at designated boxes.

4.8.1.2 Changes in disease prevalence

The present of workers onsite and offsite the project can also increase public health issue, including changes in disease prevalence. The potential source is expected from derivative effects of labour acceptance and mobilization and environmental sanitation. The management plan and its indicators for changes in disease prevalence conditions at the site and off-site is as follow:

1. Control the prevalence of infectious diseases in the villages around the project site
2. No complaints from the community around the project due to health problems and changes in the health status.
3. The incidence rate and prevalence of disease due to changes in the health status is under control
4. Maintain public health in the villages around the project where migrant workers reside

The proposed mitigation measures to minimise the potential impact of changes in disease prevalence are as follows:

1. When recruiting local and foreign workers, conduct proper pre-employment and periodic health screening sexually-transmitted diseases (STD), human papillomavirus (HPV) infection, trichomoniasis, chlamydia, herpes simplex virus (HSV) infection, gonorrhea, syphilis, human immunodeficiency virus (HIV) infection and hepatitis B, tuberculosis, dengue fever and chikungunya in order to avoid infection on project site and surrounding area.
2. Conduct inductions and counseling on impact of drugs, alcohol, sexually transmitted diseases (STD), and other infectious diseases (e.g. HIV AIDS, TB, etc.) regularly to the workforce
3. Implement CSR program on health service and public health affair with local health institutions (health clinic, hospitals and others) to affected communities
4. Consult with community regarding public health issue and health program for community.
5. Provide construction workers and employee with insurance coverage according to labor regulations requirement

4.8.1.3 Increase of COVID-19 occurrences

Coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered coronavirus. There is no effective vaccine has been found yet, the best way to prevent the spread of the Coronavirus is to avoid being exposed to the virus. Person who is infected by COVID-19 has some symptoms such as fever, dry cough, tiredness, difficult breathing or shortness of breath, chest pain or pressure, loss of speech or movement. Less common symptoms are aches and pains, sore throat, diarrhoea, conjunctivitis, headache, loss of taste or smell, a rash on skin, or discolouration of fingers or toes. Infection of COVID-19 can occur anywhere, including at construction site, quarters and accommodation for the workers.

Malaysian government through The Ministry of Works Malaysia and Construction Industry Development Board (CIDB) has developed Standard Operation Procedure for Construction Industry to Operate during Movement Control period (MCO) to prevent and mitigate the spread of COVID-19. The SOP is as follows:

1. Received approval to operate by National Security Council and displayed the approval letter at construction-site
2. COVID-19 screening to all workers before resuming operation and they are free from the virus
3. Temperature measure and worker screening daily. Reading of temperature of each worker has to be recorded and kept for at least 3 months. If body temperature is 37.5o or more, the worker is not allowed to enter the premise and should be referred to the company panel clinic or nearby health centres.
4. Reduced number of workers to the minimum level or at least 50% of the current number needed. Number of visitors is also to be limited.
5. Operating hours for construction-site are from 8:00am to 5:30pm, 5 days a week and no extension time is allowed.
6. Repaired and maintenance of heavy machinery is not allowed.
7. Foreign workers/ workers who do not reside in Malaysia are not allowed to work, including those who just return from travel abroad which is required to undergo on 14-days quarantine.
8. Movement of worker is limited from home to the construction-site.
9. Transport arrangement for the movement of workers practices social distancing and vehicles must be disinfected and sanitized before and after each use. Vehicle to transport the workers is not allowed to cross the district/zone border and only allowed within the zone concerned only.
10. Conduct risk management, job scheduling and distribution of workers.
11. Appoint one or more coordinators for COVID-19 prevention measures.
12. Quarter and accommodation of workers should be centralized.

