Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
Noise	Increase in ambient noise levels	Noise levels in Leq, Leq day, Leq night and hourly Leq	Identified NSRs within 500 m from the Project boundary	24-hour	Quarterly	3rd Party Environmental Consultant	EPC Contractor Cost (Approx ~3,000 USD / time)
	Workers Health	Noise levels in Leq	Identified location within the construction area	24-hour	Monthly	EPC Contractor	EPC Contractor Cost (included in Capex cost)
Soil	Contamination of soil	pH, salinity, NH_4^+, total P, heavy metals	Construction site or laydown area or spill area	Standard analytical methods	In the event of any leakage or spillage of hazardous substances, oil, or toxic chemicals	3rd Party Environmental Consultant	EPC Contractor Cost (Approx ~2500 USD / time)
	Soil quality	Monitoring of soil quality in the event of any leakage or spillage of hazardous substances, with the parameters to be sampled based upon the likely chemical compositions of the material.	Locations, to be defined on a case by case basis.	Standard analytical methods	Frequency to be defined on a case by case basis.	3rd Party Environmental Consultant	EPC Contractor Cost (Approx ~2500 USD / time)
Surface Water	Contamination of surface water	pH, Electrical Conductivity, Biochemical Oxygen Demand	Yangon River (upstream and downstream of the Power plant location)	Standard analytical methods	Every 6 month	3rd Party Environmental Consultant	EPC Contractor Cost (Approx ~2500 USD / time)

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
		(BOD), Chemical Oxygen Demand (COD), Total Nitrogen, Total Phosphorus, Oil & Grease, Total Suspended Solids(TSS), Total Coliform Bacteria (TCB), Total Chromium (Cr), Copper (Cu), Iron (Fe), Zinc (Zn), Lead (Pb), Cadmium (Cd), Mercury (Hg); Arsenic (As).					
Ground Water	Contamination of ground water	pH, Electrical Conductivity, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Nitrogen, Total Phosphorus, Oil & Grease, Total Suspended Solids(TSS),	At nearest ground water extraction pump in Ahlone Towsnship	Standard analytical methods	Every 6 month or upon complaint from local stakeholders	3rd Party Environmental Consultant	EPC Contractor Cost (Approx ~2500 USD / time)

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
		Total Coliform Bacteria (TCB), Total Chromium (Cr), Copper (Cu), Iron (Fe), Zinc (Zn), Lead (Pb), Cadmium (Cd), Mercury (Hg); Arsenic (As).					
Occupational Health and Safety	Accidents or incidents due to construction activities, workers' health	Near-misses, incidents, occupational diseases, dangerous occurrences	Project activity areas and construction workers camp	As defined in construction phase Health & Safety Plan to be prepared by EPC contractor	As defined in H&S Plan	EHS Team of EPC Contractor	EPC Contractor Cost (included in Capex cost)
Waste	Impact from non-hazardous wastes storage, transport and disposal	Implementation of Waste Management Plan (WMP)	Project activity areas and construction workers camp, transport assets and disposal areas	Compliance to the WMP	Unplanned audit twice a year	EHS Team of EPC Contractor	EPC Contractor Cost (included in Capex cost)
	Impact from hazardous wastes storage, transport and disposal	Implementation of Waste Management Plan (WMP)	Project activity areas and construction workers camp, transport assets and disposal areas	Compliance to the WMP	Unplanned audit twice a year	EHS Team of EPC Contractor	EPC Contractor Cost (included in Capex cost)

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
Biodiversity	Impacts to biodiversity values (habitats and species) due to vegetation clearing (Habitat loss) and mortality (vehicle strike, hunting and poaching) at the work site	Records of training, Fauna Shepherding protocol and accidents	NA	Compliance against protocols.	3 monthly basis	EHS Team of EPC Contractor	EPC Contractor Cost (included in Capex cost)
Biodiversity	Introduction/ proliferation of invasive species in natural habitat	Implementation of mitigation measures	Project activity areas and construction workers camp	Compliance against invasive management measures	Monthly	EHS Team of EPC Contractor	EPC Contractor Cost (included in Capex cost)
Social	Local content employment	Percentage of local (directly from the Project SAoI) employed during construction	NA	Compliance against the Sourcing, Procurement and Recruitment Management Plan	Start of construction and bi-monthly after.	EHS Team of EPC Contractor	EPC Contractor Cost (included in Capex cost)
	Stakeholder Engagement	Number or frequency of engagement	NA	Compliance against the Stakeholder Engagement Plan	Monthly	EHS Team of EPC Contractor	EPC Contractor Cost (included in Capex cost)
	Grievance Mechanism	Number and resolution of grievances	NA	Compliance of resolution duration of grievance with Grievance Mechanism	Weekly	EHS Team of EPC Contractor	EPC Contractor Cost (included in Capex cost)

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
	Impact to navigation	Permit and safety equipment	Construction vessels	Unplanned Compliance audit against international regulation for operating vessels	Every 4 month	EHS Team of EPC Contractor	EPC Contractor Cost (included in Capex cost)
	Impact to traffic	Permit and code of conduct	Construction area and roads used for transport of workers and construction material	Unplanned Compliance audit against worker Code of Conduct	Every 4 month	EHS Team of EPC Contractor	EPC Contractor Cost (included in Capex cost)
	Impact to existing facilities	State of Public infrastructures	Roads used for construction	Capacity to use the infrastructure safely	Monthly	EHS Team of EPC Contractor	EPC Contractor Cost (included in Capex cost)
	Impacts to health and safety of the community	Worker training, grievances, accident log, implementation of Community H&S monitoring and surveillance programme, implementation of worker code of conduct	NA	Compliance against plan	Bi monthly review of training log; Monitoring and review of accidents due to construction (daily monitoring and monthly review). Community health and safety monitoring and surveillance program.	EHS Team of EPC Contractor	EPC Contractor Cost (included in Capex cost)

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
					Daily monitoring of construction area, worker camp and surrounding; Regular unplanned audit on worker code conduct; Monthly visual inspection of first aid facilities and records. Weekly review of grievance log.		
Community Health and Safety	Community disturbance and potential safety hazard due to road traffic	Accidents, incidents and complaints	Roads used for transport of workers and construction material	Incidents, accidents and community complaints	Based on occurrence and yearly	EHS and/or Community Liaison Officer of EPC Contractor	EPC Contractor Cost (included in Capex cost)
	Public concerns	Complaints from community	Neighbouring communities around the Project activity areas	As per the grievance redress mechanism	Continuous	Project Company	EPC Contractor Cost (included in Capex cost)
Operation Phase							
Air Quality	Impact to air quality due to operation emissions	Stack emissions	Stack	NOx	Yearly	3rd Party Environmental Consultant	TPMC Opex cost (Approx ~5000 USD / time)
Noise	Impact to ambient noise level	Noise from operation activities	Nearest NSR	Decibels	Yearly	3rd Party Environmental Consultant	TPMC Opex cost (Approx ~2000 USD / time)

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
Surface water	Impact to surface water through release of colling water	Temperature	Discharge pipeline	Temperature	Bi-weekly	TPMC EHS team	TPMC Opex cost
Soil and ground water	Accidental Leaks of demineralized plant neutralized water	Monitoring of soil quality in the event of any leakage or spillage of hazardous substances, with the parameters to be sampled based upon the likely chemical compositions of the material.	Locations, to be defined on a case by case basis.	Standard analytical methods	Frequency to be defined on a case by case basis.	3rd Party Environmental Consultant	Approx ~2500 USD / time
	Accidental leak of cooling water	Discharge pipeline integrity	Discharge pipeline	Visual inspection	Monthly	TPMC EHS team	TPMC Opex cost
Waste	Impact to soil, groundwater, surface water, biodiversity and human receptors	Implementation of Waste Management Plan (WMP)	Project activity areas and construction workers camp, transport assets and disposal areas	Compliance to the WMP	Unplanned audit yearly	TPMC EHS team	TPMC Opex cost
	Impact to soil, groundwater, surface water, biodiversity and human receptors	Effluent water quality.	Discharge location	Standard analytical methods	Bi-monthly	TPMC EHS team	TPMC Opex cost

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
Social	Local content employment	Percentage of local (directly from the Project SAoI) employed during operation	NA	Compliance against the Sourcing, Procurement and Recruitment Management Plan	Start of operation and yearly after.	TPMC EHS team	TPMC Opex cost
	Stakeholder Engagement	Number or frequency of engagement	NA	Compliance against the Stakeholder Engagement Plan	Quarterly	TPMC EHS team	TPMC Opex cost
	Grievance Mechanism (all impact)	Number and resolution of grievances	NA	Compliance of resolution duration of grievance with Grievance Mechanism	Weekly	TPMC EHS team	TPMC Opex cost
	Impacts to health and safety of the community	Compliance with operation plans	Project activity areas	Percentage of non-compliance against plans	Bi-yearly review of training log. Bi-yearly review of compliance against community health and safety monitoring and surveillance programme. Conduct regular unplanned audit of the worker code of conduct.	TPMC EHS team	TPMC Opex cost

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
					Bi-yearly unplanned audit of waste management activities. Monthly visual inspection of first aid facilities and record, review of employment records and health insurance subscription records.		
	Impact to occupational health and safety	Accidents or incidents due to operation activities, workers' health	Near-misses, incidents, occupational diseases, dangerous occurrences	Project activity areas	As defined in operation phase Health & Safety Plan to be prepared by EPC contractor	TPMC EHS team	TPMC Opex cost

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
Greenhouse Gas	Potential impacts on climatic condition due to GHG emissions	Fossil fuel consumption report	LNG Power Plant	Record of fuel use for project operation and calculate GHG emission annually according to recognized international guideline or standard (e.g. IPCC, GHG Protocol)	Record or monitor the fossil fuel consumption report on a monthly basis and quantify GHG emissions annually	TPMC EHS team	TPMC Opex cost

12.6 Institutional Setting and Implementation Arrangements

12.6.1 Construction Phase

The ESMP will be included in the construction contract and the contractor will be responsible for implementation of the measures associated with design and construction. The Project Proponent's staff, specifically the EHS Officer and Site Engineer, will monitor the implementation of these mitigation measures by the contractors at the site. These officers will be responsible for the field level monitoring of the Project.

The roles and responsibilities of the Project Proponent and EPC Contractor for implementation and monitoring have been outlined in ***Table 12.7***.

Table 12.7: Roles and Responsibilities of Sponsor and EPC Contractor

Sponsor	EPC Contractor
Obtaining statutory clearances required during pre-construction stage of the Project	Obtaining permits required during the construction stage
Overall Project co-ordination and management through EPC Contractor and supported by the third party environmental consultants	Joint verification with the Project Proponent and Third Party Environmental Consultant for review of ESMP implementation
Interaction and reporting to the respective department of Government of Myanmar	Interaction with the Project Proponent and appointed supervision consultant, if any
Interaction and reporting to lenders	Filling of reporting formats as per the reporting schedule and submission to the Project Proponent
Effective implementation of ESMP and monitoring of ESMP implementation	Environmental monitoring through Third Party Environmental Laboratory
Carryout verification/ supervision exercises during the construction phase of the Project for implementation of ESMP	Preparation of various plans for effective implementation of ESMP by the Sponsor
Keeping records of all permits obtained by EPC Contractor	Management of labour camp and to provide drinking water, sanitation facility
Overall supervision of ESMP implementation	
Approval of plans prepared by EPC Contractor	
Addressing grievances of local community and information dissemination	
Environmental monitoring through laboratory	

While the EPC Contractor or a particular party is responsible for physical implementation of the mitigating measures, the whole implementation process requires supervision, checking, documentation and verification so that problems are identified and properly addressed before they get out of hand. In order to ensure proper execution of the ESMP, implementation reviews will be conducted by the Project engineer such as the weekly construction meetings, construction log book, monthly and other construction reports etc. Records of these minutes of the weekly meeting, monthly reports and special reports on implementation of the mitigating measures will also be maintained and available for review by the Project management. It is suggested to identify documents and records that require templates and accordingly suitable templates shall be developed, which shall include but not limited to policies, procedures and work instructions, meeting minutes, monitoring results, training attendance records, emergency contract lists, action plans etc. Further, all these templates shall be communicated to all potential users. All these records will be archived at the Project office and will be maintained by the

EHS officer. All documents and records shall be archived with a unique identifier so that they can be distinguished from any other material and can be easily retrieved. The Sponsor will document the process for creating, allocating and approving unique identifiers and will communicate this to relevant staff.

12.6.2 Operation Phase

During Operation Phase, the Project Proponent, especially the EHS team and operation team will be fully responsible for implementation of the ESMP. The Project Proponent's staff, specifically the EHS Officer and Plant Engineer, will monitor the implementation of these mitigation measures.

12.7 Training

12.7.1 Construction Phase

Prior to commencement of major civil works at site, a suitably qualified in-house/ external expert will be appointed by the EPC contractor in consultation with the Sponsor to develop and deliver a training program on implementation of the ESMP, monitoring and reporting will be conducted in line with the applicable reference framework for the Project. The training will include the following topics:

- Environment, Health and Safety Policy of the EPC contractor;
- Environment and fundamentals of environmental pollution in relation to the Project;
- EHS management plans prepared by the EPC Contractor;
- Do's and Don'ts for the construction workers;
- Safety procedures and guidelines;
- Internal reporting and response system;
- Hazardous chemicals and waste handling;

In addition, specific training will be provided to the team involved in environmental and social monitoring and reporting, which will include:

- Applicable environmental and social guidelines and standards;
- Sampling site selection guidelines in line with environmental monitoring plan;
- Sample collection, storage, transportation and analysis procedures;
- Solid and hazardous waste management;
- Quality assurance and quality control;
- Environmental monitoring report preparation

The training will help in capacity building and implementation of the ESMP during the construction phase of the Project. It will also help in ensuring internal and external monitoring and verification of the environmental and social performance of the Project. The timeframe for reporting and verification during the construction phase will be agreed between the Project Proponent, the relevant authorities and the Lenders.

12.7.2 Operation Phase

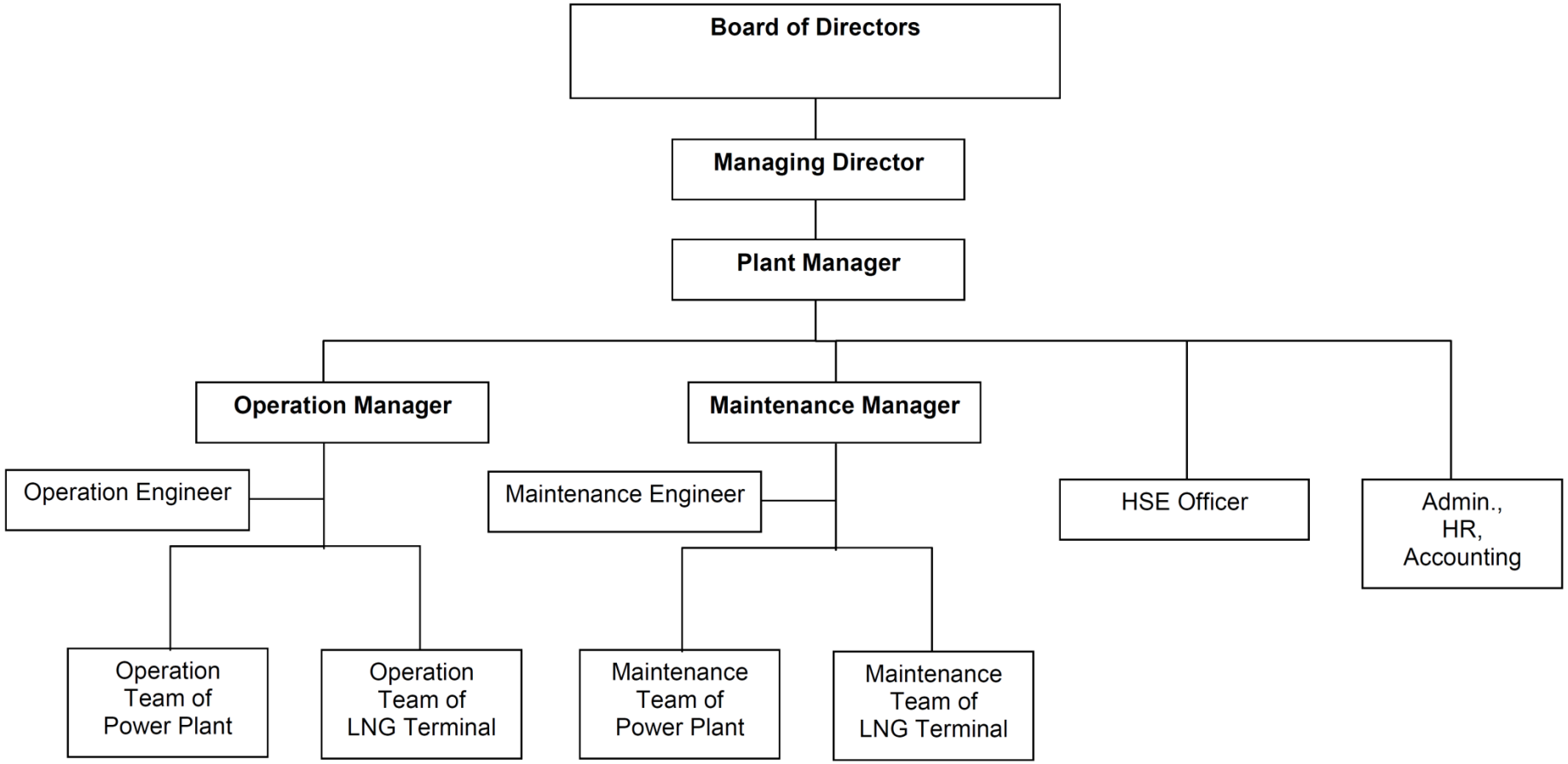
Prior to the commencement of the Plant operation, a suitably qualified in-house/ external environmental expert will be engaged by the Sponsor to develop and deliver a training program on operation phase environmental and social monitoring and reporting. The topics will be mostly same as that during the construction phase. However, it will also include following modules, which are specific to the operation phase:

- Continuous emission monitoring;
- Hazardous chemicals and waste management;
- Occupational health and safety programs, including Emergency Response Plan for both employee and nearby communities;

The training will help in capacity building and implementation of the ESMP during the operation phase of the Project. It will also help in ensuring internal and external monitoring and verification of the environmental and social performance of the Project. The timeframe for reporting and verification during the construction phase will be agreed between the Sponsor, the relevant authorities and the Lenders.

The Project Proponent's overall Project organisation chart, the Project Proponent's organisation chart during construction, including EPC contractor and other contractors, are shown in ***Figure 12.1***.

Figure 12.1: TPMC's Overall Project Organisation Chart



Source: TPMC, 2018.

12.8 Plans for Construction and Operation Phase of the Project

12.8.1 Construction Phase

Prior to the beginning of major site works, the EPC contractor in cooperation with the Project Proponent will develop the following plans:

12.8.1.1 Emergency Response Plan

TPMC has in place a Project Incident and Emergency Response Plan to provide the necessary course of action during an unplanned event.

The potential emergency scenarios that apply to this plan are as follows:

- Person(s) fall from height – on land;
- Material fall from height;
- Vehicle collision with plant/equipment/pedestrian(s);
- Vehicle incident offsite;
- Collapse of scaffold – no person(s) present/person(s) present;
- Collapse of structure – no person(s) present/person(s) present;
- Collapse of deep excavations – person(s) present;
- Fire/Explosion – electrics, substances;
- Chemical spillage – on land;
- Medical emergency – mass food poisoning/bird flu;
- Medical emergency – contagious disease;
- Uncontrolled flammable/toxic release;
- Adverse weather conditions (flooding, lighting strike);
- Loss of services (water, sewerage, electricity);
- Radiation (Radiation Source Exposition); and
- Other (Earthquake, terrorist act, bomb threat, trespassers).

The full Project Incident and Emergency Response Plan is shown in ***Appendix H***.

12.8.1.2 Health and Safety Plan

The EPC Contractor will prepare and implement a Health and Safety Plan prior to commencing work. This plan will include method statements for work activities, plant utilisation, construction sequence and safety arrangements. Measures will be implemented to reduce the likelihood and consequence of the following hazards:

- falling from height;
- falling into water;
- entanglement with machinery;
- tripping over permanent obstacles or temporary obstructions;
- slipping on greasy or oily walkways;
- falling objects;
- asphyxiation;
- explosion;
- contact with dangerous substances;
- electric shock;
- variable weather conditions;
- lifting excessive weights; and
- traffic operations.