The SOP may be updated accordingly based on the latest policy and directive from the Malaysian government. Ministry of Health in their Management Guidelines for Workplaces No.5/2020, Annex 25, stated the following actions to be taken by the employers:

a. Communicate to employees about COVID-19;
    i. Advice employees on preventive methods; including personal hygiene and respiratory etiquette.

ii. Remind employees of the need to practice hand hygiene regularly e.g. via email, social media, gamification etc.

iii. Provide regular updates on COVID-19 to employees.

iv. How to Use Surgical Masks.

v. Provide appropriate health education materials regarding COVID19 to all employees

b. Instruct supervisors to monitor symptoms of employees at workplace

c. Encourage employees to take temperature regularly and monitor for respiratory symptoms

d. Consider obtaining travel declaration from employees on travel history.

e. If employee develops symptoms;

vi. If at home:

- Wear a surgical mask and seek medical attention at the nearest health facility immediately.
- Avoid contact with family members.
- Accompanying person should also wear a surgical mask.

vii. If at workplace:

- Relieve staff members from work if they are sick.
- Wear a surgical mask and seek medical attention at the nearest health facility immediately.
- Avoid contact with fellow employees.
- Accompanying person should also wear a surgical mask.

f. Conduct mental health assessment among employees and carry out appropriate measures to reduce stress among employees.

g. Monitor sick leave and absenteeism among employees. Keep a record of staff sick leave including reasons for leave, duration of leave and current status.

The employees who also plays important roles in managing their health during the COVID 19 outbreak period are also required to do the following:

a. Always maintain good personal hygiene;

i. Frequent hand washing with soap and water or hand sanitizer.

ii. Practice respiratory etiquette.

b. Employees are encouraged to take their meals at their desk

c. Limit food handling and sharing of food in the workplace

d. Keep updated on COVID-19

e. If develop symptoms;

i. Need to alert supervisor immediately.

ii. Wear surgical mask.

iii. Seek medical treatment immediately.

iv. Avoid contact with fellow employees.

Refer to Ministry of Health's Management Guidelines for Workplaces No.5/2020 for more details.

4.8.2 Social Interaction/ Perception

The present of the workers onsite and offsite the project area can increase social-cultural issue, specifically influence on local culture and social conflict. This social-culture issue is derived from labour (local and foreign workers) recruitment and mobilization of maximum 7,000 people who carry their own respective customs and culture.

The management plan and its indicators for social interaction/ perception at the site and off-site is as follow:

1. No disputes arise due to cultural differences among the employee as well as between employee and community.
2. Arts-culture activities will be regularly conducted in local art and cultural arts community.
3. No potential conflict between migrant workers and local communities.
4. Minimum/ low concerns and complaints from communities.
5. Consultation with the local community is recorded.
6. Implementation of grievance mechanism.

The proposed mitigation measures to minimise the potential impact and influence on local culture are as follows:

1. Introduce local culture (through employee induction) to migrant workers employed by the project
2. Require project employees to respect local culture and avoid the taboos prevailing in the local community
3. Support the community and government program
4. Encourage local cultural promotion activities
5. Apply labour Camp Management Plan (refer to **Appendix D**)
6. Consult with local authority on recruiting migrant workers and minimizing impacts with local communities
7. Provide orientation and local community awareness program for migrant workers to introduce cultural sensitivity, taboo, custom, and wisdom of local communities

4.8.3 Employment, Income, & Livelihood

During the construction phase, PEC needs and recruit large number of employees as well as workforce mobilization to site with estimation of 7,000 workers. High demands for workers is expected to increase employment and business opportunity.

The proposed measures in order to maximise the potential positive impact on local employment and business opportunity are as follows:

1. Consider and prioritize local workers to fulfil position in accordance to project needs and qualification required.

2. Disclose information on availability of job opportunities to public periodically or through Village Head, and Department of Labour Johor and Local Authority Pengerang in an open and transparent manner.
3. Assist the selected local people in determining the type of training needed to improve their qualifications and skill therefore they have greater opportunity to be hired as labour by project proponents or contractors.
4. Provide training to project personnel according to the project needs.
5. Implement labour recruitment in accordance with applicable labour regulations, including if migrant workers are hired.
6. Provide internship program if applicable to allow young Malaysian (especially local) to have internship experience.
7. If workforce (with certain qualifications and skills) is unavailable locally within 1-5 km range from the project site, the employment opportunity will be given to locals Kota Tinggi (district level), state, and national wide, or migrant workers.
8. For business opportunity, optimize the absorption of local products from agriculture (fruits), fisheries, and other commodities available in the area.
9. Optimizing small and medium business development of local communities to provide material and service to the project.
10. Open opportunities for local entrepreneurs to take part in project development activities including supporting facilities, such as in food and project materials and labour supply, etc.
11. Provide support and assistance to local entrepreneurs (including training, business plan development, etc.) and helping them to achieve a healthy and profitable business.
12. For smallholder farmers, fisherman, and small business owner living around the project site, provide farming, fishery, and other livelihood-related training to improve their skills and income and linked to PEC CSR program

However, at the end of construction phase, PEC will gradually reduce and terminate construction workers and prepare for demobilization, thus it decreases employment and business opportunity, changes in the community livelihood pattern, and changes in the community income level. In order to minimize drastic impact on employment and local business opportunity, below are some indicators to consider:

1. Demobilization of workforce is conducted after end of employment contract and the former employees receive their rights in accordance with the agreement and the applicable provisions according to labour regulation.
2. If migrant workers were hired, demobilization of migrant workers will reduce potential of social conflict.
3. Local workforce who are demobilized have alternative of livelihood.
4. The absorption of products from agriculture, fishery, and other commodities and products from the closest villages to the project.
5. Availability of small / medium industries / services that can provide services to the project.

The proposed mitigation measures to minimize the potential impact to local employment and business opportunity are as follows:

1. Regularly inform Department of Labour Johor and Local Authority Pengerang about the number of labours who will be demobilized during the construction period and the end of the construction period. Also Inform village head regarding this matter in transparent manner.
2. The demobilization of workforce is conducted in accordance with agreements between the company and employee.
3. Labour demobilization according to the applicable laws and regulations on employment, including provision the right of employee.
4. The company follows laws and regulations on employment regarding the worker demobilization.
5. For the changes in the community livelihood pattern, identified the need of skills to be enhanced an alternative to new livelihoods.
6. Provide agricultural training (fruits cultivation related training), and processing of fishery products, catering enterprise, entrepreneurship, and other identified livelihood-related training for communities living around the project site.
7. Provide opportunity and support to develop small and medium enterprise development of local communities.
8. Open opportunities for local entrepreneurs to take part in project development activities including supporting project facilities, as contractors or sub-contractors.
9. Optimize the use of local available products (fruits, fish, etc.)
10. Potential and talented construction workers are considered to be employed at the operational stage as required and meet company qualifications and requirements
11. Provide skills training to the workforce from the villages surrounding the project who are recruited for operation stage

4.8.4 Grievance Mechanism and Stakeholder Engagement

During the construction period, concerns and community grievance may arise as a result of project activities that cause disruption on villager activities such as due to decrease of air quality, increase noise, dust, traffic disruption due to equipment and material mobilization, etc. It is also essential to have good community relations with stakeholders, through stakeholder engagement, in order to, for the project to success. Indicators for grievance mechanism and stakeholder engagement are PEC receives minimum/ low concerns and complaints from communities, well recorded of implementation of stakeholder engagement (including consultation) with the local community as well as received a social license with positive feedback and reaction from stakeholders.

The proposed mitigation measures to minimize the potential complaints from community and received positive feedback and reaction ‘Social License to Operate’ for the project and to build and maintain good relationship with the project’s external stakeholder. The mitigation measures are as follows:

1. Implement traffic and noise management plan
2. Conduct socialization and disclose of information on grievance mechanism and construction, and other project activities, including condensate splitter and aromatics plant which may cause disturbance to communities

3. Implement stakeholder engagement plan and maintain good communication with stakeholders, including to discuss social impacts handling programs due to the development and operation of the project, and other related project activities.
4. Grievances submitted by the community are recorded, investigate, processed, and solved.
5. Accommodate and follow up on grievance, if there are complaints, during the construction of the condensate splitter and aromatics and its supporting facilities

Contractor and PEC to refer to Generic Stakeholder Engagement Plan and Grievance Mechanism and Grievance Mechanism Procedure which have been developed by PEC as the reference for detail grievance mechanism process implementations.