12.8.1.3 Construction Environmental and Social Management Plan (Site Specific Plan)

The EPC Contractor will prepare and implement a Construction Environmental and Social Management Plan prior to commencing work to manage the construction related environmental and social aspects.

12.8.1.4 Traffic Management Plan

The EPC Contractor will prepare and implement Traffic Management Plan prior to commencing work to manage the construction traffic. This will be required towards prevention of local traffic disruptions, avoid peak hours rush and prevent accidents. Movement of all heavy equipment and vehicles from Jetty to Project site needs to be coordinated with the logistics team of the Project Proponent and in discussion with relevant local authorities. This will also include waterways traffic for construction vessels and vessels transporting equipment and material.

Additionally, it is to be noted that the detailed management plans as specified in ***Section 12.4*** will also be developed prior commencing activities in relation to such plans.

12.8.2 Operation Phase

During the operation phase of the Project, the Project Proponent will develop the following plan/ management systems for effective operation of the Plant:

12.8.2.1 HSE and Social Management System

The Project Proponent will develop and implement an HSE and Social Management System (HSE&SMS) to international guidelines for the entire Plant premises and its impact zones (project area of influence as defined under IFC PS) within sixteen (16) months of commissioning the Plant.

12.8.2.2 Waste Management Plan

For effective segregation, handling, storage and disposal of solid and hazardous wastes generated from the Plant operations, a waste management plan will be developed by the Project Proponent.

12.8.2.3 Spill Response and Emergency Plan

The Project Proponent will prepare a spill response and emergency plan to address accidental spillages or release of hazardous wastes.

12.8.2.4 Emergency Response and Disaster Management Plan

Based on the outcome of the consequence analysis as well as detailed quantitative risk assessment of the Project after finalisation of project design, emergency response and disaster management plans will be developed by the Project Proponent. These will define protocols to be followed in the event of emergencies or disasters in order to limit the impact on the employees and the local community. The plan will address both on-site and off-site emergency situations due to the operation of the different component of the project. The plans will disclose potential disasters and potential risks from the LNG Terminal, the Natural Gas Pipeline and the plant to the local community as well as the plan of action on emergency protocol in the event of any such eventuality. These will also include awareness programs for the Project personnel, local community and local administration.

Additionally, it is to be noted that the detailed management plans as specified in ***Section 12.4*** will also be developed prior commencing activities in relation to such plans.

12.8.3 Budget

The EPC Contractor and the Project Proponent will allocate separate budget for environmental and social management plan implementation, training, environmental monitoring, analysis and reporting,

verification monitoring and capacity building. It should be noted that costs for many in-built mitigation measures, such as, acoustic enclosures for noise control, water and wastewater treatment, CEM, etc., are already included in the EPC contract cost estimate and/or operating cost estimates. In addition, separate budget will be allocated for CSR activities, which will be conducted by the Sponsor for community development.

12.9 Updating of ESMP

This ESMP will be updated, revised and reviewed internally on regular basis to ensure particularly that ESMP continuing suitability, adequacy and effectiveness regarding the Project commitment to continual improvement. The ESMP of the Project will be monitored and reviewed on half-yearly basis.

Furthermore, in the event of an unanticipated impact and design change with respect to the Project Standards (including Myanmar Government and IFC requirements); the ESMP would be updated as necessary.

13. PUBLIC CONSULTATION AND DISCLOSURE

This Chapter describes the stakeholder engagement activities undertaken during development of the ESIA. This includes key issues raised by stakeholders and where each of these issues have been addressed in the ESIA.

The engagement process has been designed to meet both Myanmar legal requirements according to the Environmental Impact Assessment Procedure No. 616/2015 for public participation, and international requirements for engagement as outlined by the IFC Performance Standards.

13.1 Methodology and Approach

13.1.1 Purpose of the Consultation

The first step in establishing a dialogue is identifying the Project stakeholders. Stakeholders are persons or groups who are directly or indirectly affected by a project, and those who may have interests in and/ or the ability to influence a project's outcomes (either positively or negatively).

The Project team is committed to undertaking a process that delivers inclusive and continuous dialogue with the Project stakeholders during the ESIA. The objectives of this engagement are to:

- Identify all those affected or interested in the Project to ensure they are included in the engagement process
- Ensure Understanding through open, culturally inclusive, appropriate and transparent engagement process. Information has been disclosed as early and comprehensively as possible.
- Involve Stakeholders in the scoping of issues, the assessment of impacts, the generation of mitigation and management measures and the finalisation of the ESIA report. Stakeholders also played an important role in providing local knowledge and information for the baseline that informs the impact assessment.
- Build Relationships and trust through open dialogue and engagement. Establish transparency of TTCL activities to build and maintain trust with stakeholders.
- Engage Vulnerable Peoples by having an inclusive approach to consultation. Some stakeholders need special attention in such a process due to their vulnerability.
- Manage Expectations with respect to proposed Project benefits. The engagement process served as a mechanism for understanding and managing stakeholder and community expectations, where the latter will be achieved by disseminating accurate information in an accessible way.
- Ensuring Compliance. The process is designed to ensure compliance with both Myanmar regulatory requirements and international best practices.

13.1.2 Identification of Relevant Stakeholders and Potential Issues

A stakeholder mapping exercise was undertaken to identify the Project stakeholders as well as potential issues of concern to the stakeholders. A key part of this process was to identify individuals and groups who may find it difficult to participate, as well as those who may be differentially or disproportionately affected by the Project because of their marginalised or vulnerable status.

The mapping exercise was developed based on desktop review of maps detailing the Project site and surrounding land uses/ activities, data collected during early site visits, discussions with some of the stakeholders, and the scoping report prepared for the Project.

Stakeholders were prioritized based on their level of interest in the Project and their power or ability to influence the Project. Level of interest for each stakeholder was confirmed during the subsequent visits to the site through formal engagement or ad-hoc discussions.

By identifying the Project stakeholders early, the ESIA team was able to tailor the engagement approach to meet their needs and expectations – e.g. address the issues of most concern to stakeholders during meetings.

Table 13.1 provides the list of Project stakeholders identified during the mapping exercise. It includes villages located in close proximity to the Project site and/ or its associated facilities.

Table 13.1: List of Project Stakeholders

Stakeholder Group	Stakeholder
Union Government	■ Ministry of Natural Resources and Environmental Conservation (MONREC) ■ Ministry of Electricity and Energy (MOEE) ■ Electric Power Generation Enterprise (EPGE) ■ Myanmar Investment Commission (MIC) ■ Myanma Oil and Gas Enterprise (MOGE) ■ Myanmar Port Authority (MPA) ■ Ministry of Agriculture, Livestock and Irrigation (MALI) ■ Ministry of Labour, Immigration and Population (MLIP) ■ Ministry of Social Welfare, Relief and Resettlements (MSWRR) ■ Ministry of Sports and Physical Education
Regional Authorities	■ Department of Electrical Power Planning (DEPP) ■ Chief Minister Office ■ Myanmar Port Authorities
Township Authorities (Ahlone, Dagon, Lanmadaw, Latha, Pabedan, Kyauktada, Seikkan, Botataung, Pazundaung, Mingala Taungnyunt, Kyimyindaing, Sanchaung, Bahan, Seikgyikanaungto, Dala, Thanlyin, Thuwana, Thingangyung, Pardagyi, Sin Kan, Kyauktan, Oak Pho Su, Bauk Htaw Twin, Bago Su, Myoma, Nyaung Thone Pin, Myo Haung, Bago Su, Shwe Pyout, Shwe Pyi Thar Yar, Shwe Kone, Thidar Myine, Phayar Kone, Oak Pho, Amhuhtan, Thout Taw Twin, A Lwan Swut, Htan Pin Kone, Myo Thit, Kyaung Oak Sake, Pu Zun Daung).	■ General Administration Department (GAD) ■ Department of Livestock, Fisheries and Rural Development ■ Department of Irrigation and Agriculture ■ Department of Electric Power ■ Department of Industry and Trade ■ Department of Social Welfare, Relief and Resettlements ■ Department of Labour ■ Forestry Department ■ Fire Department ■ Health Care Department ■ Finance Department ■ Water Utilization Department ■ Municipal Department ■ Tax and Revenue Department ■ Development Committee
Communities Stakeholders	■ Village Tract Leaders ■ Local villagers – Shan Kan, Nyaung Chaung, Tha Pyay Kone, Gwa, Nyaung Ngoke To, Nga Tan Ta Yar, Pyawbwe, Yakaing gyaung, Pyaw Bwal Gyi, Tone Tin Gan, Pyaw Bwal Gyi, Htun O, Pann Pin Chaung, Thet Kal Kwin, Rakhine Chaung, Kyan Sitt Tharr, Shan Kan, Mhaw Sett, Sein Pan, Ka Mar Ka Sit, Da Note, Pazundaung, Shwe Lay Chaung, Ta Pin Shwe Htee, Nyaung Chaung, Shwe Lay Chaung, Tar Gyi, Tha Yaw Tan, Kyar Hpyu Kan, Ye Chaung, Tha Ke Ta, Tha Khin Ba Thaung, Nyaung Ngoke To, Tha Pyay Kone, Shwe Hlay Chaung, Pyaw Bwe Gyi, Shan Kan, Htaw, Shan Kan, Da Noke, Kha Naung Ywar Ma, Paya Kone, Htan Pin Kone, Nyanung Thone Pin, Shwe Pyauk, Bogyoke, Ah Lwan Sut, ■ Farmers within local villages

	■ Fishermen within local villagers ■ Women's group representatives within local villages ■ Youth representatives within local villages ■ Healthcare workers within local villages and regional health care facilities ■ Community based organisations ■ Boat owners ■ Vulnerable groups (e.g. landless, poor) within the local villages
NGO, Media, Academic	■ Myanmar Environment Rehabilitation-Conservation Network (MERN) ■ Biodiversity and Nature Conservation Association (BANCA) ■ Ecosystem Conservation and Community Development Initiative (ECCDI), Yangon Or ■ Environmental Conservation and Livelihood Outreach Foundation (ECLOF), Yangon ■ Yangon University
Business	■ Yangon Industrial Ports ■ Yangon Ferry Operators ■ New Yangon Development City ■ Samsung ■ Yangon Electricity Supply Corporation (YESC) ■ Engineering Procurement Construction (EPC)

Source: ERM, 2019.

13.1.3 Overall Approach and Scope of Engagement for the Impact Assessment

Under Section 7 of the Environmental Conservation Law and Articles 52 and 53 of the Environmental Conservation Rules of the Republic of the Union of Myanmar, the Project Proponent is required to undertake an Environmental Impact Assessment (EIA) to obtain the Environmental Compliance Certificate (ECC) for the proposed LNG Receiving Terminal development and operations. The EIA Procedure (dated 29 December 2015) sets out the requirements for development, assessment and subsequent monitoring of an EIA, which are illustrated in ***Figure 13.1***, including the consultation requirements, which are discussed below.

According to Article 50 of the EIA Procedure (2015), as part of the Scoping exercise, the Project Proponent shall ensure the following public consultation and participation processes are carried out:

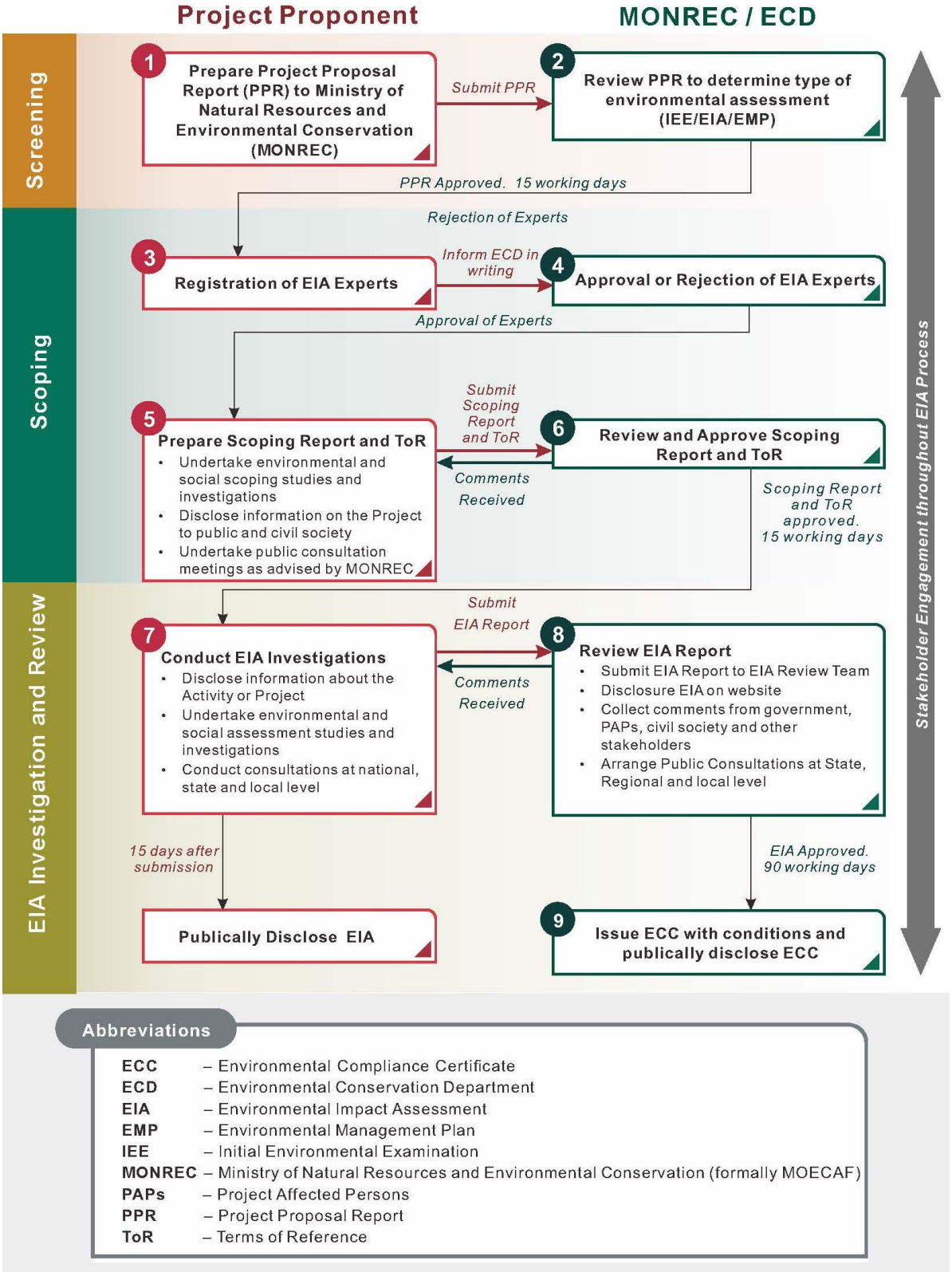
- Disclose information about the proposed Project to the public and civil society through posting on the Project or Project Proponent's website(s) and local media, including by means of the prominent posting of legible sign boards and advertising boards at the Project site which are visible to the public;
- Arrange the required consultation meetings, as advised by the Ministry, with local communities, potentially PAPs, local authorities, community based organizations, and civil society, and provide appropriate and timely explanations in press conferences and media interviews;

According to Article 61, as part of the EIA investigations the Project Proponent shall undertake the following consultation process:

- Timely disclosure of all relevant information about the proposed Project and its likely Adverse Impacts to the public and civil society through local and national media, the website(s) of the Project or Project Proponent, at public places such as libraries and community halls, and on sign boards at the Project site visible to the public, and provide appropriate and timely explanations in press conferences and media interviews;
- Arrange consultation meetings at national, regional, state, Nay Pyi Taw Union Territory and local levels, with PAPs, authorities, community based organizations and civil society;

- Consultations with concerned government organizations including the Ministry, the concerned sector ministry, regional government authorities and others; and
- Field visits for the Ministry and concerned government organizations.

Figure 13.1: Role of the Project Proponent on Stakeholder Engagement in the EIA process as defined by the EIA Procedure (2015)

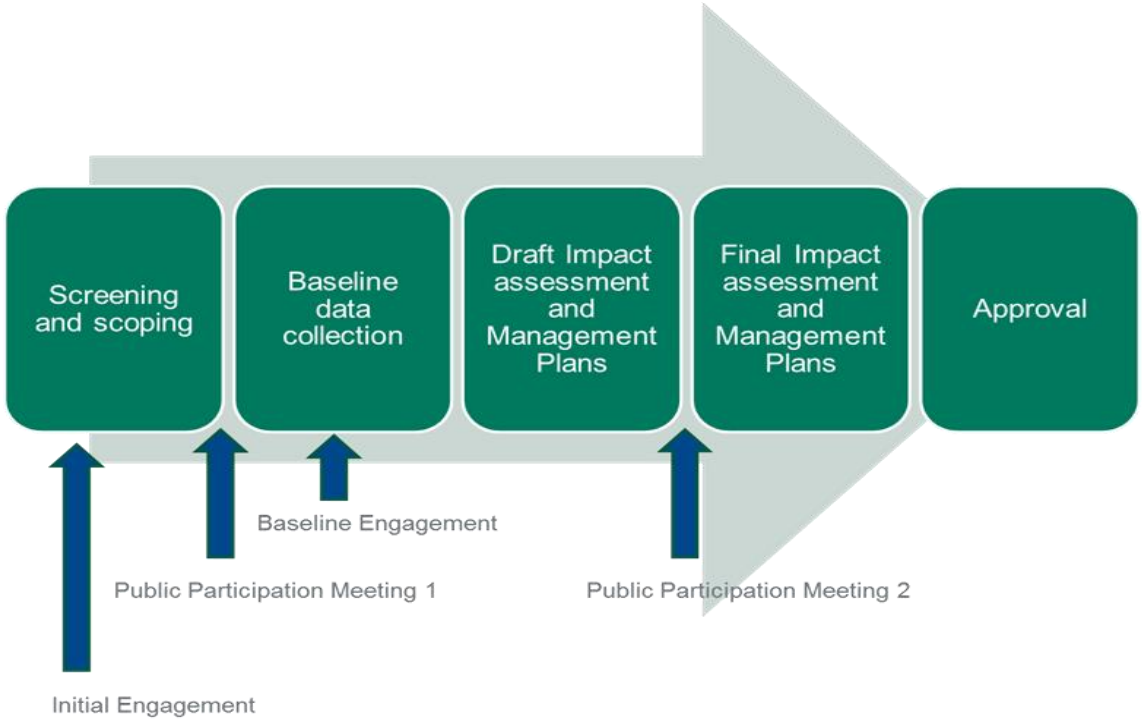


Source: ERM, 2018.

Project stakeholders have been engaged at various moments during the development of the ESIA, as shown in Figure 13.2. The engagement activities focused on:

- Introducing the Project and providing ongoing updates as the design of the Project is further refined;
- Providing an overview of the likely impacts and proposed management measures and related monitoring activities;
- Gathering stakeholder insights and input, including feedback on previously identified impacts, proposed management measures and monitoring activities; and
- Responding to key issues raised by stakeholders.

Figure 13.2: Steps of Stakeholder Engagement Process for the ESIA



Source: ERM, 2019.

13.2 Consultation for the Scoping Process

13.2.1 Format and Content of Consultation Meetings

The stakeholder consultation meetings were structured as follows:

- Introductions and information disclosure: introduce the Project Proponent, the ESIA and the proposed stakeholder engagement process, the potential environmental and social impacts and mitigation to help the stakeholders understand the Project and the Project Proponent's intentions for engagement.
- Question and answer (Q&A) session for all stakeholders in the township meeting to raise concerns, comments or ask questions that the ESIA consultant and Project Proponent could directly respond.
- Data collection: collection of additional in-depth information through interviews with key stakeholder groups in the village tracts.

In order to inform stakeholders about the Project and share information on the activities, a four page Information Document containing Project information and details on how to feedback into the Project was produced. All information was communicated by the use of visual media (including posters and power point presentations) and provided in local Myanmar language. Copies of the presentations can be found in ***Appendix S***. Copy of the Business Information Document in ***Appendix T***. Minutes of the engagement meetings can be found in ***Appendix U***.

Stakeholders were also given time to share their concerns and views and any further clarifications they required at the end of the meetings. A feedback form was also provided to stakeholders for raising any additional questions or comments they may not have been able to raise during the Question and Answer session.

To gather more environmental and social baseline data and to identify potentially affected communities, Focus Group Discussions (FDGs) were undertaken at village level and were guided by questionnaires covering information relating to:

- Generic village profile: Collected information on demographic patterns, communities, occupations, and communication and grievance systems from Village leader.
- FGD questionnaires: Collected information on fishing, farming, women and ecosystem services.
- Health: Collected information on main health issues and services from Health Practitioner.