4.8.5 Compliance Monitoring Programmes

The ESIA document predicts that the project would potentially decrease environmental sanitation and make some changes in disease prevalence due to the present of workers from outside the area. The local community is also anticipated to benefit from the project due to employment of local people and business opportunity by providing goods and services to the Project both directly in project jobs and indirectly. The decline of employment, business opportunity and changes of livelihood will be experienced by local community during the end of construction phase.

As part of the framework in Social Management Plan, various parameters will be monitored in order to ensure to ensure a positive relationship with the local communities and to ascertain the social impacts of the project: The parameters are as the following.

1. **Public Health**: number of medical consultations, types of illnesses, and effectiveness of treatments; Incidence rate and prevalence of disease due to changes in the health status, including number of prevalence of infectious diseases in the villages around the project site; number of induction and counselling on impact of drugs, alcohol, sexually transmitted diseases (STD), and other infectious diseases to workers or surrounding community; number of CSR program implemented with pubic public health affair and local health institutions. For internally PEC, type and insurance coverage for workers and employee, number of induction and counselling about environmental sanitation; collection schedule of temporary domestic wastewater treatment (WWTP); number of shelter and sorting of waste program, and type and schedule of waste disposal (organic and non-organic); number of posters keeping clean environment, and trash boxes provided.
2. **Social interaction/ Perception**: number of disputes and cases due to cultural differences; number of arts cultural and local culture introduction activities conducted; number of consultations with local community; number of supports to the community and government program; location of accommodation for foreign workers (including facilities, hall, etc.), and number of orientation and local community awareness program for migrant workers
3. **Community Relations**: complaints and grievances, community attitudes (including number community complaints around the project due to decreasing environmental sanitation - liquid waste, solid waste, etc. health problems and changes in the health status by local community), traffic, noise, attitude of foreign workers, and other matters related to the project.
4. **Employment**: Numbers of people employed full-time or part-time (including details of ethnic origin, religion, sex, age, work experience, education level, skill level and other

types of work desired, local and foreign workers), vacancies available advertised to local communities and Department of Labor Johor and Local Authority Pengerang; and number of internship program open, type and number of training provided to local community and project personnel; labor recruitment process; number of internship program available;

5. **Business opportunity**: number of local companies and type awarded project by PEC (including Canteen and store operation inside the project site; food supply and daily need that absorb local products mainly from agriculture (fruits) and fishery commodities, catering service and to meet demand for employee); Equipment and material demand for project; Construction of condensate splitter and aromatics plant and supporting facilities and materials, and others; number and type of training and assistance provided to support and assist local entrepreneurs and smallholder farmers, fisherman, and small business owner living around the project site.
6. **Grievance Mechanism and Stakeholder Engagement Plan**: monitoring parameter is presented in Grievance Mechanism and Stakeholder Engagement Plan documents

Location of the social monitoring are villages around the project site mainly Kg. Lepau, Kg Bukit Pelali, Kg Bukit Buloh, Kg Bukit Gelugor, Kg Bukit Raja, Taman Regit Jaya, Kg Sungai Kapal, Sungai Buntu. Social monitoring shall be conducted through data collection from government agencies, direct observations, and random interviews with the community around the project site. Interviews will be conducted using structured questionnaires. Data collected will be analysed quantitatively and qualitatively.

4.9 Audit Programme

The main objective of the audit is to provide an independent check on the environmental and social compliance performance programmes. The audit findings will be used to identify any weaknesses in the ESMP implementation for the purpose of updating the ESMP and to allow for improvement of environmental and social management practices.