Any queries raised by the stakeholders were responded to, and noted as additional information for the impact assessment process for the ESIA.

Household Interviews that were carried out in each village are listed on ***Table 13.2***.

Table 13.2: Household Interviews in each Village

Township	Village	No. of Households (HH)
Ahlone	Thit Taw	23
	Saw Yan Paing	17
Dala	Ta Pin Shwe Hti	11
	Kyansisthar	8
	Tha Pyae Kone	15
	Ye Chaung Wa	15
	Tone Tin Gan	10
	Thet Kal Kwin	7

Township	Village	No. of Households (HH)
	Tone Tin Gun	2
Seikgyikanaungtoe	Nyaung Ngok To	12
	Seikgyi (East)	19

Source: ERM, 2019.

13.2.2 Summary of Consultation Activities Undertaken for the Scoping Process

Representatives from 17 Townships and villages were invited to attend public consultation meeting – Thanlyin, Kyauk Tan, Shwe Pyi Thar, Ahlone, Lanmadaw, Seik Kan, Dagon, Mingalardon, Pazundaung, Kamaryut, Tarmwe, Dala, Seikgyikanaungto, Shwe Pyi Thar, Pu Zun Daung, Tha Ke Ta, and Tha Khin Ba Thaung.

The meetings held were conducted between 30October and 11 December 2018. Various stakeholders were invited including Chief Minister and State Government, concerned Regional level ECD and GAD, Members of Parliament, Township GAD, village administrators, and local communities. The date, time, location, stakeholder and number of participants of each meeting is provided in ***Table 13.3***. The consultations were also communicated in two (2) Myanmar Newspapers both in English and Myanmar language (see ***Figure 13.3***).

The consultation helped the Project gather information on potentially affected people, and on potential data gaps and how these can be closed out in the ESIA Report. It also enabled various stakeholders to learn about the project and voice out their concerns and suggestions.

Table 13.3: Consultation Activities Undertaken for the Scoping Process

Date	Location	Stakeholder	Number of Participants
29/10/2018	Ahlone Township hall	GAD (Forestry and Fire Department), Parliament Member (Regional Gov't), Regional ECD, Village Leader, Elder people, Villagers, Journalist, Reporter, Yangon Electricity Supply Corporation (YESC), Corporations, and Engineering Procurement Construction (EPC)	182
10/12/2018	Dala Township hall	Parliament Member, GAD, Concerned Departments, Ward Administrator, Village Leader, Villagers, Ministry of Sports and Physical Education, YESC, Journalists, Reporters, and Yangon City Development Committee (YCDC)	211
11/12/2018	Thanlyin Township hall	GAD, Concerned Departments, Village Leader, Elder people, Villagers, Journalist, EPC, and Corporation	208

13.2.3 Results of Consultation after the Scoping Process

The following section summarises the key issues raised during the scoping public consultation meetings and ***Table 13.4*** presents the responses concerned with these issues. Photos taken during the first public consultation are shown in ***Figure 13.3***.

Table 13.4: Key Concerns and Question Raised during Public Consultation 1

Questions	Stakeholder	Response	Reference/Response in ESIA
How much is the electric cost per unit?	Name: Daw Khin Thwe Thwe Tun Position: Ward administrator Address: Dagon Township	TPMC: Currently, we cannot provide exact details regarding the electricity rates since we are still discussing with MOEE regarding the power purchase agreement. However, the discussion with MOEE is only in regards to the rates between producers and buyers for long-term contract. The MOEE is responsible for the distribution of electricity and electricity rates.	N/A
How will you prevent accidents?	Name: Daw Khin Thwe Thwe Tun Position: Ward administrator Address: Dagon Township	ERM: Within the ESIA, accidents are referred to as unplanned events. ESIA will study what types of unplanned events are likely to occur, and how the Project can manage them properly. In addition, emergency response training sessions are included in the management plan. The mitigation measures for unplanned events are included as a part of the ESIA report. TTCL has a separate EHS organization for safety management. The organization has the function in developing risk assessment and identifying risk factors. The safety management plan will always be developed in cooperation with international safety organization and specialist. TTCL Company holds ISO-9001 and ISO-14001 certificates	Project Description Chapter Unplanned Event Chapter Environmental and Social Management Plans (ESMP) Chapter.
How will you manage compensation to affected community?	Name: Daw Khin Thwe Thwe Tun Position: Ward administrator Address: Dagon Township	TPMC: We will need to conduct the compensation process, if there are any impacts, especially impacts generated from the natural gas pipeline construction. Nevertheless, our compensation for stakeholders will be provided in accordance with Myanmar Laws and guidelines from relevant authorities.	Social Impact Assessment (SIA) chapter
Please explain details of gas pipeline design and pipeline routing. One concern is that if gas pipeline crosses Ahlone Township, which is a crowded area, there might	Name: U San Tun Position: Ward administrator Address: Dagon Township	TPMC: Both terminal and gas pipeline of this project are designed in accordance with international standards and guidelines for LNG facilities, and with comments and suggestions from LNG business specialists. The construction of gas pipeline will be operated under the guidelines and supervision of MOGE. Gas pipeline will not cross through Ahlone Township as it will be connected with the existing power plant, which is located at Yangon river bank. As the construction of gas pipeline beneath	Project Description Chapter

Questions	Stakeholder	Response	Reference/Response in ESIA
be impacts on residential areas. Will there be disturbance in water traffic and navigation, if there is gas pipeline across Yangon River?		the Yangon river will be taken place by using HDD machine, there will therefore be no impact on the navigational traffic.	
Are there CSR activities carried out by TTCL in previous project activities, ERM or other third-party organizations?	Name: U Sit Maung Position: Ward Elder Address: Ahlone Township	TPMC: In our previous projects, we have organized “CSR committee”, which includes people from local communities. We have two types of CSR activities: internal CSR activity and external CSR activity. Internal CSR activities focus on our staff. For external CSR activities, we had supported local people’s needs in the project areas such as, educational, religious and health support. We also donated in the areas, affected by floods.	N/A
One concern is the shortage of LNG. So, is there long-term contract with LNG supplier?	Name: U Sit Maung Position: Ward Elder Address: Ahlone Township	TPMC: We have to contract with LNG supplier for long-term purchase. We may have to sign contract with more than one supplier in order to assure the long-term availability of LNG. It is also important for us to have substantial LNG along the operational period. If we do not have sufficient LNG power, we have to provide compensation to the government for incapability in supplying power as per contract agreement.	Project Description Chapter
According to presentation, I assumed that the LNG terminal is located on the bank of Yangon River, which is near Twan Tay canal. The current river flow in that area is about 7 miles per hour. There is high navigational traffic every day. Another concern is your proposed terminal location is very	Name: U Than Aye Position: Resident Address: Ahlone Township	TPMC: Our LNG terminal will be located on the riverbank of southern Dala township, which is the opposite side of Thilwa Industrial Zone. Therefore, it is far from Dala downtown area. The LNG vessel will dock once per week. As the jetty will only be located in where the Myanmar Port Authority allows us, it will not disturb the river waterway.	Project Description Chapter

Questions	Stakeholder	Response	Reference/Response in ESIA
close to the area of Dala Township. So, will it be possible to relocate the LNG terminal to another safer area?			
What are the gas pipeline construction codes and standards, API standard or MOGE guideline? And, what are the codes and practices of MOGE?	Name: U Thet Aung Soe Position: Engineer/ observer	TPMC: Currently, we are considering API for gas pipeline construction. However, gas pipeline ROW is not finalized by MOGE. In addition, the code and standard for gas pipeline construction will follow MOGE guidelines.	Administrative Framework Chapter
What are the vertical and horizontal clearance of existing and new 230 KV transmission line? Are they in line with the right of way (ROW) guideline from Department of Power Transmission and System Control (DPTSC)?	Name: U Thet Aung Soe Position: Engineer/ observer	TPMC: For right of way of transmission line, the allowed clearance is published on MOEE's website. The right of way of our new transmission line will be ready by DPTSC and its guidance.	Project Description Chapter
How long is the project construction period?	Name: N/A Position: Resident Address: Kyauktan	TPMC: The project is estimated to start construction work in the middle of 2019. Project construction will take about 28 months. The operation period is 25 to 30 years.	Project Description Chapter
How will you control for the noise, air & water pollution? We are experiencing constantly the noise from one of the power plant from Thilawa Zone.	Name: U Nay Win Position: Resident Address: Kyauktan Township	ERM: To determine impacts from project, we have to collect the existing soil, air quality and noise data from study area as well as need to study the potential impact from project. Depends on the existing air, soil , water quality and potential impact study, mitigation measures and monitoring plan will proposed if necessary. ESIA report including monitoring plan have to submit to MONREC for approval. Project proponent company have to comply with our proposed impact	Impact Assessment Chapters

Questions	Stakeholder	Response	Reference/Response in ESIA
		management plan. Environmental monitoring report is required to submit to MONREC department minimum every six month. If after the Project is running and mitigation are implemented, you still experience impact; you have access to the grievance mechanism to report issues to TPMC.	
Is there any punishment procedure from ECD if the project company does not follow the limitation of ESIA law?	Name: U Si Thu Position: Resident Position: Kyauktan Township	ERM: Local residents are allowed to report to ECD department in the case they experience impact from project. ECD department will monitor and make sure the project is running within the given environmental guidelines. We will also have unplanned check procedure to monitor the emission from project. If we found out the project company not follow their mitigation measures, we may severely punished the project company, from WARNING stage to terminating the plant/factory entirely.	ESMP Chapter
Due to third party is hired by project company, how can we ensure the transparency of information?	Name: U Si Thu Position: Resident Position: Kyauktan Township	ERM: EIA third party company is hired by project proponent company. However, EIA organization has to work on their own principles and regulatory guidelines. Environmental impact studies and mitigation measure proposed to project company will indicated in Impact assessment report. Final ESIA report will be reviewed by EIA review committee which is formed with experts from each relevant ministries.	N/A
Are there emergency response plan?	Name: U Si Thu Position: Resident Position: Kyauktan Township	ERM: Yes, mitigation measures for unplanned events and emergency responses will be included as a part of ESIA report.	Unplanned Event Chapter ESMP Chapter
Have you considered the natural disaster like Earthquake in your terminal design?	Name: N/A Position: Ward Elder Address: Dala	TPMC: When we design the foundation of Terminal, we have to implement the earthquake zone information (seismic factor) in design. Also, there is Myanmar National Building Code (MNBC 2016) to implement in associated building design.	Project Description Chapter
Will the jetty from your terminal make impact to riverbank and river waterway?	Name: N/A Position: Ward Elder Address: Dala	TPMC: Unlike ordinary jetty, the width of LNG receiving jetty is just about 60 feet, only the jetty mooring area is about 200m. Also, our selected terminal area has 10m water depth. So, dredging work is not required and it will not make impact to water way.	Project Description Chapter

Questions	Stakeholder	Response	Reference/Response in ESIA
Are there any impact from vessel anchored to the jetty?	Name: N/A Position: Ward Elder Address: Dala	TPMC: LNG vessel will come to anchor at the jetty approximately 3 times/ month. Maximum anchoring time is about 1.5 days for LNG unloading process. So, it will not make impact to traffic in river and water way.	Project Description Chapter
Since you proposed the gas pipeline to pass through residential area and agriculture lands, how will you compensate impacted people?	Name: U Hla Maung Position: Red Cross member Address: Seikkyikhanaungto	TPMC: Considering minimum impact to residential area & agriculture land, our current gas pipeline has been designed to route in parallel with Dala - Danote main road. We will seek approval of our pipeline route from YESC, MOGE and other relevant ministries. In the case of impact with private own land, we will directly and properly engage with owner in accordance with the guideline from Land Compensation committee. Additionally, as we have mentioned earlier, HDD method will deploy to avoid the damage to road & public properties.	Project Description Chapter SIA Chapter
Are there impact to soil due to gas pipe construction?	Name: U Thaung Position: Resident Address: Kyine Kyii village	ERM: To determine impacts from project, we have to collect the existing soil, air quality data from study area; we need to study the potential impact from project. Depends on the existing air, soil , water quality and potential impact study, mitigation measures and monitoring plan will proposed if necessary. ESIA report including monitoring plan have to submit to MONREC for approval.	Impact Assessment Chapters
How would you take Responsibility for project stakeholder?	Name: U Thaung Position: Resident Address: Kyine Kyii village	TPMC: As the project will develop in collaboration with MOEE, we fully aware for taking responsibilities and transparency of the project. The purpose of this public participation meeting is to inform the stakeholders about our project to consult any concerns. That is indicate the transparency of our project. We will arrange the second time public participation meeting and further detail information will present.	Public Consultation Chapter
Are there Job opportunities for local?	Name: U Thaung Position: Resident Address: Kyine Kyii village	TPMC: This project will create job opportunities for local business and people throughout the construction to operation phases. As we will hire the local contractors during construction phase of project. Local people will also have the chance to be employed in our project along the operation period. For example, in our Ahlone 1 project, during first three years of operation phase, foreign technician are worked together with	Project Description Chapter

Questions	Stakeholder	Response	Reference/Response in ESIA
		locals. Job training were provided at that time. After 3 years, now our plant is running with 95% local employees	
Since Seikkyikhanaungto township is surrounded by water, we are experiencing riverbank collapsing from every aspect. So, how it will impact to your gas pipe construction?	Name: U Tin Nyunt Position: Resident Address: Seikkyikhanaungto	ERM: As we have mentioned, we are in progress of ESIA assessment. We will consider your suggestion for our study and will present the results of these studies along with the analysis of potential impacts and proposed management strategies at the second round of public participation.	Impact Assessments Chapter
In my experience, local farmers were not able to carry on their plantation due to construction material deposit in farmland during gas pipe construction. Moreover, leakage from old gas pipeline are noticed during wet season.	Name : U Chit Naing Win Position :Ward leader Address : Seikkyikhanaungto	TPMC: We are working on selection of proper gas pipeline right of way. Once we have concluded the gas pipe right of way with relevant ministries, we will directly engage with impacted landowner. In addition, using quality material for gas pipe is also mandatory for our company. If there is fuel shortage occur, we will also have to suffer for not meeting promised power capacity. Therefore, we are fully aware of this matter.	Project Description Chapter Unplanned Event Chapter

Figure 13.3: Photos during 1st Public Consultation Meetings

Staffs conducting presentation in Ahlone Township

Participator in Ahlone Township presented questions and concerns

Staffs conducting presentation in Dala Township

Staffs conducting presentation in Thanlyin Township

Source: TPMC, 2018.

13.3 Consultation during the Draft ESIA Presentation

13.3.1 Format and Content of Consultation Meetings

The stakeholder consultation meetings during ESIA phase were structured as follows:

- Introductions and information disclosure: Introduce the Project Proponent, the ESIA and the results of the Environmental and Social Impact Assessment and proposed mitigation measures to avoid, reduce or compensate for these impacts.
- Propose plan for future engagement and grievance mechanism.
- Question and answer session for all stakeholders in the township meeting to raise concerns, comments or ask questions to which the ESIA consultant and Project Proponent could directly respond.
- Collect feedback from stakeholders on the proposed mitigation measures.

All information was communicated by the use of visual media (including posters and power point presentations) and provided in local Myanmar language. Copies of the presentations can be found in ***Appendix V***. Minutes of the engagement meetings can be found in ***Appendix W***. Feedbacks received from the stakeholders were integrated into the final impact assessment report and feedback and comment forms were distributed for stakeholders to raise additional questions or concerns after the meeting.

13.3.2 Summary of Consultation Activities Undertaken for draft ESIA Presentation

Representatives from 32 Townships and Villages were invited to attend public consultation meeting – Dala, Thingangyung, Thanlyin, Pardagyi, Sin Kan, Kyauktan, Oak Pho Su, Bauk Htaw Twin, Myoma (South & North), Bago Su, Nyaung Thone Pin, Myo Haung (West, East, and Middle), Shwe Pyout, Nyaung Wine, Shwe Pyi Thar Yar, Shwe Kone, Thidar Myine, Phayar Kone, Oak Pho, Amhuhtan, Thout Taw Twin, A Lwan Swut, Yaynan, Htan Pin Kone, Myo Thit (west), Kyaung Oak Sake, A Lwan Swut, Thar Kya Ta, Aungmingalar, Ahlone, Latha, Thuwana, and Dagon.

The meetings were held from 12 to 14June 2019. Various stakeholders were invited including Chief Minister and State Government, concerned Regional level ECD and GAD, Members of Parliament, Township GAD, village administrators, and local communities. The date, time, location, stakeholder and purpose of each meeting is provided in ***Table 13.5***. The consultations were also communicated in two (2) Myanmar Newspapers both in English and Myanmar language (see ***Figure 13.6***).

The consultation helped the Project gather information on potentially affected people, and on potential data gaps and how these can be closed out in the ESIA Report. It also enabled various stakeholders to learn about the project and voice out their concerns and suggestions.

Table 13.5: Consultation Activities Undertaken during draft ESIA presentation

Date	Location	Stakeholder	Number of Participants
12/06/2019	Ahlone Township hall, Ahlone Township	GAD (Project), ECD, Village Leader, CSOs, Elder people, Villagers, MOGE, Ministry of Education, Ministry of Agriculture, Livestock and Irrigation , Ministry of Electricity & Energy , Reporter, Myanmar Industrial Port, YCDC, NGO, Corporations, and EPC	187
13/06/2019	Thardana Beikmann Hall, Thanlyin Township	GAD (Health Care, Finance, MONREC, Fire service Department), Ministry of Agriculture, Livestock and Irrigation, EPC, YCDC, Parliament Member, ECD, Ward Administrator, Village Leader, and Villagers	180
14/06/2019	Thin Zaya Naw Ya Htar Hall, Dala Township	GAD (Construction, Project, Health Care, Piping, Agriculture, Administration, Fire service, Water and Sanitation, MONREC, and Ward Administration Department), MOE, Parliament Member (Regional Gov't), Regional ECD, Red Cross Society, Village Leader, Elder people, and Villagers	143

13.3.3 Results of Consultation during Draft ESIA Presentation

This section summarises the key issues raised during the public consultation meetings ***Table 13.6*** shows the responses concerning these issues, and photos taken during the second public consultation are shown in ***Figure 13.4.***

Table 13.6: Key Concerns and Questions Raised during Draft ESIA presentation

Questions	Stakeholder	Response	Reference/Response in ESIA
Has any construction started in Dala? Why is the power plant not constructed in Hlaingtharya?	Name: U Tin Lin Position: Lut Latt Yay Ward Administrator Address: Ahlone	There is an existing 121MW Power Plant near MOEE's electricity supply and distribution office (Ahlone) by which constructed and operated by TTCL since 2012. It is MOEE's guidance and instruction to construct this new combine cycle power plant on the vacant land next to existing power plant. That is why the power plant is located in Ahlone. Additionally, the reason of building the terminal and jetty in Dala townships is that the selected location's water depth is deep enough to construct the jetty for LNG carrier vessel.	Project Description Chapter
How will the electricity be transferred from Ahlone to Hlaingtharyar?	Name: U Hla Win, Position: Ward Administrator Address: Ahlone	The underground gas pipeline will start from LNG receiving Terminal in Dala, follow the existing Dala-Danote main road to the Seikkyikhanaungto township and directly to the power plant located on Ahlone river bank by crossing the Yangon river from below. Therefore, gas pipe will not pass through downtown townships.	Project Description Chapter
Which Township will benefit from the project?	Name: U Hla Win, Position: Ward Administrator Address: Ahlone	As TTCL is an independent power producer, our scope of work is to build and operate the plant. All the produced power will be sold out to MOEE with power purchase agreement. Distribution to households is in the scope of MOEE.	Project Description Chapter
What are the possible impact of the project on electricity cost?	Name: U Hla Win, Position: Ward Administrator Address: Ahlone	It is under the management of MOEE whether there will be impact on electricity cost or not.	N/A
How will the maintenance of the pipeline be done for the section under the Yangon River?	Name: N/A, Position: MOEE, Address: Ahlone	For the process of unloading and storage of LNG, We will required advised from experienced safety Consultant Company (experience in Japan, china, Korea, etc.). We will utilize their technical know-how and experiences in our terminal design for safety operations.	Project Description Chapter
Suggested TTCL to recruit and seek advice by local engineer	Name: N/A, Position: MOEE, Address: Ahlone	Our gas Pipeline standard followed minimum compliance of MOGE's practices. However, international code and standards such as ASME are also complied by monitor and maintain the gas Pipeline every year to ensure the good condition	Project Description Chapter SIA Chapter

Questions	Stakeholder	Response	Reference/Response in ESIA
Suggested operating the power plant safely and sustainably.	Name: N/A, Position: MOEE, Address: Ahlone	Company has to put a huge amount of investment on the Project. Therefore, the sustainable operation of project is a very crucial point for the Company. Regarding to safety concerns of the Projects, we have hired experts from safety Consultant Company. With their support, we have already presented about our project safety precautions to Yangon Regional Government & MOEE.	Project Description Chapter ESMP Chapter
What sort of impacts are expected from LNG operation?	Name: N/A, Position: Parliament member	LNG unloading and storage process will be complied with the International fire prevention and safety guideline such as NFPA. Equipment such as fire prevention and leakage detection sensors will be equipped in terminal to prepare for the immediate actions of any event. In the case of unplanned event, LNG storage layout is properly designed to handle the impact within the terminal area only.	Impact Assessment Chapters
In term of impact, where does the LNG rank compared with other type of fuel?	Name: N/A, Position: Parliament member	There are various source of energy such as coal, hydro, natural gas. LNG is a liquid form of natural gas, which is one of the energy sources with minimum impact to the environmental. In terms of safety, this project will applied IFC and other international standard/guidelines.	N/A
How will the impacts be mitigated?	Name: N/A, Position: Parliament member	Our unplanned event mitigation measures are prepared according to applicable international guideline and analysing what is likely to occur in LNG fuel power plant. These measures included how to prevent the accidents, how to properly respond in the case of accidents, and train project personnel for the emergency response plan. As our measures are prepared for the worst-case scenario, such unplanned accidents will be properly handle.	Impact Assessment Chapters
Project information should be displayed to Township parliament office.	Name: Dr. Sein Mya Aye Position: Parliament member Address: Dala	During the first round of public consultation we have distributed project information documents to all attended stakeholders. In which, we have described all the project progress and way forward. We have also informed about the grievance mechanism Local communities were invited to report if there is any issues or comments on ESIA process. Comments and suggestions from first meeting are recorded and implemented in the ESIA report.	Public Consultation Chapter

Questions	Stakeholder	Response	Reference/Response in ESIA
What kind of CSR activities will contribute to local?	Name: Dr. Sein Mya Aye Position: Parliament member Address: Dala	Our project will be developed only after MIC permit is granted. In order to obtain MIC permit from, Project Company is required to develop and comply with the CSR program. We are going to implement our CSR program with the collaboration from local level.	N/A
Suggested TTCL to inform people more about their rights toward the Project.	Name: Dr. Sein Mya Aye Position: Parliament member Address: Dala	N/A	N/A
How will the company activities will be verified or monitor? What would be the punishment and penalties if Project Company does not follow the ESIA law?	Name: Dr. Sein Mya Aye Position: Parliament member Address: Dala	There are Myanmar Environmental conversation law, Environmental Conversation Rule & Environment Impact Assessment procedure 2015. ECD department will determined the necessary level of environmental assessment for the proposed project. Project proposed company is responsible to comply with the applicable environmental law. If company fail to follow environmental management, the company is punishable to pay fine or other severe punishment according to law.	ESMP Chapter
Suggested the impact to public road should be repair by the company	Name: N/A Position: Resident	Our gas pipeline route is currently designed to be along the Dala-Danote main road. However, it is subjected to change depending to detail survey that we are about to do with the cooperation from relevant government departments. In the case of road damage occurred by Machinery/Vehicles used in pipeline construction, company will be responsible to repair.	SIA Chapter ESMP Chapter
Why the construction of power plant is not in Dala?	Name: N/A Position: Resident	We have to develop project components only on permitted land/ area by government. We have decided to build up the terminal and jetty in Dala townships following the instruction from Yangon regional government and Myanmar Port Authority. The selected location's water depth is deep enough to construct the jetty for LNG carrier vessel.	Project Description Chapter
What is the project schedule?	Name: N/A Position: Resident	Commercial operation of project will commence 28 months after PPA effective date.	Project Description Chapter
TTCL should include the risk management plan	Name: N/A, Position: Police Department,		ESMP Chapter

Questions	Stakeholder	Response	Reference/Response in ESIA
If project affect the paddy field people should receive fair compensation.	Address: Dala	Company will be responsible for every impact occurred by project activities during construction and operation phase. Company will compensate fair amount of compensation.	
What are the measures to prevent gas leakage?	Name: N/A, Position: Village Administrator Address: Pyaw Bwe Gyee Village	ERM has proposed specific mitigation measures for an un-planned event of spill or leakage of oil, fuel and gas. The measures including how to prevent and prepare for the leakage, and providing training for staffs to properly respond in the case of gas leakage	Project Description Chapter
What are the measures in the case of gas leakage?	Name: N/A, Position: Village Administrator Address: Pyaw Bwe Gyee Village	Detection system is implemented in gas pipeline design to detect the gas leakage. Block valve stations located between terminal and power plant will also implemented for emergency response. When the gas leakage is detected, company will be able to take immediate action to prevent the people and environment	ESMP Chapter
Which part of the Seikkyikhanaungto Township will be impacted by the project?	Name: N/A Position: Medical personnel	Underground gas pipe from Dala township will be connected to Seikkyikhaunaungto Township crossing the Twantay Canal by deploying HDD machine. The gas pipe will then directly connected to Power plant from the below of Yangon River. Therefore, a small portion of Seikkyikhanaungto townships is concerned in project components.	Project Description Chapter

Figure 13.4: Photos during 2nd Public Consultation Meetings

Staffs conducting presentation in Ahlone Township

Participator in Ahlone Township presented questions and concerns

Staffs conducting presentation in Thanlyin Township

Staffs conducting presentation in Dala Township

Source: TPMC, 2019

13.4 Ongoing Consultations

During the Project, there will be additional engagement as per the recommendations in the impact assessment chapters of this report. It is expected that meetings will be held on ad-hoc basis with the relevant stakeholder. The format of these meetings will vary based on the type of information that needs to be shared with the stakeholders.

13.5 Disclosure

Information disclosure is one of the most important aspects of any engagement process. The process of disclosure involves the provisioning of information in an accessible manner (allowing for easy understanding, such as in the local language or using visual tools) to the various stakeholders in the Project. This disclosure not only allows for trust building amongst the stakeholders through the sharing of information, but also allows for more constructive participation in the other processes of consultation and resolution of grievances due to availability of accurate and timely information.

As per the requirements of the EIA Procedure, the Project Proponent has disclosed information about the Project on their website at the following address: http://www.ttcl.com/news/activities. Project information will continue to be available on this website and signboards will be posted at the Project site. There will also be adverts in one English and one Myanmar newspaper within 15 days from submission of the report to ECD and hard copies of the report (Executive Summary chapter in Myanmar language) will be made available at the Project office in Ahlone Township and at Parliament of GAD offices within the Project Study Area.

The advertisements announcing the draft ESIA engagement where done in The Global New Light of Myanmar (English) and The Mirror (Burmese) on October for the Scoping process (see ***Figure 13.5***) and June for the draft ESIA process (see ***Figure 13.6***).

Figure 13.5: Newspaper Advertisements during Scoping Process

TTCL Power Myanmar Company Limited

16B, 16th Floor, Centre Point Tower, No. 65, Corner of Sule Pagoda Road and Merchant Street, Kyauktada Township, Yagon, Myanmar

News Release

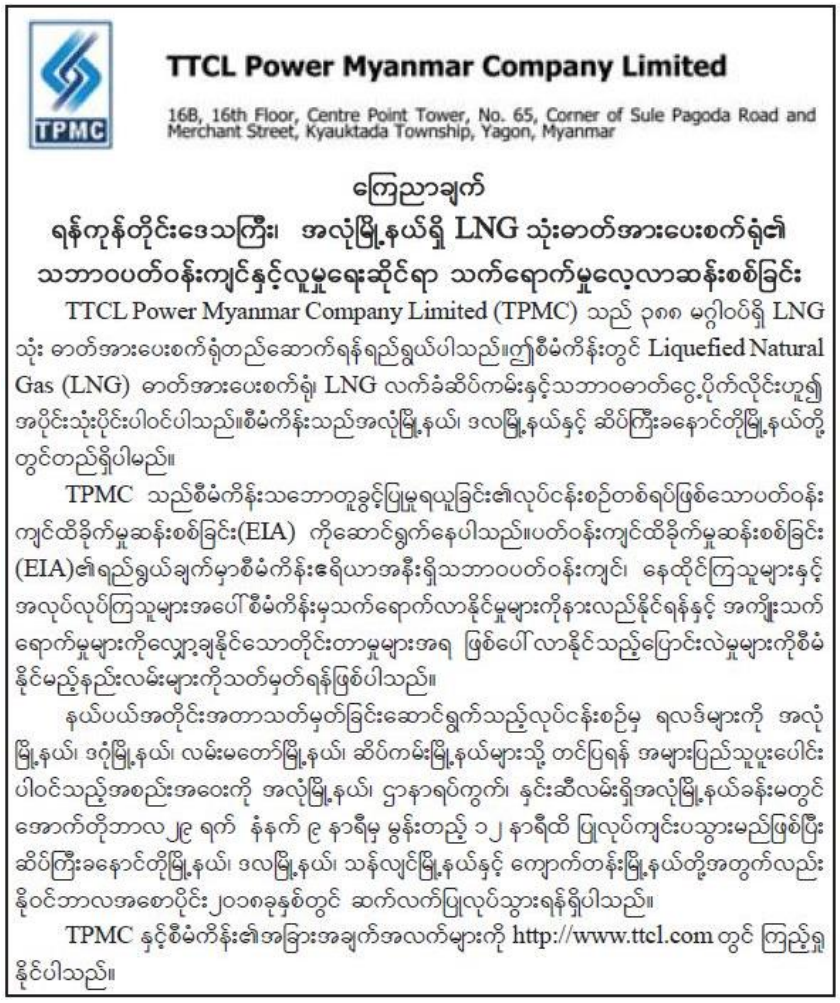
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENTS of a 388 MW Combined Cycle Power Plant in Ahlone Township, Yangon Region.

TTCL Power Myanmar Company Limited (TPMC)is planning to build a 388 MW Combined Cycle Power Plant supplied in Natural Gas. The project consists of three main components, which includes the Liquefied Natural Gas (LNG) power plant, the LNG receiving facility, andnatural gas (NG) pipeline. The Project will be located in Ahlone, Dala, and Seikgyikanaungto Townships.

As part of the approval process, TPMC is undertaking an Environmental Impact Assessment (EIA) study. The purpose of the EIA is to understand how the Project may impact the environment and the people living and working close to the Project area and identify ways to manage any changes that may occur through the development of mitigation measures.

Public Participation meeting to present the result of the scoping phase will be held in Ahlone, Dagon, Lanmadaw, Seikkan Township on 29th October as well as in Seikgyikanaungto and Dala Townships, Thanlyin and Kyauktan in October 2018.

More info about TPMC and the Project can be found at http://www.ttcl.com



TTCL Power Myanmar Company Limited

16B, 16th Floor, Centre Point Tower, No. 65, Corner of Sule Pagoda Road and Merchant Street, Kyauktada Township, Yagon, Myanmar

ကြေညာချက်

ရန်ကုန်တိုင်းဒေသကြီး၊ အလုံမြို့နယ်ရှိ LNG သုံးဓာတ်အားပေးစက်ရုံ၏ သဘာဝပတ်ဝန်းကျင်နှင့်လူမှုရေးဆိုင်ရာ သက်ရောက်မှုလေ့လာဆန်းစစ်ခြင်း

TTCL Power Myanmar Company Limited (TPMC) သည် ၃၈၈ မဂ္ဂါဝပ်ရှိ LNG သုံး ဓာတ်အားပေးစက်ရုံတည်ဆောက်ရန်ရည်ရွယ်ပါသည်။ဤစီမံကိန်းတွင် Liquefied Natural Gas (LNG) ဓာတ်အားပေးစက်ရုံ၊ LNG လက်ခံဆိပ်ကမ်းနှင့်သဘာဝဓာတ်ငွေ့ပိုက်လိုင်းဟူ၍ အဓိကသုံးပိုင်းပါဝင်ပါသည်။စီမံကိန်းသည်အလုံမြို့နယ်၊ ဒဂုံမြို့နယ်နှင့် ဆိပ်ကြီးခနောင်တိုမြို့နယ်တို့တွင်တည်ရှိပါမည်။

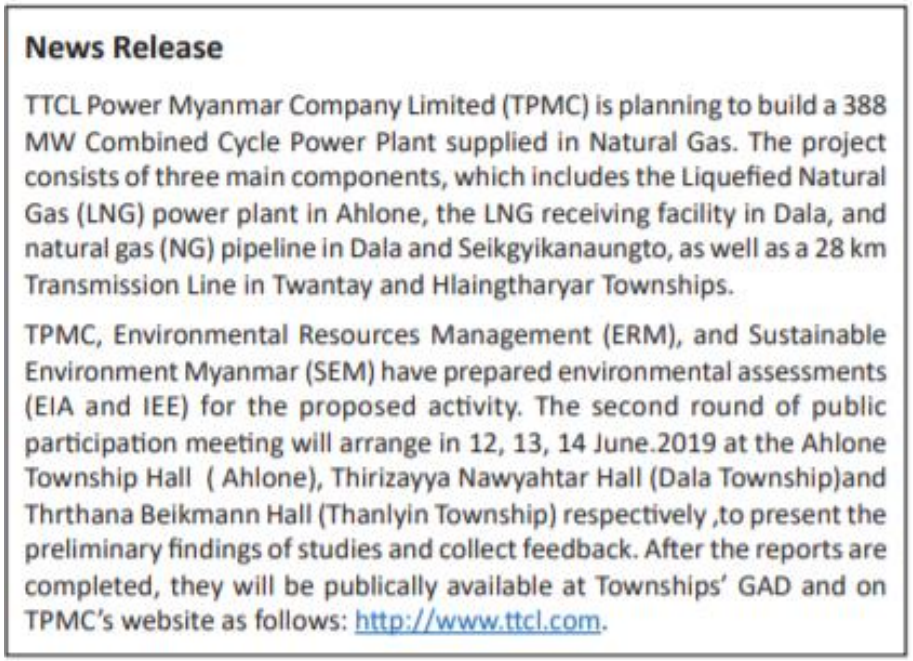
TPMC သည်စီမံကိန်းသဘောတူခွင့်ပြုမှုရယူခြင်း၏လုပ်ငန်းစဉ်တစ်ရပ်ဖြစ်သောပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း(EIA) ကိုဆောင်ရွက်နေပါသည်။ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း(EIA)၏ရည်ရွယ်ချက်မှာစီမံကိန်း၏ရေယာအနီးရှိသဘာဝပတ်ဝန်းကျင်၊ နေထိုင်ကြသူများနှင့် အလုပ်လုပ်ကြသူများအပေါ် စီမံကိန်းမှသက်ရောက်လာနိုင်မှုများကိုနားလည်နိုင်ရန်နှင့် အကျိုးသက်ရောက်မှုများကိုလျှော့ချနိုင်သောတိုင်းတာမှုများအရ ဖြစ်ပေါ်လာနိုင်သည့်ပြောင်းလဲမှုများကိုစီမံနိုင်မည့်နည်းလမ်းများကိုသတ်မှတ်ရန်ဖြစ်ပါသည်။

နယ်ပယ်အတိုင်းအတာသတ်မှတ်ခြင်းဆောင်ရွက်သည့်လုပ်ငန်းစဉ်မှ ရလဒ်များကို အလုံမြို့နယ်၊ ဒဂုံမြို့နယ်၊ လမ်းမတော်မြို့နယ်၊ ဆိပ်ကမ်းမြို့နယ်များသို့ တင်ပြရန် အများပြည်သူပူးပေါင်းပါဝင်သည့်အစည်းအဝေးကို အလုံမြို့နယ်၊ ဌာနာရပ်ကွက်၊ နှင်းဆီလမ်းရှိအလုံမြို့နယ်ခန်းမတွင် အောက်တိုဘာလ ၂၉ ရက် နံနက် ၉ နာရီမှ မွန်းတည့် ၁၂ နာရီထိ ပြုလုပ်ကျင်းပသွားမည်ဖြစ်ပြီး ဆိပ်ကြီးခနောင်တိုမြို့နယ်၊ ဒဂုံမြို့နယ်၊ သန်လျင်မြို့နယ်နှင့် ကျောက်တန်းမြို့နယ်တို့အတွက်လည်း နိုဝင်ဘာလအစောပိုင်း ၂၀၁၈ခုနှစ်တွင် ဆက်လက်ပြုလုပ်သွားရန်ရှိပါသည်။

TPMC နှင့်စီမံကိန်း၏အခြားအချက်အလက်များကို http://www.ttcl.com တွင် ကြည့်ရှုနိုင်ပါသည်။

Source: TPMC, 2018.

Figure 13.6: Newspaper Advertisements during Draft ESIA Process



News Release

TTCL Power Myanmar Company Limited (TPMC) is planning to build a 388 MW Combined Cycle Power Plant supplied in Natural Gas. The project consists of three main components, which includes the Liquefied Natural Gas (LNG) power plant in Ahlone, the LNG receiving facility in Dala, and natural gas (NG) pipeline in Dala and Seikgyikanaungto, as well as a 28 km Transmission Line in Twantay and Hlaingtharyar Townships.

TPMC, Environmental Resources Management (ERM), and Sustainable Environment Myanmar (SEM) have prepared environmental assessments (EIA and IEE) for the proposed activity. The second round of public participation meeting will arrange in 12, 13, 14 June.2019 at the Ahlone Township Hall (Ahlone), Thirizayya Nawyahtar Hall (Dala Township)and Thrthana Beikmann Hall (Thanlyin Township) respectively ,to present the preliminary findings of studies and collect feedback. After the reports are completed, they will be publically available at Townships' GAD and on TPMC's website as follows: http://www.ttcl.com.

အများသိစေရန်ကြေညာခြင်း

TTCL Power Myanmar Company Limited (TPMC)

သည် ၃၀၀ မဂ္ဂါဝပ်ရှိ LNG သုံးဓာတ်အားပေးစက်ရုံ တည်ဆောက်ရန် ဆောင်ရွက်လျက်ရှိပါသည်။ ဤစီမံကိန်းတွင် အလုံမြို့နယ်အတွင်း တည်ရှိမည့် Liquefied Natural Gas (LNG) ဓာတ်အားပေးစက်ရုံ၊ ဒလမြို့နယ်အတွင်းတည်ရှိမည့် LNG လက်ခံဆိပ်ကမ်းနှင့် ဒလမြို့နယ်နှင့် ဆိပ်ကြီးခနောင်တိုမြို့နယ်တို့အတွင်းတွင် တည်ရှိမည့် သဘာဝဓာတ်ငွေ့ပိုက်လိုင်းသွယ်တန်းခြင်းဟူ၍ အဓိကအပိုင်း သုံးပိုင်း ပါဝင်ပါသည်။ ထို့အပြင် (၂၈) ကီလိုမီတာခန့် အရှည်ရှိမည့် ဓာတ်အားလိုင်းသွယ်တန်းခြင်းလုပ်ငန်းလည်း တွဲတေးနှင့် လိုင်သာယာမြို့နယ်အတွင်း ဆောင်ရွက်မည်ဖြစ်ပါသည်။

TPMC , Environmental Resources Management (ERM), and Sustainable Environment Myanmar (SEM) ကုမ္ပဏီတို့မှ အဆိုပါစီမံကိန်းအတွက် ပတ်ဝန်းကျင်ထိခိုက်မှု လေ့လာဆန်းစစ်ခြင်းစာတမ်း (EIA နှင့် IEE)တို့ကို လေ့လာပြုစုလျက်ရှိပါသည်။ အဆိုပါလေ့လာမှု၏ ပဏာမတွေ့ရှိချက်များကို စီမံကိန်းနှင့် သက်ဆိုင်သူများသို့တင်ပြ၍ ဆွေးနွေးအကြံပြုချက်များကို လက်ခံလိုသောကြောင့် ဒုတိယအကြိမ် လူထုပါဝင်ဆွေးနွေးပွဲကို ၂၀၁၉ ခုနှစ် ဇွန်လ ၁၂၊ ၁၃၊ ၁၄ ရက်များတွင် အလုံမြို့နယ်ခန်းမ၊ ဒလမြို့ သီရိဇေယျနောရထာခန်းမနှင့် သန်လျင်မြို့ သာသနာ့ဝိဓာန်ခန်းမတို့တွင် အသီးသီး ပြုလုပ်သွားမည်ဖြစ်ပါသည်။

ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း စာတမ်းများ ပြည့်စုံစွာပြုစုပြီးသောအခါ အများပြည်သူအတွက် သက်ဆိုင်ရာမြို့နယ်အုပ်ချုပ်ရေးမှူးရုံးများနှင့် TPMC ဝက်ဆိုဒ် http://www.ttcl.com တို့တွင် ကြည့်ရှုနိုင်မည်ဖြစ်ပါသည်။

Source: TPMC, 2019.