4.9.1 Audit Requirement

According to the EIA CoA 61(i), the Environmental Audit shall be performed once every 4 months by a third-party Environmental Auditor who is registered with the DOE. The audit costs are to be borne by the facility. For ESMP purposes, internal audit for social shall be conducted as it is not required by DoE and submission of the audit report to Lenders will include the environmental audit.

4.9.2 Scope of Audit

The audit should include a site inspection and review of environmental and social documents, interviews with the relevant personnel at various levels, site observations and review of environmental and social monitoring reports. The audit shall be carried out in accordance with the DOE's Environmental Audit Guidance Manual and IFC Performance Standards for safety and health and social.

The audit scope includes the following:

- Review of relevant environmental and social requirements including relevant permit and licenses, scheduled wastes inventory and consignment for disposal, relevant maintenance log sheet, relevant records on environmental audit note, site memo and others;
- Inspection/auditing of mitigation measures implemented onsite in accordance to ESMP;

- Review the adequacy of the implemented mitigation measures;
- Verification of whether the environmental quality monitoring results comply with or exceeded applicable criteria or the defined environmental performance limits; and
- Assessment of the overall compliance status and effectiveness of the environmental and social management system, practices and procedures.

4.9.3 Audit Checklist

The audit inspection checklist is developed for the facility containing these key elements to be audited: -

i) Environmental and Social Management System;
   a. Policy;
   b. Roles and responsibilities;

ii) Environmental and Social Legal and Approval Requirements;

iii) Implementation of Environmental and Social Mitigation and Control Measures:

iv) Environmental and Social Monitoring and Auditing Programme and Reporting;

v) Public complaint and Non-conformance records; and

vi) Environmental and Social Performance Review and Improvement Plan.

5 EMERGENCY SERVICES

This section summarises the emergency services and facilities within the Pengerang area. During the event of an emergency, PEC will be contacting the following emergency service provided. The emergency provider listed below can be contacted through the contact details as shown in the table below or through emergency number of "999" (police and ambulance), "994" (fire department) or "112" (all emergency service providers for mobile phone users).

The details of the emergency service providers are as shown in *Table 5.1*. The location of the emergency service providers in Pengerang area is shown in *Figure 5.1*.

Table 5.1: List of Emergency Providers

Emergency Services	Address	Contact Information	Approximate Distance from PEC
Health Care Providers			
Hospital Kota Tinggi	Jalan Tun Habab, Pekan Kota Tinggi, 81900 Kota Tinggi, Johor	+6078831131	75 km
Hospital Pasir Gudang	36, Jalan Gunung 35, Bandar Baru Seri Alam, 81750 Masai, Johor	N/A	78 km
Pengerang Gateway Clinic (Under Construction)	Lot 5819, Ground Floor (BM2569, Kampung Lepau, 81600 Pengerang, Johor	N/A	3 km
Pengerang Health Clinic	Jalan Besar, Tanjung Merak, 81600 Pengerang, Johor	+6078252455	12 km
Sungai Rengit Clinic	Lorong 8 Batu Hitam, 81600 Pengerang, Johor	+60197719242	9 km
Sungai Rengit Health Clinic	Kampung Sungai Rengit, 81600 Pengerang, Johor	+6078263285	9 km
Air Tawar 2 Health Clinic	Jalan Pasar, Kampung Sungai Rengit, 81900 Bandar Penawar, Johor	+6078932207	10 km
Fire and Rescue Station			
Sebana Cove Fire and Rescue Station (Under Construction)	81600 Bandar Penawar, Johor	N/A	11 km
Sungai Rengit Fire and Rescue Station	81600 Bandar Penawar, Johor	+6078246774	12 km
Punggai Fire and Rescue Station	90, Kampung Baru, 81900 Bandar	+6078861963	25 km