13.6 Grievance Mechanism

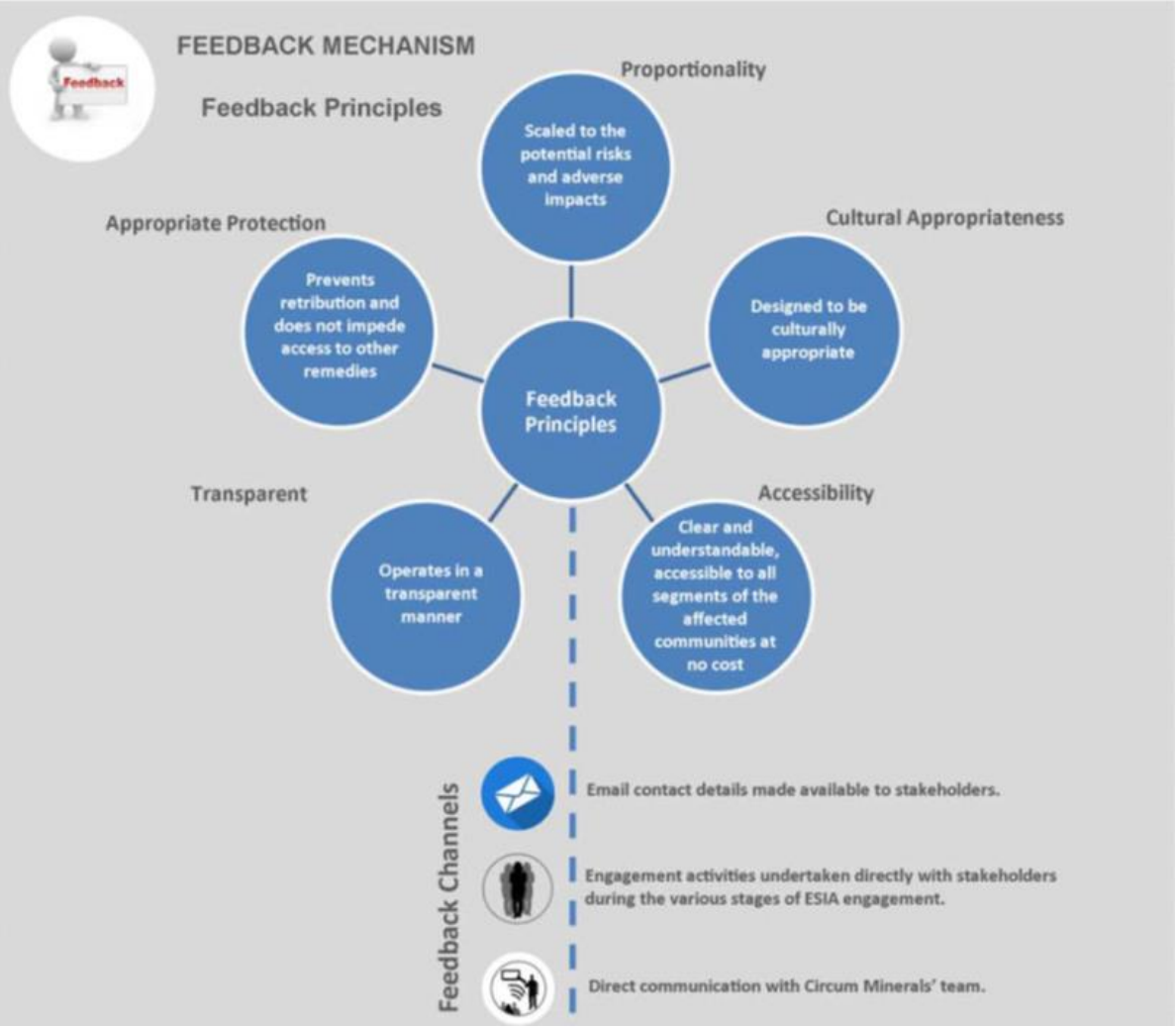
A grievance is an actual or perceived problem related to the Project that gives ground for complaint by an affected stakeholder (person, group or entity). The purpose of a Grievance mechanism is to ensure that stakeholders affected by the proposed Project can present their feedback (opinions, concerns, requests, and suggestions) to the ESIA or Project team for consideration and redress, if required. The grievance mechanism will actively manage and track feedback associated with the proposed Project, and will be used to identify and resolve potential issues at the earliest possible time and ensure that appropriate actions are taken and resolutions achieved that will be in the interest of all parties concerned.

13.6.1 The Process

The guiding principles of the grievance mechanism, the five key steps through which it operates and the feedback channels available to stakeholders are illustrated in ***Figure 13.7***. These elements of the feedback mechanism will be adapted for the Project implementation phase.

All feedback that is gathered will be recorded in an Issues and Response database in which relevant responses or resolutions will also be recorded. This table will be used to identify and analyse issues, including any unforeseen issues that will be relevant for any potential future ESIA or engagement activities in the area. A detailed Issues and Response record has the advantage of strengthening the continuity between the ESIA phase and Project implementation, building on the experience and lessons learned from the stakeholder engagement process and understanding stakeholder needs and expectations.

Figure 13.7: Grievance Mechanism Principles



Source: ERM, 2018.

The Grievance Mechanism consists of five (5) steps (see ***Figure 13.8***):

1. Publication of the mechanism within the impact assessment engagement or the first engagement with stakeholders (this must include all type and level of stakeholders, in particular local communities) and training / building capacity of the team to manage stakeholder grievances;
2. Receive and register stakeholder grievances throughout the different Project stages;
3. Review and analyse grievances and where relevant provide feedback to relevant Project team members;
4. Develop resolution options, respond to grievance and close out; and
5. Monitor and evaluate Grievance as Project progresses.

All gathered grievance will be recorded in an Issues and Response table database and where relevant responses or resolutions will be recorded. This table will be used to identify and analyse issues including unforeseen issues that will be relevant for any potential future project or engagement activities in the area. This will have the advantage of strengthening the continuity between ESIA phase and future work and to start building experience on issues related to the vulnerability of these particular groups.

Figure 13.8: Grievance Mechanism

Source: ERM, 2019.

Grievances will initially be addressed by the TPMC public relation team. Stakeholders should be able to submit their grievances through various means, including through the contractors, the Project staff, or local village chief. In all cases, the grievance will be recorded in writing and then forwarded to the public relation team. Contact details including physical address, email address and telephone number have been communicated during the two rounds of public participation meetings as well as on the website and in the brochures handed-out to stakeholders during scoping stage.

Upon receipt by the public relation team, the grievance will be recorded, reviewed and assessed for eligibility. If determined that a grievance is not connected to a Project activity or that the Project is being carried out in full compliance with applicable national and international standards, public relation team will explain the reasoning in writing to the complainant. In all other cases public relation team will investigate, assess the validity of the grievance, and in consultation with the contractor, seek measures to redress valid grievances and prevent such incidents occurring again.

TPMC will have 15 days to resolve the grievance and respond to the complainant in writing, including disclosing the results of the investigation and the proposed course of action. Depending on the nature of the complaint the course of action will be implemented by the contractor or TPMC. If the complainant considers the issue to be satisfactorily resolved, they will be asked to sign a Statement of Satisfaction. If the grievance remains unresolved TPMC will seek additional information about the grievance and propose alternative solutions.

If at this stage the stakeholder or TPMC are not satisfied by the proposed response, Myanmar judicial system may be used.

TPMC should also consider contacting the complainant at a later stage to ensure that there are no further problems. If there is a remaining problem, the issue should be treated as a new grievance and re-enter the process.

14. CONCLUSION AND RECOMMENDATION

This Environmental Impact Assessment (EIA) report has been prepared based on the technical information provided by the Project Proponent, existing studies and reports relevant to the Project, site visits, baseline environmental and social data collection and the stakeholder engagement.

Through this process, the assessment has been conducted of the potential environmental and social impacts attributable to the construction and operation phases of the Project. Qualitative and quantitative (where relevant) assessments of impacts have been presented, significance of each potential impact has been identified, and mitigation measures to minimise and reduce the impacts have been recommended. Cumulative environmental impacts particularly on air quality, noise, waste and community health and safety have also been assessed taking into consideration the existing industrial facilities and civil activities and known future projects present in the Study Area.

Although a number of potential environmental, social and health impacts were identified, the assessments found that impacts are typically short term in duration have minor residual significance after implementation of mitigation measures. The potential for impacts is well understood with little or no evidence of adverse consequences on the majority of environmental, social or health receptors provided that adequate in-place controls and/or mitigation measures are implemented. The suggested mitigation measures in the ESMP are well established amongst international practice, and proven to be effective in managing any impacts that might occur to acceptable levels, including for similar projects in similar settings.

Many of the impacts are localised and short-term or temporary in nature (linked to the construction phase) and can be readily addressed by some embedded control measures in the engineering design of the Project as well as additional mitigation measures as suggested in the Environmental and Social Management Plan (ESMP).

In terms of social aspect, the results from initial stakeholder engagement indicate that the Project has received favourable support from local people and other stakeholders. Stakeholders appreciated that in addition to providing a reliable power supply to the region, the Project will have several other benefits such as supporting economic growth in the region, potential employment (direct and indirect) and that the negative impacts can be mitigated, provided the Project proponent implement all the proposed mitigation measures.

For all the impacts identified in the study, mitigation measures have been proposed and included in the ESMP chapters, including the schedule for monitoring. If any impacts result in more severe significance that assess in this report, actions to be taken by the Project proponent or its contractors are also described.

The effective implementation of the ESMP and adherence with the Myanmar NEQ, and IFC guidelines will assist in minimising the environmental impacts to acceptable levels. With continued engagement with local stakeholders and monitoring as proposed in the ESMP of impact significance, the environmental and social assessment of the Project ascertains that the Project is unlikely to cause any significant environmental and social impacts and will bring benefits to local stakeholders and a more reliable supply of electricity to the region.

15. REFERENCES

7 day trip ideas for getting out of Yangon. Accessed on 24 October 2018 at https://frontiermyanmar.net/en/7-day-trip-ideas-for-getting-out-of-yangon

Ahlone Street. Accessed on 24 October 2018 at https://myanmar-streets.openalfa.com/streets?q=AHLONE

Ahlone, Yangon, Myanmar (Burma). Accessed on 24 October 2018 at https://www.latlong.net/place/ahlone-yangon-myanmar-burma-24788.html

ANZECC, & ARMCANZ. (2000). Sediment Quality Guidelines. National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Retrieved from http://www.waterquality.gov.au/anz-guidelines/Documents/ANZECC-ARMCANZ-2000-guidelines-vol1.pdf

API. (2009). Compendium of Greenhouse Gas Emissions Methodologies for Oil and Natural Gas Industry. American Petroleum Institute (API). Retrieved from https://www.api.org/~/media/files/ehs/climate-change/2009_ghg_compendium.ashx

API. (2009). Compendium of Greenhouse Gas Emissions Methodologies for Oil and Natural Gas Industry. American Petroleum Institute (API). Table 3-8. Retrieved from https://www.api.org/~/media/files/ehs/climate-change/2009_ghg_compendium.ashx

Asia World Port Terminal. Accessed on 24 October 2018 at http://www.yangondirectory.com/en/categories-index/yangon-region/ahlone/716-ports/L456_000000000_asia-world-port-terminal_16851

Aung, T.T., Shimozono, T. & Okayasu, A. (2013). Numerical simulation on sedimentation in Yangon River and its navigation channel. Mer. 51. 91-104.

BREEZE Software. (2013). BREEZE Incident Analyst Version 1.2 [Computer software]. Retrieved from https://www.breeze-software.com/software/incident-analyst

Budget information for 2017-2018 Fiscal Year (Citizen's budget). Accessed on 24 October 2018 at https://themimu.info/sites/themimu.info/files/documents/Core_Doc_Citizens_Budget_Information_for_2017-2018_31May2017.pdf

CDP. (2019). CDP Technical Note: Conversion of fuel data to MWh. CDP Worldwide. Retrieved from https://b8f65cb373b1b7b15feb-c70d8ead6ced550b4d987d7c03fcdd1d.ssl.cf3.rackcdn.com/cms/guidance_docs/pdfs/000/000/477/original/CDP-Conversion-of-fuel-data-to-MWh.pdf?1479755175

CGS. (2012). Groundwater Serial Maps of Asia. China Geological Survey (CGS). Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000220768

Circular Train, The Cheapest Way to See Yangon. Accessed on 24 October 2018 at http://yangon-rangoon.com/yangon-circular-train.html

Copernicus. (2015). EMSR130: Flood in Myanmar. Copernicus: Emergency Management Service – Mapping. European Commission. Retrieved from https://emergency.copernicus.eu/mapping/list-of-components/EMSR130

Country Profile Indicators (Interpretation Guide). Accessed on 12 March 2019 at https://www.who.int/nutrition/nlis_interpretation_guide.pdf

Day Trip to Dala Village near Yangon, Myanmar. Accessed on 24 October 2018 at https://drifterplanet.com/dala-village-near-yangon-myanmar/

De Koning, R.J. & Janssen, M.P.J. (2015). Delft3D-FLOW Model of the Yangon Port Area. Delft University of Technology.

DEC. (2010). Contaminated Sites Management Series: Assessment levels for Soil, Sediment and Water. Department of Environment and Conservation (DEC), Government of Western Australia. Version 4, Revision 1, Pp 26. https://www.der.wa.gov.au/images/documents/your-environment/contaminated-sites/guidelines/2009641_-_assessment_levels_for_soil_sediment_and_water_-_web.pdf

Diarrhea Among Children Under Five In Myanmar: A Systematic Review. Accessed on 12 March 2019 at https://tci-thaijo.org/index.php/jhealthres/article/download/78346/62760/

ECCA. (2019). Material Safety Data Sheet: Bentonite. ECCA Holdings (PTY) Limited. Retrieved from http://www.capebentonite.co.za/downloads/BENTONITE%20MATERIAL%20SAFETY%20DATA%20SHEET.pdf

EIA. (2018). *Natural Gas Explained*. U.S. Energy Information Administration (EIA). Retrieved from: https://www.eia.gov/energyexplained/index.php?page=natural_gas_home

Electricity-specific emission factors for grid electricity, August 2011, https://ecometrica.com/assets/Electricity-specific-emission-factors-for-grid-electricity.pdf

Environment Canada. (1984). Manual for spills of hazardous materials. Environment Canada. Environmental Protection Service. Retrieved from http://publications.gc.ca/site/eng/9.699182/publication.html

EPA. (2009). Stationary Fuel Combustion Sources. United States Environmental Protection Agency. Retrieved from https://www3.epa.gov/carbon-footprint-calculator/tool/definitions/stationary-fuel.html

EPA. (2016). Greenhouse Gas Inventory Guidance: Direct Emissions from Stationary Combustion Sources. United States Environmental Protection Agency. Retrieved from https://www.epa.gov/sites/production/files/2016-03/documents/stationaryemissions_3_2016.pdf

European Commission Joint Research Centre (EUR 19754 EN), Greenhouse Gas Emissions from Fossil Fuel Fired Power Generation Systems.

FAO. (1974). Key to the FAO Soil Units (1974). Food and Agriculture Organization of the United Nations (FAO). Retrieved April 12, 2017 from http://www.fao.org/soils-portal/soil-survey/soil-classification/fao-legend/key-to-the-fao-soil-units/en/

FAO. (1999). AQUASTAT Country-profile: Myanmar. Retrieved from http://www.fao.org/nr/myanmar/aquastat-myanmar.pdf

FAO. (2008). Geographical distribution of 10 dominant soil types in Myanmar. Myanmar – FAO/NR Data, Tools and Maps (General). Food and Agriculture Organization of the United Nations (FAO). Retrieved from http://www.fao.org/nr/myanmar/page4_en.htm

FAO. (2012). Myanmar: Water use. Food and Agriculture Organization of the United Nations (FAO). Retrieved from http://www.fao.org/nr/water/aquastat/countries_regions/MMR/

FAOSTAT. Myanmar, Emissions – Agriculture total, viewed on March 18, 2017.

FEMA. (2010). Planning Guidance for a Response to a Nuclear Detonation. Federal Emergency Management Agency (FEMA). Retrieved from https://www.fema.gov/media-library/assets/documents/24879

FHWA. (2017). Highway Traffic Noise Barriers at a Glance. U.S. Department of Transportation. Federal Highway Administration. Retrieved from: https://www.fhwa.dot.gov/Environment/noise/noise_barriers/design_construction/keepdown.cfm

FHWA. (2017). Special Report - Measurement, Prediction, and Mitigation. U.S. Department of Transportation. Federal Highway Administration. Retrieved from http://www.fhwa.dot.gov/environment/noise/highway/hcn03.htm

Food and Agriculture Organization of the United Nations Statistics Division (FAOSTAT). Myanmar, Emissions – Land use total, viewed on March 18, 2017.

Franks, D., et al. 2010. Cumulative Impacts: A Good Practice Guide for the Australian Coal Mining Industry.

Gillenwater, M. (2005). Calculation Tool for Direct Emissions from Stationary Combustion. WRI/WBCSD. Green House Gas Protocol. Version 3.0. Retrieved from https://ghgprotocol.org/sites/default/files/Stationary_Combustion_Guidance_final_1.pdf

HarP-F and MIMU, 2018. Vulnerability in Myanmar: A Secondary Data Review of Needs, Coverage and Gaps.

Health in Myanmar 2012. Accessed on 24 October 2018 at http://mohs.gov.mm/ckfinder/connector?command=Proxy&lang=en&type=Main&currentFolder=%2FPublications%2FHealth%20In%20Myanmar%2F&hash=a6a1c319429b7abc0a8e21dc137ab33930842cf5&fileName=Health%20in%20Myanmar%20(2012).pdf

Health, Health Care and Diseases in Myanmar. Accessed on 24 October 2018 at http://factsanddetails.com/southeast-asia/Myanmar/sub5_5f/entry-3118.html

Healthcare. Accessed on 24 October 2018 at https://www.myanmore.com/2015/02/healthcare/

HIV and AIDs in Myanmar. Accessed on 24 October 2018 at https://www.avert.org/professionals/hiv-around-world/asia-pacific/myanmar

Hoornweg, D., & Bhada-Tata, P. (2012). What a Waste: A Global Review of Solid Waste Management. Word Bank. Urban Development & Local Government Unit. Retrieved from http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1334852610766/What_a_Waste2012_Final.pdf

Horton, et al. 2016. *Assessing Climate Risk in Myanmar*. New York, NY, USA: Center for Climate Systems Research at Columbia University, WWF-US and WWF-Myanmar.

Hospital Statistics Report 2014-16. Accessed on 24 October 2018 at https://themimu.info/sites/themimu.info/files/documents/Report_Hospital_Statistics_Report_2014-16_MOHS_Jun2018.pdf

Hospital Statistics. Accessed on 24 October 2018 at https://www.slideshare.net/zulfiquer732/hospital-statistics-79835548

IEA. (2006). Energy Technology Perspectives 2006: Scenarios & Strategies to 2050. IEA/OECD, Paris, 484 pp.

IFC. (2007). Environmental, Health, and Safety (EHS) General Guidelines. International Finance Corporation (IFC). World Bank Group. Retrieved from https://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES

IFC. (2008). Environmental, Health, and Safety Guidelines for Thermal Power Plants. International Finance Corporation (IFC). World Bank Group. Retrieved from https://www.ifc.org/wps/wcm/connect/dfb6a60048855a21852cd76a6515bb18/FINAL_Thermal%2BPower.pdf?MOD=AJPERES&id=1323162579734

IFC. (2012). Performance Standards on Environmental and Social Sustainability. International Finance Corporation (IFC). World Bank Group. Retrieved from https://www.ifc.org/wps/wcm/connect/115482804a0255db96fbffd1a5d13d27/PS_English_2012_Full-Document.pdf?MOD=AJPERES

IFC. (2017). Environmental, Health, and Safety Guidelines for Liquefied Natural Gas Facilities. International Finance Corporation (IFC). World Bank Group. Retrieved from https://www.ifc.org/wps/wcm/connect/edb102c5-ca61-4561-8b8e-8124fa2060af/20170406-FINAL+LNG+EHS+Guideline_April+2017.pdf?MOD=AJPERES

IFC. (2017). Environmental, Health, and Safety Guidelines for Ports, Harbours, and Terminals. International Finance Corporation (IFC). World Bank Group. Retrieved from https://www.ifc.org/wps/wcm/connect/d2f2cf88-ce22-4a48-86fc-45ee3b8e9e45/20170201-FINAL_EHS+Guidelines+for+Ports+Harbors+and+Terminals.pdf?MOD=AJPERES

IHA. (2016). Myanmar. International Hydropower Association (IHA). Retrieved from https://www.hydropower.org/country-profiles/myanmar

Institute of Air Quality Management (IAQM) (2014) Guidance on the Assessment of Dust from Demolition and Construction [Online] Available at: http://iaqm.co.uk/guidance/ [Accessed 13 February 2019]

Intergovernmental Panel on Climate Change (IPCC). 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2,Chapter 3 :Mobile Combustion, Page 3.10

International Finance Corporation (IFC). 2007a. Environmental, Health and Safety General Guidelines. Washington D.C.: IFC.

International Finance Corporation (IFC). 2012. Performance Standards on Environmental and Social Sustainability. Washington D.C.: IFC.

International Finance Corporation (IFC). 2013. Good Practice Handbook—Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets. Washington D.C.: IFC.

IPCC. (2006). Introduction. Energy. *Guidelines for National Greenhouse Gas Inventories*. Vol. 2. Ch. 1. Table 1.2. Retrieved from: https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html

IPCC. (2006). Mobile Combustion. Energy. *Guidelines for National Greenhouse Gas Inventories*. Vol. 2. Ch. 3. Pg. 3.10. Retrieved from https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html

IPCC. (2006). Mobile Combustion. Energy. *Guidelines for National Greenhouse Gas Inventories*. Vol. 2. Ch. 3. Table 3.2.1. Retrieved from: https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html

IPCC. (2006). Mobile Combustion. Energy. *Guidelines for National Greenhouse Gas Inventories*. Vol. 2. Ch. 3. Table 3.2.2. Retrieved from: https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html

IPCC. (2006). Mobile Combustion. Energy. *Guidelines for National Greenhouse Gas Inventories*. Vol. 2. Ch. 3. Table 3.3.1. Retrieved from: https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html

IPCC. (2006). Stationary Combustion. Energy. *Guidelines for National Greenhouse Gas Inventories*. Vol. 2. Ch. 2. Retrieved from https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html

IPCC. (2006). Stationary Combustion. Energy. *Guidelines for National Greenhouse Gas Inventories*. Vol. 2. Ch. 2. Table 2.2. Retrieved from https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html

IPCC. (2007). Changes in Atmospheric Constituents and in Radiative Forcing. AR4 Climate Change 2007: The Physical Science Basis. Retrieved from https://www.ipcc.ch/report/ar4/wg1/

IPCC. (2007). Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp. Retrieved from https://www.ipcc.ch/site/assets/uploads/2018/02/ar4_syr_full_report.pdf

Irin. (2011). Myanmar's urban areas at risk from earthquakes. Myanmar Times. Retrieved from https://www.mmtimes.com/national-news/2691-myanmar-s-urban-areas-at-risk-from-earthquakes.html

JICA. (2014). The Preparatory Survey for the Project for expansion of Yangon Port in Thilawa Area. Retrieved from http://open_jicareport.jica.go.jp/pdf/12244893.pdf

Lees F.P. (1980). Loss Prevention in the Process Industries. Vol. 1. Retrieved from https://www.academia.edu/37264110/Loss_Prevention_in_the_Process_Industries_Volume_1

McDonald-Madden, E. Gordon, A. Wintle, B. Walker, S. Grantham, H. Carvalho, S. Bottrill, M. Joseph, L. Ponce, R. Stewart, R. & Possingham, H. P. (2009). "True" Conservation Progress. Science 323: 43-44.

Medical Assistance. Accessed on 24 October 2018 at https://mm.usembassy.gov/u-s-citizen-services/doctors/

MEPE (2013). http://www.ubifrance.com/medias/press/mepe_9_7_2013_29_31.pdf Accessed 8 June 2015.

Metcalf& Eddy Inc. Wastewater Engineering: Treatment, Disposal, Reuse. 3rd Edition McGraw Hill, Network, 1979

MIMU. (2016). Total Number of Government Schools in States/Regions. Myanmar Information Management Unit. Retrieved from: https://reliefweb.int/sites/reliefweb.int/files/resources/Sector_Map_Edu_Government_Schools_in_ST-RGN_2014_MIMU1479v01_7Nov2016_A4.pdf

MOE. (2015). Thailand Alternative Energy Situation. Ministry of Energy. Department of Alternative Energy Development and Efficiency. Pg 57. Retrieved from: http://www.dede.go.th/download/state_59/Thailand%20alternative%20energy%202015.pdf

MOECAF (2015) Environmental Impact Assessment Procedure. Ministry of Environmental Conservation and Forestry Notification No. 616 / 2015.

Myanmar 2015-16 Demographic and Health Survey (Key Findings). Accessed on 24 October 2018 at https://dhsprogram.com/pubs/pdf/FR324/FR324.pdf

Myanmar Patients Pays The Price. Accessed on 24 October 2018 at https://www.irrawaddy.com/news/environment/myanmar-patients-pay-the-price.html

Myanmar Road Network. Accessed on 24 October 2018 at https://dlca.logcluster.org/display/public/DLCA/2.3+Myanmar+Road+Network

Nam, K., Cham, M.R., & Halili P.R. (2015). Power Sector Development in Myanmar. Asian Development Bank (ADB). Retrieved from https://www.adb.org/publications/power-sector-development-myanmar

New Yangon City Development Company Ltd (NYDC), 2018. Socioeconomic Master Plan for New Yangon City.

Norrgård, J. (2018). LNG terminals – land-based vs. floating storage and regasification technology. Wartsila. Retrieved from https://www.wartsila.com/twentyfour7/in-detail/lng-terminals-land-based-vs-floating-storage-and-regasification-technology

Number of Basic Education School in Yangon Region. Accessed on 24 October 2018 at https://reliefweb.int/sites/reliefweb.int/files/resources/Number%20of%20Basic%20Education%20School%20in%20Yangon%20Region.pdf

Nutrition (Stunning In A Nutshell). Accessed on 12 March 2019 at https://www.who.int/nutrition/healthygrowthproj_stunted_videos/en/

Online Piping and Usage Specification (System Non-potable Water). Accessed on 12 March 2019 at http://opus.mcerf.org/application.aspx?id=-6228344935996635278

Ports in Yangon, Myanmar. Accessed on 24 October 2018 at http://www.globalmarsshipping.com/ports-in-ygn.htm

Premakumara, D.G.J., & Hengesbaugh, M. (2016). Quick Study on Waste Management in Myanmar. Institute for Global Environmental Strategies (IGES). Retrieved from https://www.iges.or.jp/files/research/scp/PDF/20160613/17_Quick_study_Web.pdf

Reform of the Education System: Case Study of Myanmar. Accessed on 24 October 2018 at https://www.pic.org.kh/images/2017Research/20170523%20Education_Reform_Myanmar_Eng.pdf

Rural Road and Access. Accessed on 24 October 2018 at https://www.adb.org/sites/default/files/publication/189079/mya-rural-roads.pdf

Shwedagon Pagoda. Accessed on 24 October 2018 at http://www.shwedagonpagoda.com/

Sule Pagoda. Accessed on 24 October 2018 at https://www.bestpricevn.com/travelguide/destinations-1/Sule-Pagoda-421.html

Taw, N.P. (2014). Fifth National Report to the United Nations Convention on Biological Diversity. Ministry of Environmental Conservation and Forestry of the Republic of the Union of Myanmar. Retrieved from https://www.cbd.int/doc/world/mm/mm-nr-05-en.pdf

TB Still A Serious Threat, Says Doctors. Accessed on 24 October 2018 at https://www.mmtimes.com/news/tb-still-serious-threat-say-doctors.html

Tchobanoglous, G., Burton, F. L., & Metcalf & Eddy. (1991). Wastewater engineering: Treatment, disposal, and reuse. New York: McGraw-Hill.

The 2014 Myanmar Population and Housing Census (Ahlone Township). Accessed on 24 October 2018 at https://themimu.info/sites/themimu.info/files/documents/TspProfiles_Census_Ahlone_2014_ENG.pdf

The 2014 Myanmar Population and Housing Census (Dala Township). Accessed on 24 October 2018 at https://themimu.info/sites/themimu.info/files/documents/TspProfiles_Census_Dala_2014_ENG.pdf

The 2014 Myanmar Population and Housing Census (Occupation and Industry). Accessed on 24 October 2018 at http://www.burmalibrary.org/docs22/2B_Occupation_and_Industry_EN.pdf

The 2014 Myanmar Population and Housing Census (Seikgyikanaungto Township). Accessed on 24 October 2018 at https://themimu.info/sites/themimu.info/files/documents/TspProfiles_Census_Seikkyi-Khanaungto_2014_ENG.pdf

The 2014 Myanmar Population and Housing Census (Thematic report on education). Accessed on 24 October 2018 at https://reliefweb.int/sites/reliefweb.int/files/resources/4G_Labour%20Force%209JUNE_forWEB.pdf

The 2014 Myanmar Population and Housing Census (Yangon Region). Accessed at 24 October 2018 at http://www.dop.gov.mm/sites/dop.gov.mm/files/publication_docs/yangon_region_census_report_-_english.pdf

The 2017 Myanmar Living Conditions Survey. Accessed on 24 October 2018 at https://themimu.info/sites/themimu.info/files/documents/Report_Myanmar_Living_Conditions_Survey_2017_Jun2018.pdf

The Biodiversity Consultancy (TBC) (2013) Getting through PS6: Critical Habitat and its requirements. Case Studies from Guinea and Mongolia.Whitmore, T.C. (1984) Tropical Rain Forests of the Far East. Oxford University Press. Second Edition.

The Project for the Strategic Urban Development Plan of the Greater Yangon (Final Report I). Accessed on 31 October 2018 at http://open_jicareport.jica.go.jp/pdf/12122529_02.pdf

The State of Local Governance: Trends in Yangon. Accessed on 25 October 2018. At https://www.themimu.info/sites/themimu.info/files/documents/Report_Local_Governance_Mapping_Yangon_UNDP_Feb2015.pdf

The Survey Program for the National Transport Development Plan in the Republic of the Union of Myanmar (Final Report). Accessed on 24 October 2018 at http://open_jicareport.jica.go.jp/pdf/12230728_02.pdf

Theilen-Willige, B., & Pararas-Carayannis, G. (2009). Natural Hazard Assessment of SW Myanmar – A Contrubution of Remote Sensing and GIS Methods to the Detection of Areas Vulnerable to Earthquakes and Tsunami / Cyclone Flooding. Tsunami Society. Retrieved from http://tsunamisociety.org/282ThielenGPCa.pdf

Travel Naypyitaw. Accessed on 24 October 2018 at http://travelnaypyitaw.org/index.php/ar/destinations/shopping/201-myoma-market

Tun Lwin, Khin and Cho Cho Shein. (2006). Hydrology and Meteorology report of Myanmar.

UNEP RISØ. (2013). Emissions Reduction Profile: Myanmar. UNEP RISØ Centre. Retrieved from http://www.acp-cd4cdm.org/media/363090/emissions-reduction-profile-myanmar.pdf

UNEP-WCMC. (2019). Protected Area Profile for Myanmar from the World Database of Protected Areas. Protected Planet. Retrieved from https://www.protectedplanet.net/country/MM

UNFCCC. (2019). Burma ratified the UNFCCC as Myanmar. UNFCCC Status of Ratification. United Nations Framework Convention on Climate Change (UNFCCC). Retrieved March 20, 2017 from https://unfccc.int/node/61122.

USAID. (2017). Greenhouse Gas Emissions in Burma. U.S. Agency for International Development. Retrieved from https://www.climatelinks.org/resources/greenhouse-gas-emissions-factsheet-burma

Volunteers determined to clean up Yangon. Accessed on 24 October 2018 at https://www.mmtimes.com/lifestyle/26332-volunteers-determined-to-clean-up-yangon.html

Vulnerability in Myanmar. Accessed on 24 October 2018 at https://themimu.info/sites/themimu.info/files/documents/Report_Vulnerability_in_Myanmar_HARP-MIMU_Jun2018_ENG_Print_version.pdf

Water Supply Options For The Growing Megacity Of Yangon - Scenarios With The WEAP Model. Accessed on 24 October 2018 at https://www.weap21.org/Downloads/Yangon.pdf

WEF, ADB, & Accenture. (2013). New Energy Architecture: Myanmar. World Economic Forum (WEF). Retrieved from http://www3.weforum.org/docs/WEF_EN_NewEnergyArchitecture_Myanmar_2013.pdf

WHO. (2005). Minimum water quantity needed for domestic uses. World Health Organization (WHO) Regional Office for South-East Asia. Retrieved from http://ec.europa.eu/echo/files/evaluation/watsan2005/annex_files/WHO/WHO5%20-%20Minimum%20water%20quantity%20needed%20for%20domestic%20use.pdf

World Bank. (1985). Techniques for Assessing Industrial Hazards: A manual. The World Bank. Retrieved from http://documents.worldbank.org/curated/en/278461468740173194/Manual-of-industrial-hazard-assessment-techniques

World Resources Institute Climate Analysis Indicators Tool (WRI CAIT 2.0, 2017). Global Warming Potentials (GWPs) are from the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report (SAR).

WRI. (2014). Myanmar. CAIT Climate Data Explorer. World Resources Institute (WRI). Retrieved May 15, 2017 from: http://cait.wri.org/profile/Myanmar

WWF. (2019). Southern Asia: Along the coasts of India, Myanmar, Malaysia, and Thailand. World Wildlife Fund (WWF). Retrieved from https://www.worldwildlife.org/ecoregions/im1404

Yangon (Myanmar). Accessed on 24 October 2018 at https://www.britannica.com/place/Yangon

Yangon port. Accessed on 24 October 2018 at http://www.mpa.gov.mm/yangon-port

Yangon Region, A Snapshot of Child Wellbeing. Accessed on 24 October 2018 at https://www.unicef.org/myanmar/Yangon_Region_Profile_30-07-15.pdf

Zaw, T., Than, M.M. (2017). Climate change and groundwater resources in Myanmar. Journal of Groundwater Science and Engineering. Retrieved from http://gwse.iheg.org.cn/EN/abstract/abstract260.shtml#

APPENDIX A PPR SUBMISSION LETTER

บริษัท ทีทีซีแอล จำกัด (มหาชน)
TTCL PUBLIC COMPANY LIMITED
COMPANY REGISTRATION NO. 0107551000185
27th-30th FLOOR, SERMMIT TOWER, 159/41-44 SUKHUMVIT 21, ASOKE ROAD,
NORTH KLONGTOEY, WATTANA, BANGKOK 10110 THAILAND
TEL. +66 (0) 2260-8505 FAX. +66 (0) 2260-8525-6

To
U Hla Maung Thein
Director General
Environmental Conservation Department
Ministry of Natural Resources and Environmental Conservation
Office 53, Naypyidaw
The Republic of Union of Myanmar

Letter: TTCL 063/17 H/O
Date: December 11th, 2017

Subject: Appointment of Third Party Consultant for Environment Impact Assessment (EIA) Study for the development of an expansion phases for 354 MW Combined Cycle Power Plant for Ahlone Power Plant in Yangon, Myanmar

TTCL is pleased to inform that Environmental Resources Management (ERM) has been appointed as the organisation to carry out the Environmental Impact Assessment (EIA) Study for the project.

ERM have formally applied as an Organisation to undertake IEEs and EIAs in Myanmar on the Transitional Consultant Registration Scheme.

ERM will undertake an Environmental Impact Assessment (EIA) Study (also referred to as Environmental and Social Impact Assessment: ESIA) for the Project. The outcomes of the EIA Study will be submitted to relevant Myanmar authorities for assessment in order to inform the decision for the Project Proponent to obtain an Environmental Compliance Certificate (ECC).

For this Project, ERM will work with the qualified sub-consultant, Sustainable Environment Myanmar Co., Ltd (SEM), who has experience in carrying out the baseline survey and public consultation meetings in the local context. Note that all the works provided by SEM are under ERM supervision.

Should you require further information on TICL's intended EIA approach, please do not hesitate to contact me.

We do attach: (A) ERM's Company Profile & Experience
(B) SEM's Company Profile & Experience

Best Regards,

Mr. Hironobu Iriya
President & CEO
TTCL Public Company Limited

Copy to:

1. Union Minister, Ministry of Electricity and Energy
2. Deputy Minister, Ministry of Electricity and Energy
3. Permanent Secretary, Ministry of Electricity and Energy
4. Managing Director, Electric Power Generation Enterprise, MOEE
5. Director General, Department of Electric Power Planning, MOEE

บริษัท ทีทีซีแอล จำกัด (มหาชน)
TTCL PUBLIC COMPANY LIMITED
COMPANY REGISTRATION NO. 0107551000185
27th-30th FLOOR, SERMMIT TOWER, 159/41-44 SUKHUMVIT 21, ASOKE ROAD,
NORTH KLONGTOEY, WATTANA, BANGKOK 10110 THAILAND
TEL. +66 (0) 2260-8505 FAX. +66 (0) 2260-8525-6

To
U Hla Maung Thein
Director General
Environmental Conservation Department
Ministry of Natural Resources and Environmental Conservation
Office 53, Naypyidaw
The Republic of Union of Myanmar

Letter: TTCL 064/17 H/O
Date: December 14th, 2017

Subject: Submission of Project Proposal Report for Environment Impact Assessment (EIA) Study for the Development of an expansion phases for 354 MW Combined Cycle Power Plant for Ahlone Power Plant in Yangon, Myanmar

TTCL Public Company Limited (TTCL) is pleased to attach herewith the Project Proposal Report for the proposed development of expansion phases for 354 MW Combined Cycle Power Plant for Ahlone Power Plant in Yangon, Myanmar

This Project Proposal Report has been prepared by the Project Proponent and Environmental Resources Management (ERM), as per Section 7 of the Environmental Conservation Law, Articles 52 and 53 of the Environmental Conservation Rules of the Republic of the Union of Myanmar, and Annex 1 of the EIA Procedure, dated 29th December 2015, that MONREC requires the Project Proponent to proceed with an Environmental Impact Assessment (EIA) Study of the Project and prepare an Environmental Management Plan (EMP) to put forward its commitments for environmental and social mitigation and management measures.

Please do not hesitate to contact me directly should you have any queries on the enclosed.

We do attach: (A) Project Proposal Report (PPR)
Booklet Report and CD are enclosed herewith

Best Regards,

Mr. Hironobu Iriya
President & CEO
TTCL Public Company Limited

Copy to:

1. Union Minister, Ministry of Electricity and Energy
2. Deputy Minister, Ministry of Electricity and Energy
3. Permanent Secretary, Ministry of Electricity and Energy
4. Managing Director, Electric Power Generation Enterprise, MOEE
5. Director General, Department of Electric Power Planning, MOEE

APPENDIX B SCOPING REPORT SUBMISSION LETTER

บริษัท ทีทีซีแอล จำกัด (มหาชน)
TTCL PUBLIC COMPANY LIMITED
COMPANY REGISTRATION NO. 0107551000185
27th-30th FLOOR, SERMMIT TOWER, 159/41-44 SUKHUMVIT 21, ASOKE ROAD,
NORTH KLONGTOEY, WATTANA, BANGKOK 10110 THAILAND
TEL. +66 (0) 2260-8505 FAX. +66 (0) 2260-8525-6

To,
Director General
Department of Electric Power Planning
Ministry of Electricity and Energy
Office 27 Naypyidaw,
The Republic of the Union of Myanmar

Letter No: TTCL 004/19 H/O
Date: January 9th, 2019

Project: LNG Power Plant (Ahlone) Project

Subject: Submission of Scoping Report for Environmental Impact Assessment (EIA) study of LNG Power Plant (Ahlone) Project, Yangon, Myanmar.

TTCL Public Company Limited (TTCL) is pleased to attach the Project Scoping Report which is the next step for EIA process for LNG Power Plant (Ahlone) Project, Yangon, Myanmar. Please refer to **Attachment (A).**

In accordance with Myanmar's EIA procedure, TTCL have been acquired the approval form Ministry of Natural Resources and Environmental Conversation (MONREC) on the Third Party Appointment and Project Proposal Report for the EIA study of LNG Power Plant (Ahlone) Project. Refer to per **Attachment (B)** and **(C)** respectively.