Emergency Services	Address	Contact Information	Approximate Distance from PEC
	Penawar, Johor		
Police Station			
Sungai Rengit Police Station	Polis Diraja Malaysia JKR P910, Jalan Pasar, 81620 Kota Tinggi, Johor.	+6078263222	9 km
Pengerang Police Station	Jalan Besar, Tanjung Merak, 81600 Pengerang, Johor	+6078252222	11 km
Department of Environment (DoE)			
DoE Pengerang	Jalan Pantai, Kampung Sungai Rengit, 81600 Pengerang, Johor	+6078266822	9 km
DoE Johor	46, Jalan Pertama 1, Taman Tampoi Indah 2, 81200 Skudai, Johor	+6075500522	100 km

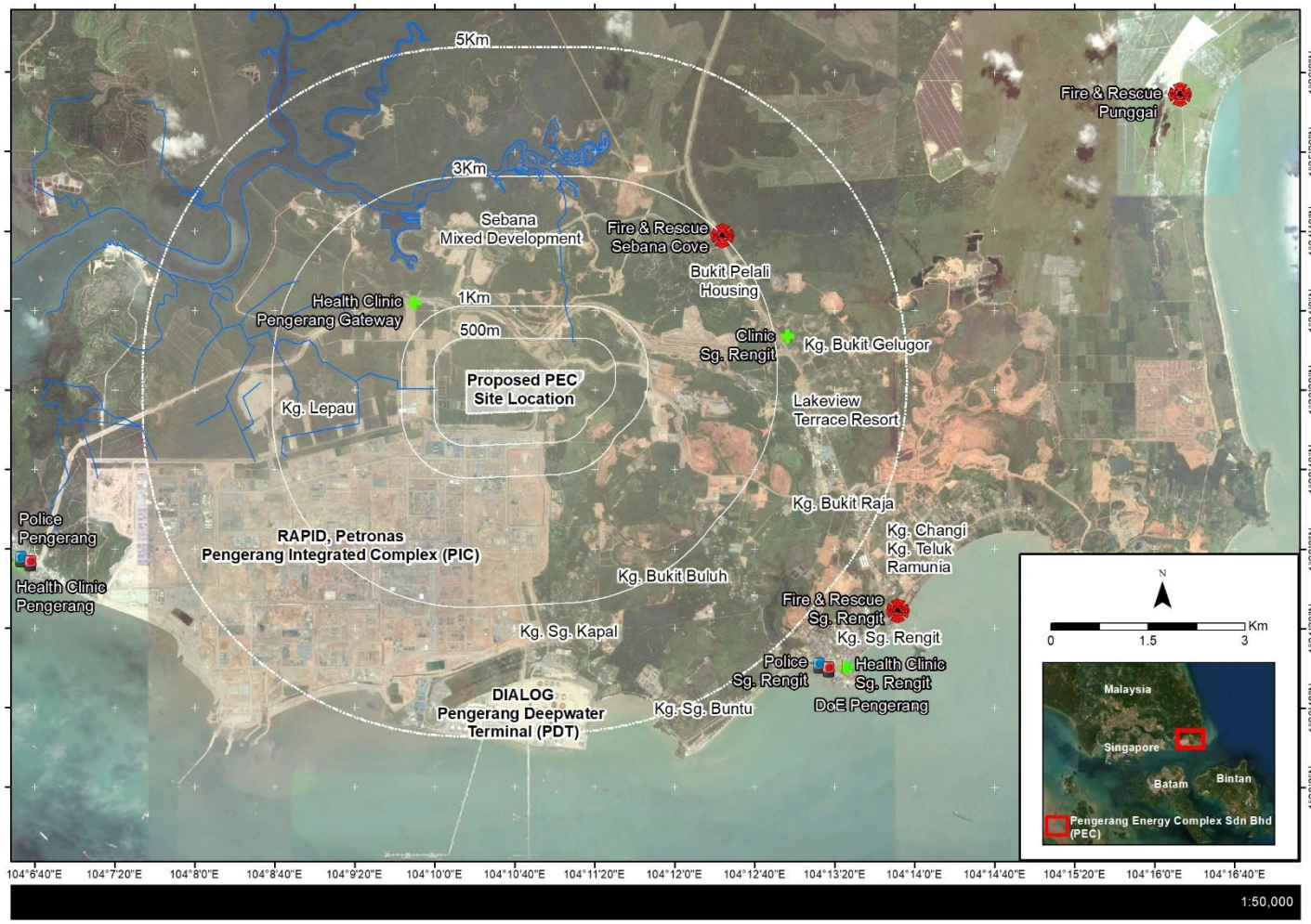


Figure 5.1 – Location of Emergency Service Providers in Pengerang

6 CAPACITY DEVELOPMENT AND TRAINING

HSE requirements at the PEC site are communicated through establishment of training programmes. Formal training programmes comprise presentations, workshops, training exercises and discussion sessions organised by the HSES Department.

6.1 Employee Training Programme

All employees, on joining the company, receive an orientation training programme inclusive of general HSE induction training, briefing on the known hazards and the appropriate environmental protection procedures and fire and emergency drills. Specific trainings/ instructions pertaining to the employee's workplace are arranged by the relevant department managers and supervisors. In addition, 'Refresher' training is provided to all personnel on a regular basis, updating them on new and amended HSE developments at PEC. The specific types of annual environmental training established for the PEC personnel are as follows:

- Environmental Awareness;
- Environmental Audit;
- Waste Management;
- Spill Management; and
- Environmental Incident Reporting and Investigation.

In addition to the above, Occupational Safety and Health (OSHA) training courses for construction activities are also provided. During the construction phase of PEC, the training will be provided PEC's main contractor to all workers on-site. Refresher course will also be provided to existing workers. The OSHA training course will include the following:

- Site Safety Induction Course;
- First Aid Training;
- Fire Safety and Emergency Response Training;
- Personal Protective Equipment (PPE) Training;
- Good Practices Training Program;
- Risk Management Training;
- Material Handling Training; and
- Housekeeping Training

The OSHA trainings above, except for site safety induction course and PPE training which are mandatory for all staff, will be conducted annually or when required for the designated personnel by certified bodies (NIOSH/ DOSH/ Fire Department).

7 IMPLEMENTATION SCHEDULE AND COST ESTIMATE

7.1 Cost for Mitigation Measures by Contractor

Contractor will allocate approximately USD 50,000 per month for the mitigation measures on HSE. The budget for mitigation measure by contractor shall cover necessary measures to prevent the potential impacts as described in the following:

- *Section 4.1* to *Section 4.8* detail out the control of pollution by environmental and social aspect/ activity;
    - Air quality;
    - Noise;
    - Water quality;
    - LD-P2M2;
    - Management of wastes;
    - Traffic;
    - Occupational Safety and Health; and
    - Social.
- *Section 4.9* summarises the environmental audit programme.

7.2 Cost for Environmental Monitoring Program

For environmental monitoring, the Contractor will allocate approximately USD 25,000 per month which shall cover the following:

- Air Quality, Ambient Air Quality Monitoring Program;
- Noise, Ambient Noise Monitoring Program;
- Vibration, Vibration Monitoring Program;
- Surface Water, Surface run-off discharge Monitoring Program and River Water Quality Program;
- Traffic, Periodic Vehicle and Driver Inspection; and
- Vehicle Entry Inspection, Daily Traffic Monitoring.

On top of the budget allocated for monitoring program, the Contractor will allocate approximately USD 50,000 for equipment costs.

7.3 Cost for Training and Capacity Building

In terms of training and capacity building, the Contractor will allocate around USD 50,000 per month to the following aspects:

- Environmental Awareness;
- Environmental Audit;
- Waste Management;
- Spill Management;
- Environmental Incident Reporting and Investigation;
- First Aid Training;
- Personal Protective Equipment (PPE) Training;
- Good Practices Training Program;

- Risk Management Training;
- Material Handling Training; and
- Housekeeping Training

7.4 Total Cost of ESMP Implementation

In total, the Contractor annual budget for the ESMP implementation is approximately USD 1.2 million per annum. The cost will cover the following aspects:

- Implementation of mitigation measures during construction;
- Environmental monitoring programs, audits and inspections; and
- Training and capacity building.