Moreover, TTCL have been accomplished the first round of Public Participation Meeting with the participants from project concerned townships, according to Myanmar EIA law and regulation.

This Project Scoping Report has been prepared by the Project Proponent and Environmental Resources Management (ERM), as per section 7 of the Environmental Conversation Law, Article 52 and 53 of the Environmental Conversational Rules of the Republic of the Union of Myanmar, and Annex 1 of the EIA procedure, dated 29th December 2015.

TTCL confirms that the Scoping Report including the Terms of Reference will be implemented and form part of the FULL ESIA study.

Should you require further information, please do not hesitate to contact Mr. Htet Aung Mon via htetaung.m@ttcl.com or phone on +95 9974953914 or +95-1-371963.

Attached with
(A) Scoping Report for the LNG Power Plant (Ahlone) Project
(B) ECD respond letter for Third Party Confirmation_Letter_EIA-2/ Petroleum [1018/2018]
(C) ECD Respond Letter for PPR_Letter_EIA- 2/2 [1005 (E)/2018]

Best Regards,

Ms. Suratana Trinratana
Senior Vice President
TTCL Public Company Limited

10.1.19
067-431490-
1011

JOY OF ENGINEERING AND ACHIEVEMENT

APPENDIX C ECD COMMENTS ON SCOPING REPORT

No.	Comment from ECD	Response from ERM
1.	Sufficient ESIA shall carry out to cover the total project capacity of 388MW as ECD found out the project capacity indicated in Scoping Reported have been increased to 388MW, although the approved PPR report had indicated as 356MW.	The Project Description and Alternative chapter (***Chapter 4*** of this report) include the 388MW capacity and the ESIA has been carried-out considering this capacity and not the initial 356MW described in the PPR report.
2.	To indicate current Myanmar Legislation Relevant to the Project. To describe the project commitment to follow those Myanmar legislation, regulation, procedure and applicable International standard relevant to the project.	The relevant Myanmar legislation are presented in the Policy, Legal and Institutional Framework Chapter (***Chapter 3*** of this report). The Project Commitment relative to the legislation, regulation, procedure and applicable standards are included in the Conclusion and Statement of Commitment Chapter (***Chapter 14*** of this report).
3.	To indicate the updated project timeline of each components.	The Project Description and Alternative chapter (***Chapter 4*** of this report) include the tentative timeline for each of the Project's components.
4.	To indicate the Fire Prevention Plans, Emergency Response plans for the project main components of Power Plant, LNG receiving Terminal & LNG storage tank.	The Project Description and Alternative chapter (***Chapter 4*** of this report) and the Environmental and Social Management Plan chapter (***Chapter 12*** of this report) include a description of these management plans. The plans are also appendixes to this report.
5.	To indicate the flooding risk & prevention plans for the project main components of Power Plant, LNG receiving Terminal & LNG storage tank.	The Environmental and Social Management Plan chapter (***Chapter 12*** of this report) include mitigation measures to be implemented in relation to flooding risks. In addition, the flooding risk study has been carried out for the Power Plant, this is attached as ***Appendix X***.
6.	To indicate the impact assessment on climate based on the climate change projection data available from union level and international research organization, including impacts on environmental & societies, action plan and emergency response plan.	The Impact Assessment Chapters (***Chapters 7***, ***8***, and ***9*** of this report) include the assessment of impact from Greenhouse Gas and the Environmental and Social Management Plan chapter (***Chapter 12*** of this report) include mitigation measures to be implemented in relation to these impacts.
7.	To identify the primary impacts(Environment, Communities)from the project development	The Impact Assessment Chapters (***Chapters 7***, ***8***, and ***9*** of this report) include the assessment of all the potential impacts from the development of this Project.
8.	To indicate the complete environmental and social baseline data collected from project main components area.	The Description of the Environment Chapter (chapters 5 of this report) include the complete environmental and social baseline data collected in the Project Area of Influence.
9.	To indicate the project impacts and mitigation measures as well as action plan, in charge organization.	The Impact Assessment Chapters (***chapters 7***, ***8***, and ***9*** of this report) include the assessment of all Project impacts and the Environmental and Social Management Plan chapter (***Chapter 12*** of this report) include mitigation measures to be implemented in relation to these impacts as well

No.	Comment from ECD	Response from ERM
		as the company organisation during construction and operation.
10.	To indicate the mitigation measure for road traffic & river traffic.	The Impact Assessment Chapters (***Chapters 7***, ***8***, and ***9*** of this report) include the assessment of the Project impacts in relation to road and river traffic and the Environmental and Social Management Plan chapter (***Chapter 12*** of this report) include mitigation measures to be implemented in relation to these impacts.
11.	To study out the **Cumulative Impact** assessment related to project impacts (air quality, noise, waste disposal, road traffic) and to propose mitigation measure.	All cumulative impacts and mitigation measures are presented in the Cumulative Impact Assessment chapter (***Chapter 11*** of this report) and reported in the Environmental and Social Management Plan chapter (***Chapter 12*** of this report).
12.	To indicate detail of project waste classification base on type/volume, waste management plan, hazardous waste storage plan, transportation and final disposal location.	The Project Description and Alternative chapter (***Chapter 4*** of this report) include the details of Project waste. The Environmental and Social Management Plan chapter (***Chapter 12*** of this report) include the framework of the waste management plan.
13.	To indicate the number of worker during construction phase and worker accommodation plan. To indicate the environmental & social impact due to worker workers influx and mitigation measure.	The Project Description and Alternative chapter (***Chapter 4*** of this report) include the details of required workers for each component and each phase of the Project. The Impact Assessment Chapters (***Chapters 7***, ***8***, and ***9*** of this report) include the assessment of the Project impacts in relation to the presence of these workers and worker accommodations.
14.	To indicate the Stake Holder Communication plan during Operation Phase.	The Public Consultation and Disclosure chapter (***Chapter 13*** of this report) include the framework for stakeholder engagement during operation. The Impact Assessment Chapters (***Chapters 7***, ***8***, and ***9*** of this report) also include some details on the stakeholder engagement during operation phase.
15.	To indicate detail the job employment rate (%) for local people into project and job training program.	The Project Description and Alternative chapter (***Chapter 4*** of this report) include the details of required workers for each component and each phase of the Project, including the expected level of local workers. The Impact Assessment Chapters (***Chapters 7***, ***8***, and ***9*** of this report) and the Environmental and Social Management Plan chapter (***Chapter 12*** of this report) include details of mitigation measures relative to training programme.
16.	To carry out the ground survey and study the erosion and sedimentation impacts from proposed project.	The Description of the Environment Chapter (***Chapters 5*** of this report) details the survey realised for this Project. The Impact Assessment Chapters (***Chapters 7***, ***8***, and ***9*** of this report) and

No.	Comment from ECD	Response from ERM
		the Environmental and Social Management Plan chapter (***Chapter 12*** of this report) include details of mitigation measures relative to these aspects.
17.	To indicate the water consumption for Power Station and water resource competition assessment for project nearby.	The Project Description and Alternative chapter (***Chapter 4*** of this report) include the details of water consumption need for the Project. The Impact Assessment Chapters (***Chapters 7***, ***8***, and 9 of this report) and the Environmental and Social Management Plan chapter (***Chapter 12*** of this report) include details of mitigation measures relative to these aspects. The Cumulative Impact Assessment chapter (***Chapter 11*** of this report) consider the other planned development and projects in the Project Area of Influence.
18.	According to ***Section 8.4*** of Scoping report, to carry out the Future Stakeholder Engagement activities on village, township level focusing on project nearby communities. To implement their suggestions & concerns.	The Public Consultation and Disclosure chapter (***Chapter 13*** of this report) include details of all the engagement conducted during the development of the ESIA for this Project as well as the results of these engagement. The minutes of all the meetings are appendixes to this report.
19.	To indicate the complete Terms of Reference for the ESIA study as per ***Chapter 10*** of Scoping report.	The Terms or Reference of the ESIA study will be included in ***Appendix Y***.
20.	According EIA procedure paragraph 50, to disclose the project information on Project (or) project proponent website. To establish notice board/sign board purpose to disclosure of project to public in project location. To disclose on newspaper & media.	The Public Consultation and Disclosure chapter (***Chapter 13*** of this report) include details of all the disclosure realised by the Project, including print screen of disclosures in newspaper, and link to the Project disclosure on the website.

APPENDIX D THIRD-PARTY CONFIRMATION LETTER

The Republic of the Union of Myanmar

Ministry of Natural Resources and Environmental Conservation

Environmental Conservation Department

Office Number (53), Naypyitaw.

Letter No: EIA- 2/ Petroleum (1018/2018)

Date: 24 August, 2018

To

Union Ministry Office

Ministry of Natural Resources and Environmental Conservation, Office (28)

Subject: **To respond confirmation of Third Party to Environmental Resources Management (ERM) & Sustainable Environment Myanmar (SEM) who will comply EIA for 356 MW LNG Power Plant Project**

Reference: (1) Letter No. TTCL 073/18 H/O, of TTCL Public Co., Ltd on 3.7.2018

1. Refer as per subject, TTCL Public Company Limited requested to allow to conduct EIA report by Third Party who are Environmental Resources Management (ERM) & Sustainable Environment Myanmar Co., Ltd (SEM) for 356 MW LNG Power Plant Project at inside of Ahlone Power Plant Area in Ahlone Township, Yangon Division according reference letter.

2. We, ECD found out that Third Party who ERM (Hong Kong) & SEM will conduct EIA for propose project had registered certificate, and also has many experiences in Oil and Gas project fields. Many specialist members will participate to conduct the following EIA activities and subjects;

1. Technical review for Power Plant, LNG Facilities, Oil and Gas Transport and input to EIA Engineering,
2. Social Baseline Impact Assessment,
3. Environmental Baseline Impact Assessment,
4. Ecology and Biodiversity Baseline Impact Assessment
5. Air Quality Impact Assessment, GHG Assessment
6. Noise Impact Assessment
7. Health Impact Assessment
8. Surface Water Impact Assessment
9. Unplanned Event Impact Assessment
10. Regulatory requirement

11. Social Specialist
12. Local Ecology Expert

3. **Therefore, there has no objection for Third Party who are Environmental Resources Management (ERM) & Sustainable Environment Myanmar Co., Ltd (SEM) for conducting EIA Report of TTCL Public Company Limited perform 356 MW LNG Combine Cycle Power Plant Project in Ahlone Township, Yangon.**

Hla Maung Thein

Director General

Copy to-

Office received, Letter series, Case File

APPENDIX E TPMC'S HSE PLAN PROCEDURE

AHLONE 2

ISSUED
8 OCT 2018
TTCL PUBLIC COMPANY LIMITED

HSE PLAN PROCEDURE

PROJECT DOC. NO. F050-MNL-028

FOR INFORMATION

LNG POWER PLANT (AHLONE) PROJECT

TTCL JOB NO. F-050

Total (Including this Page): 24 sheets

0	24-Sep-18	For Information				
REV.	DATE	DESCRIPTION	MADE	CHECKED	APPROVED	AUTH'D

For Project Use only

Originator	Distribution	PW	PR	MA	ME	PP	EE	IN	CV	QC	PC	Proj	Site	Owner	Total
Project	No. of Copy	-	-	-	-	-	-	-	-	1	-	ORG.	1	1	4

บริษัท ทีทีซีแอล จำกัด (มหาชน)
TTCL PUBLIC COMPANY LIMITED

Revision History Sheet

Rev.	Date	Description
0	September 24, 2018	For Information

CONTENTS

CONTENTS Page

1. GENERAL

1.1 PURPOSE

The purpose of this plan is to establish HSE management System, HSE requirements, HSE rules and regulations, HSE organization and responsibilities, and provide the HSE guidelines for accident incident prevention and environmental impact protection.

This plan establishes the minimum requirements for HSE execution of **LNG POWER PLANT (AHLONE) PROJECT** and establishes safe working practices and standards which shall be implemented on the site.

Depending upon the location of the site, it is likely that some conflict will arise between the requirements of the procedure and the Laws governing HSE at work in the country. In such even, the subcontractors shall apply the more stringent of the regulations at all times.

1.2 SCOPE

The scope of this document is to establish the minimum requirements for HSE execution, define the HSE standard, HSE organization, plan, rules and regulation, responsibilities and implementation guideline for construction phase of **LNG POWER PLANT (AHLONE) PROJECT**

1.3 DEFINITION

In this HSE plan, the following words and expressions are used, and they have the respective meaning hereby assigned to them, except where the context otherwise requires.

"CONTRACTOR" means **TTCL PUBLIC COMPANY LIMITED.** is onshore construction consortium member who perform the "Engineering Procurement and Construction (EPC) of the project.

"OWNER" means **TTCL POWER MYANMAR COMPANY LIMITED .(TPMC)** employing construction in connection with the "Engineering Procurement and Construction (EPC) of the project.

"SITE" means the place or places so designated by owner for construction of the project including places adjacent thereto which are for storage and assembly of equipment and materials.

"SUBCONTRACTOR(S)" means the subcontractor(s) employed by contractor or the owner in connection with the construction of the project.

"HSE" means Occupational Health, Safety and Environment.

"HSE MS" means Occupational Health, Safety and Environmental Management System
"Standard" means HSE standard which requires condition, or the adoption or use of one or more practices, operations or process, reasonably necessary or appropriated to safe employee healthful and environmental impact protection, such as TIS etc.

"Construction Phase" means Construction activities comprising direct (prefabrication assembly, pre-commissioning up to mechanical completion, and other activity specified in Contract) and indirect (scaffolding, transport at site, maintenance of equipment etc.).

"OHSAS" means Occupational Health Safety Assessment Standard.

"TIS" means Thailand Industrial Standard.

"ISO" means International Organization for Standardization

"EIA" means Environmental Impact Assessment. The EIA report is identify the environmental sensitivities and impacts relevant to the project and environmental impact protection requirement.

"Hazard" means intrinsic property or ability of something (e.g. work materials, equipment, work methods and practices) with potential to cause harm.

"Risk" means compiling result of hazard severity and its likelihood that has potential to cause harm.

"3R Principle" means Waste Management Principle: Reduce, Reuse and Recycle.

"PTA" means Pre Task Analysis.

"PPE" mean Personnel Protective Equipment.

"ERT" means Emergency Response Team.

2. HSE MANAGEMENT SYSTEM

The HSE Management System is summarized in this plan which defines the HSE principle requirements associated with the TTCL / Sub-Contractor and any others to be practiced at construction worksites of the project at all time, to ensure safely working environment for occupational health preservation, accident / incident prevention and environmental impact protection would be achieved.

2.1 HSE GOAL AND OBJECTIVE

LNG POWER PLANT (AHLONE) PROJECT HSE Goal is to maintain an injury free workplace with minimum adverse impact of the environment. Prevent community and promote resource conservation associate with project execution.

The project HSE objectives are established followings;

1) TTCL shall carry out project management and construction management activities in compliance with the applicable legal and other HSE requirements as specified in the contract.

2) TTCL shall perform and manage construction work in safe manner to achieve the safety target of "No Lost time Accident"

3) Project incidence rates should not exceed the following value;
IFR (incidence frequency rates), 3.7
ISR (incidence severity rates), 37

4) TTCL shall perform construction work by taking into account for the Environmental impact protection and complaint from the community shall be "Zero".

The Project HSE Objectives are shown in Appendix 1 and 2.

2.2 HSE POLICY, MANAGEMENT SYSTEM STANDARD AND REFERENCE DOCUMENTS

2.2.1 TTCL HSE POLICY

TTCL Top Management considers Occupational Health, Safety and Work Place Environment issues concerned with all employees, subcontractors, customers and the community to be the utmost importance. TTCL Top Management has developed, implemented and maintained the Occupational Health, Safety and Environmental Management system and committed to provide direction and necessary resource to ensure the desirable HSE goal and objectives, including the full compliance with Thailand HSE regulation, relevant standards and requirements would be achieved.

To clearly and concisely communicated; the TTCL HSE policy and objectives are communicated to all project's personnel, subcontractor and vender through TTCL Management messages, newsletters, Pre-Mobilization Meeting, HSE awareness or HSE training program and HSE campaigns.

The TTCL HSE policy shows as the following:

บริษัท ทีทีซีแอล จำกัด (มหาชน)
TTCL PUBLIC COMPANY LIMITED
COMPANY REGISTRATION NO. 0107551000185
27th-30th FLOOR, SERMMIT TOWER, 159/41-44 SUKHUMVIT 21, ASOKE ROAD,
NORTH KLONGTOEY, WATTANA, BANGKOK 10110 THAILAND
TEL. +66 (0) 2260-8505 FAX. +66 (0) 2260-8525-6

As of June 18, 2015

HSE POLICY

TTCL Public Company Limited is a leading engineering contractor that specializes in design, engineering, procurement, construction and commissioning of turnkey projects for both industrial and process plants including related facilities. The company is most active in the fields of chemicals, petrochemicals, oil and gas, fertilizers and power generation plants.

The safety of our employees, partners, concerned parties and environmental protection are our highest priorities. TTCL is committed to maintain an injury free workplace with minimum adverse impact of the environment. With recognition to the importance of Occupational Health, Safety and Environmental Management, the company has introduced the Occupational Health, Safety and Environmental Management System as part of this commitment.

In order to achieve our desired goals, the President & CEO has established a HSE Policy Statement. This policy states:

1. *All company activities shall comply with all HSE legal and other applicable requirements.*
2. *HSE Policy and related HSE information shall be communicated to employees, partners and concerned parties to make them understand their duties and responsibilities regarding the Occupational Health, Safety and Environmental Management System and perform their tasks correctly.*
3. *HSE Objectives for the company and projects shall be established. A monitoring, measurement and control system shall be established to monitor HSE performance.*
4. *HSE Procedures and documentation for each project and functional organizations shall be established and implemented so that all activities are performed safely with concern for the environment.*
5. *The necessary resources shall be provided to support the implementation of the Occupational Health, Safety and Environmental Management Systems.*
6. *Top management shall review the HSE Policy and objectives annually for its effectiveness and suitability and seek out the opportunity for improvement of the Occupational Health, Safety and Environmental Management Systems.*

Hironobu Iriya
President& CEO
TTCL Public Company Limited

บริษัท ทีทีซีแอล จำกัด (มหาชน)
TTCL PUBLIC COMPANY LIMITED
COMPANY REGISTRATION NO. 0107551000185
27th-30th FLOOR, SERMMIT TOWER, 159/41-44 SUKHUMVIT 21, ASOKE ROAD,
NORTH KLONGTOEY, WATTANA, BANGKOK 10110 THAILAND
TEL. +66 (0) 2260-8505 FAX. +66 (0) 2260-8525-6

ณ วันที่ 18 มิถุนายน 2558

นโยบาย ด้านอาชีวอนามัย ความปลอดภัยและสิ่งแวดล้อม

บริษัท ทีทีซีแอล จำกัด (มหาชน) เป็นหนึ่งในผู้นำด้านธุรกิจวิศวกรรมบริการและรับเหมาก่อสร้างแบบครบวงจร มีความเชี่ยวชาญในการให้บริการออกแบบ, วิศวกรรมบริการ, จัดซื้อ จัดหาวัสดุอุปกรณ์และรับเหมาก่อสร้างแบบเบ็ดเสร็จ สำหรับภาคอุตสาหกรรมและโรงงาน รวมถึงสิ่งสนับสนุนอำนวยความสะดวกต่างๆ ในการผลิต โดยลูกค้าส่วนใหญ่เป็นกลุ่มโรงงานเคมี ปิโตรเคมี โรงกลั่นน้ำมันและก๊าซ โรงปุ๋ยและโรงไฟฟ้า เป็นต้น

บริษัทฯ ให้ความสำคัญอย่างสูงสุดต่อความปลอดภัยและอาชีวอนามัยของพนักงาน, คู่ค้า, ผู้ที่มีส่วนเกี่ยวข้องต่างๆ รวมถึงการป้องกันผลกระทบต่อสิ่งแวดล้อม บริษัทฯ จึงแสดงเจตนารมณ์ที่จะสร้างและรักษาไว้ซึ่งสภาพการทำงานที่ปลอดภัย ไม่มีการบาดเจ็บหรือการเจ็บป่วยจากการทำงาน และป้องกันการเกิดผลกระทบต่อสิ่งแวดล้อม

ด้วยความตระหนักถึงความสำคัญของระบบการบริหารจัดการด้านอาชีวอนามัย ความปลอดภัยและสิ่งแวดล้อม บริษัทฯ จึงได้นำเอาระบบการบริหารจัดการด้านอาชีวอนามัย ความปลอดภัยและสิ่งแวดล้อมเข้ามาเป็นส่วนหนึ่งในการดำเนินงานของบริษัทฯ และเพื่อให้บรรลุตามเป้าหมายที่ตั้งไว้ ประธานเจ้าหน้าที่บริหารและกรรมการผู้จัดการใหญ่ของบริษัทฯ จึงได้กำหนดนโยบายอาชีวอนามัย ความปลอดภัย และสิ่งแวดล้อมไว้ดังนี้

1. การดำเนินงานของบริษัทฯจะต้องสอดคล้องกับกฎหมาย และข้อกำหนดอื่นๆที่เกี่ยวข้องในด้านอาชีวอนามัย ความปลอดภัยและสภาพแวดล้อมในการทำงานและการป้องกันผลกระทบต่อสิ่งแวดล้อม
2. นโยบาย ข้อมูล ข่าวสาร ด้านอาชีวอนามัย ความปลอดภัยและสิ่งแวดล้อมจะต้องถูกสื่อสารไปยังพนักงาน คู่ค้าและผู้มีส่วนเกี่ยวข้องเพื่อให้เข้าใจ บทบาทหน้าที่ความรับผิดชอบและปฏิบัติได้อย่างถูกต้อง
3. วัตถุประสงค์ด้านอาชีวอนามัย ความปลอดภัยและสิ่งแวดล้อมของบริษัทฯและโครงการทุกแห่งรวมถึงระบบการติดตาม, วัดผลและควบคุมจะต้องถูกกำหนดขึ้น เพื่อติดตามประสิทธิผลของการดำเนินงาน ด้านอาชีวอนามัย ความปลอดภัยและสิ่งแวดล้อม
4. ระเบียบปฏิบัติและเอกสารที่เกี่ยวข้องในด้านอาชีวอนามัย ความปลอดภัย และสิ่งแวดล้อมของบริษัทฯ และโครงการจะต้องถูกจัดทำขึ้นและนำไปปฏิบัติตาม เพื่อให้การดำเนินกิจกรรมต่างๆ ของบริษัทฯ เป็นไปด้วยความปลอดภัยและคำนึงถึงสิ่งแวดล้อม
5. ทรัพยากรต่างๆที่จำเป็น จะได้รับการสนับสนุนให้เพียงพอต่อการดำเนินงานตลอดจนการดูแลรักษาและปรับปรุงพัฒนาระบบการบริหารจัดการด้านอาชีวอนามัย ความปลอดภัยและสิ่งแวดล้อม
6. นโยบาย และวัตถุประสงค์ด้านอาชีวอนามัย ความปลอดภัยและสิ่งแวดล้อมของบริษัทฯ จะต้องถูกทบทวนโดยผู้บริหารระดับสูงเป็นประจำทุกปี เพื่อทบทวนประสิทธิผลของการดำเนินงาน และความเหมาะสมกับสภาวการณ์ของนโยบาย และวัตถุประสงค์ ดังกล่าว รวมถึง มองหาโอกาสในการปรับปรุงและพัฒนา ระบบการบริหารจัดการด้านอาชีวอนามัย ความปลอดภัยและสิ่งแวดล้อมของบริษัทฯ

นายฮิโร โนบุ อิริยา
ประธานเจ้าหน้าที่บริหารและกรรมการผู้จัดการใหญ่
บริษัท ทีทีซีแอล จำกัด (มหาชน)

2.2.2 HSE MANAGEMENT SYSTEM STANDARD

The Occupational Health, Safety and Environmental Management system apply to LNG POWER PLANT (AHLONE) PROJECT. All personnel who involved with "the Project" worksites and activities are required to comply with the requirements of these HSE Management systems.

2.2.3 REFERENCE DOCUMENTS

The followings documents shall be used as applicable or for reference together with this HSE Plan.

(a) TTCL HSE Manual and Company Procedure (QM-130 and QPs)
(b) Contract Documents / Project Specifications
(c) TTCL applicable Supportive Procedure and Supportive Reference (SP and SR)
(d) Occupational Health and Safety Management system standards TIS18001 /OHSAS 18001 and Environmental Management System Standards ISO 14001currently revision.
(e) Others specific requirements and standards applicable to the project.

3. HSE ORGANIZATION AND RESPONSIBILITIES

3.1 HSE ORGANIZATION

TTCL Project Management shall establish Project HSE Organization sufficiently resourced and assigned competent person, to manage the HSE aspects of the Project within TTCL responsibility. For implementation and measure the effectiveness of the HSE system. Typical Project Organization is shown in Appendix 3.

3.2 HSE RESPONSIBILITY

TTCL PROJECT MANAGER (PM)

PM is responsible for assuring the implementation of HSE Policy, HSE Plan, HSE procedure and instruction to ensure that safe operation are performed by TTCL, Subcontractors including the compliance with Thailand HSE regulation, relevant standards and requirements.

PM shall coordinate with HSEM for provide the preventive plan for hazardous material handling and the demarcation and lay-out of areas for storage of various materials, in the particular where dangerous materials or substances are concerned.

PM is responsible for Environmental Management System during project site construction prior are minimize environmental impact and increase efficiently preventive measurement and ensuring all persons in project have environmental awareness

TTCL CONSTRUCTION MANAGER (CM)

CM is responsible for the execution of HSE procedure and instruction that safe operationsare performed by TTCL, Subcontractors including visitors and concerned persons.

CM in cooperative with HSEM, is responsible to appoint the competent persons to carry out routine or periodic inspection to construction equipments and activities inclusive of following; (but not limited to)

- Electrical equipments and appliance including hand tools.
- Scaffolding, temporary platforms ladders (Access and Egress).
- Cranes, Lifting appliance and Lifting gear / shackle.
- Heavy vehicle and Fork lift.
- Excavation including support and access
- Confined Space working
- Radiography Work
- Fire Fighting
- Spill kit

TTCL Commissioning Manager

Commissioning Manager shall supersede CM function on handed over and equipment. For grey area concern which its scope is not clear separated then it shall be co responsible by Commissioning Manager and CM. Following are Commissioning Manager responsible (but not limit to);

a) Ensure that hazards of working in commissioning are or equipment are identified and adequate preventive / protective measures are in place prior to work.
b) Approve JSA and risk assessment and Permit to Work for commissioning work and work which will be performed in commissioning area.
c) Provide adequate protection for person working on commissioning equipment from hazardous stored energy e.g. Training , LOTO, warning sign, hard barricade, appropriate PPE,etc.

TTCL Commissioning Engineer

Commissioning Engineer shall be responsible (but not limit to);

a) Review JSA and risk assessment and Permit to Work for commissioning work any work performed in commissioning area or equipment.
b) Administrative control of LOTO.
c) Check and confirm that the equipment is complete isolated and de-energized them release the Permit to Work.

TTCL HSE MANAGER/ LEADER (HSEM)

HSEM is responsible to develop an effective HSE management program;

- To establish project HSE procedures and instruction covering project activities, to ensure effective compliance with the company HSE policy, Project HSE requirements.
- Develop and implement the HSE program, organize HSE meetings, collect and report and analyze HSE performance against objective and identify initiative for implement where necessary with training.

- To establish and implement HSE promotion program.
- To implement risk assessment and environmental impacts determination and control.

HSEM shall responsible to following;

1. Ensure risk identified and risk assessment, environmental aspects identification and impacts determination are communicated to TTCL PM and Subcontractor Representatives and all concern parties including Owner.
2. Monitor and maintain the HSE performance of the Project.
3. Close contact with TTCL PM, Subcontractor Representative on the Project to enforces HSE standard practice and responsible to provide HSE feedback to TTCL PM.
4. Ensure all TTCL's Subcontractors are complying with the Project HSE requirements.
5. Ensure that Subcontractor's appointed Safety Officers who are qualified and capable of performing the duties assigned.
6. Appoint HSE competent persons or inspectors to carry out routine or periodic HSE inspection to identify unsafe action, unsafe condition, environmental aspects and take corrective action, to assure reporting of all incident and accident.
7. Ensure TTCL, Subcontractors are carry out periodic inspections of all tools and equipments and relevant records are maintained.
8. Ensure all HSE meetings; PTA toolbox talks and any required meetings are conducted and reported to all concerned.

TTCL SAFETY OFFICER (SFO)

Safety Officer Professional level (SFO) shall responsible to

1. Provide HSE training to project personnel and ensure that all project personnel have attended the HSE induction and others specific HSE training required.
2. Ensure that TTCL, Subcontractors are in full compliance with the HSE requirements under scope of works being conducted on the project, in relation to Project specific HSE rule and regulation, HSE Plans and Procedures.
3. Ensure all first aid equipments, safety equipments, spill kit, security facilities are maintained in good condition and in sufficient quantities and necessary training provided.
4. Report to HSEM for HSE matter within the project.
5. Analysis HSE statistic and provide the report to HSEM.

TTCL ENVIRONMENTAL ENGINEER (ENV)

Environmental Engineer (ENV) shall responsible to

1. Provide HSE training to project personnel and ensure that all project personnel have attended the HSE induction and others specific HSE training required.
2. Ensure that TTCL, Subcontractors are in full compliance with the HSE requirements under scope of works being conducted on the project, in relation to Project specific HSE rule and regulation, HSE Plans and Procedures.
3. Overall implementation of Waste Management, monitoring and report to HSEM and PM of any issue concerns.
4. Assist Subcontractor plans and coordinates the works for effectively implement the requirements of the procedure.
5. Ensure the required HSE records are generated and available for review by TTCL HSEM.
6. Ensure that waste management data shall be reported in weekly basis.

7. Prepare supportive document and coordinate with Project Owner for waste generator licensed requisition from DIW.

TTCL Supervisor and Engineer

SV or EN (Regardless of main contractor or subcontractor) shall responsible to;

a) Implementation of safety measure indicated in risk control plan and risk reduction plan are in place prior to work
b) Prepare and/ or review work method statement, Job Safety Analysis & Risk Assessment (JSA/RA)
c) Work preparation; right tool and equipments, adequate number and skilled of workers
d) Check and confirm condition of construction equipments, clearance of hazard in working area, skill and readiness of workers and lead tool box talk to commence daily work
e) On the training to workers of safe work and instruction to correct use of PPE
f) Direct responsible to his subordinate (and / or lower tier subcontractor) workers safety for any arising incident e.g. emergency situation therefore he shall keep record of manpower and report to HSE center accordingly.

TTCL SAFETY SUPERVISOR (SSV)

Safety technician level (SSV) shall responsible to

1. Ensure that the project HSE policy, requirements, procedure and HSE working practice are fully understood and being effectively applied.
2. Create healthy and safely working condition and environmental impact prevention throughout the project.
3. Conduct HSE inspection and reporting to Safety Officer.

SUBCONTRACTOR MANAGEMENT REPRESENTATIVE

Subcontractor Management Representatives shall responsible to

1. Ensure that Subcontractor's project HSE plan and procedure has been established and that it is adequate for Project HSE requirement,
2. Ensure that Subcontractor's project HSE plan and procedure are fully implemented and maintained,
3. Monitor their HSE performance and take appropriate corrective / preventive action if need.

SUBCONTRACTOR SAFETY OFFICER/ENVIRONMENTAL ENGINEER

Subcontractor Safety Officer/Environmental engineer shall responsible to

1. Ensure that their HSE Plan and Procedures are fully implemented and comply with the project HSE requirements,
2. Ensure that all risk assessment and significant environmental aspect are identified on the project and communicate to their employees,
3. Implement and maintain Daily Tool Box Talk and HSE Meeting,
4. Practice in the HSE inspection program and HSE promotion programs,
5. Report all HSE matter to Subcontractor Representatives.

EMPLOYEES / WORKER

All employees / workers at all levels are involved in accident prevention and environmental impact protection. Individual employee actions are the key to achievement

of HSE Goal and objectives. They have a duty to themselves and their follow employees to exercise care and good judgment in preventing accidents, avoiding hazards to health and environmental protection.

Each employee / worker is responsible for their health protection, safety and environmental impact protection and that of their co-worker whilst on the project, the responsibilities of individual worker / employee is following;

- To attend project HSE training.
- To attend a daily / weekly toolbox talk to be aware and understand the HSE requirement in the area.
- To ensure they have the correct PPE for executing work, and used it correctly.
- To ensure all tools and equipments work properly and have been inspected before used.
- To execute work in accordance with the HSE procedure and instruction.
- To report any unsafe action or unsafe condition or environmental aspect& impact to their immediate supervisor and / or HSE personnel immediately.
- Participate in and support the HSE Policy, and their site HSE promotion program.

4. HSE REQUIREMENTS

4.1 HEALTH REQUIREMENTS

TTCL develop the health requirement for occupational health preservation and protection to ensuring good occupational health for project's personnel.

General Provision

Project's personal hygiene is importance, so the temporary office and all facilities, working area, equipments / tools and storage area shall be kept in hygienic conditions.

EIA Requirements

Owner and TTCL must comply with EIA Requirements

Health Medical Facilities and First Aid

- TTCL shall provide First Aid Center, First Aid Staff and First Aid Equipments in accordance with Thailand Regulation or applicable local legislation.
- TTCL shall provided personnel First Aid instruction and training such as basic CPR/First Aid from Professional Nurse according to specific work risk.
- TTCL shall manage to acquire medical service from nearest hospital as need.
- TTCL shall arrange initial first aid with 1 emergency vehicle at the construction area for hospitalizing purpose in accordance with Thai Regulation

Welfare Facilities

- TTCL shall construct toilet for construction workers not less than those required by the Ministerial Regulation No. 2 issue under the factory Act A.D. 1992 together with the proper waste water treatment using septic tanks and cesspools.

Sanitation

- TTCL shall provide sufficient covered garbage container at the proper location to ensure adequate storage capacity and prevent litter accumulating.

- TTCL shall provide sufficient signage and containers for materials to be reused or recycled to ensure proper segregation and storage capacity, enabling the maximum reuse and recycling of material.
- TTCL shall provide sufficient signage and containers for hazardous waste and hazardous materials to avoid spillage to the environment, By safe storage, collection and disposal in accordance with Thailand regulation.
- TTCL shall collect and dispose of all wastes and recycle them in accordance with Thailand regulation.
- TTCL shall treatment of each area as necessary to prevent the breeding of insects and vermin.
- TTCL shall contact the local government authorized agencies to collect all garbage for disposal

Substances Hazardous to Health

- TTCL establish the minimum requirements for controlling substances that may be hazardous to health, which will address the instruction for handling of
- chemical, potentially toxic and hazardous materials required at each worksite.

4.2 HSE REQUIREMENTS

4.2.1 SAFETY REQUIREMENTS

- TTCL shall develop and implement HSE Management System.
- TTCL Project Manager responsible for maintain ratio of Safety Supervisor per project workforce at 1:50. (To be adjusted as per project requirement)
- The qualified safety supervisor shall as a minimum, be qualified by having attend a course approved by Ministry of Labor for Safety Practitioner.
- TTCL shall develop the project HSE procedure and instruction for identification and elimination of construction hazards, HSE incentives which focus on recognizing and awarding positive HSE activities which eliminate potential hazard incidents, the enhancement of workforce HSE behavior and awareness, and elimination of all personnel injury.

The project's HSE procedures, HSE instructions would be covered owner' HSE requirements and communicated to subcontractors by various methods such as class room training, Tool box talk, documents, CD Rom etc., to ensure that all subcontractors are acknowledged and comply with HSE procedures shall be at least as followings (But not limited to);

- Risk Assessment & JSA
- PPE provided and using guidelines.
- Incident and Emergency Response Plan
- Fire Prevention
- Excavation
- Scaffolding
- Fall Protection
- Lifting Rigging and Crane Operation

- Equipment Inspection
- Electrical Inspection and Grounding
- Compressed Gas Cylinder Handling
- Permit to Work
- Energy Isolation
- Hazard Communication
- Pressure Test
- Etc.
- TTCL will develop and implement necessary HSE Training Program for project personnel.
- TTCL will implement Work Permit system associate with Risk Assessment and Job Safety Analysis.
- TTCL will develop and implement HSE inspection and audit program to ensure project worksite achieves a safe working condition for accident and incident prevention.
- TTCL will maintain HSE statistics and generate weekly, monthly report to all concerned.
- TTCL and Subcontractors shall provide the PPE as defined standard by legal for their employee as followings;

Uniform: Trousers and Long Sleeves shirt

Mandatory basic PPE;

- Safety Helmet with chin strap (Bearing the name or logo of company and color to be agreed with TTCL).
- Safety Shoes
- Safety Glasses
- Specific PPE as required by circumstance (SDS or JSA);
- Hearing Protection
- Specific Hand protection as required
- Goggle
- Rubber boots with toe protection
- Safety harness and lifeline, include fall arrester
- Filtered eye protection for welding
- Respirator equipment as required by circumstance
- Chemical suit
- Etc. as work related.

4.2.2 ENVIRONMENTAL PROTECTION REQUIREMENTS

EIA (Project Environmental Impact Assessment)

Project Environmental Impact Assessment (EIA) mitigation measure shall be implement by all project's personnel.

Environmental Impact Control

TTCL shall provide the "Environmental Control and Management Plan" for environmental impact control system of the project, this plan will meet the following

principle:

- Prevent adverse impacts on human health and the environment.
- Reduce wastes and emissions to achieve reduction goals and manage a product's life cycle from inception to final disposal.
- Prevent Soil and Groundwater contamination.
- Control noise levels which are nuisance to project personnel and communities.
- The Facility should be low impact on the community. (e.g. Noise, Light, Odors, Smoke, Dust, etc.).
- Meet applicable regulatory requirement.

And this plan shall address the EIA mitigation measure issue; this plan will be included environmental monitoring and testing program (if required in project EIA monitoring measure) such as water sampling, noise monitoring, and emission monitoring and ambient monitoring.

Waste Management (Solid waste and Liquid waste)

- TTCL shall develop the Waste Management Plan for the project. This plan provides guideline and minimum requirements for handle, collection and separation of waste, offsite disposal method and management. Waste Management Plan established in accordance with project EIA mitigation measure, Industrial Estate requirements (if any) and 3R principle for reduce waste.
- All solid waste would be registered and the disposition would be done through an approved waste disposal company.
- For the draining of sanitary and chemical waste water, water used for the spraying or rinsing of equipment during project construction phase shall be authorized by owner and Industrial Estate.
- Prohibit littering or discarding construction material into the water drainage system.
- Site runoff shall pass though an over/under weir and be monitoring for contaminants.

Air Management

- The operation of the combustion installation or combustion engines (e.g. aggregates, welding machine, engine-driving pump, etc.) shall be in compliance with the Thailand regulation requirement.
- No waste oils may be used as fuel. Only standard fuels that can be obtained commercially may be used (e.g. light fuel oil, butane, propane, natural gas and petrol).
- The combustion installation shall be safely operated and not result in an increase of the fire risk.
- When certain activities may result in the emission of dangerous substances, the work method shall be determined beforehand.
- Open fires (with the exception of flame torch and acetylene welding/cutting and roofing burners) are forbidden.
- TTCL, Subcontractors shall keep construction machine and vehicle in good condition to reduce the pollutant emission.
- TTCL, Subcontractors shall provide canvas to cover the trucks carrying during construction material transportation to the project for material falling protection or prevent dust dispersion.
- TTCL, Subcontractors shall clean up the access roads or public roads if construction materials drop or spill during transportation.

Noise Control

Noise control measure will be applied to all project equipment by using low noise equipment where practicable. Where high noise cannot be reduced following method can be applied.

- Hydraulic piling hammers will be used wherever practicable in preference to diesel driven hammer.
- Acoustic shielding will be employed to contain the high noise levels in defined project boundaries.
- Silencers will be fitted during blow down and drying of lines and vessels during pre-commissioning.

Prior to the commencement of noisy or vibration operation TTCL Construction Manager (CM) shall inform intended working hours to owner. Noise and vibration monitoring program will be developed by TTCL.

Wastewater Management

The following mitigation measures are presented for minimizing impact from wastewater handling and disposal;

- Construction equipment and vehicle washing to be carried out at designed areas provided with wash water collection systems. Alternatively, equipment and vehicle washing may be carried out at off-site locations (such as central workshops of contracting companies), where adequate facilities are available. The wash water collection system will typically include settling tanks for separation of suspended solids and oil& grease. The floating oil& grease is to be removed using skimmers or soaking pads and collected in drums. The water after settling is to be routed to Sewage treatment plant (STP) for treatment.
- Sewage generated on-site to be collected through underground pipes into holding tanks, from where the sewage will be routed to onsite sewage treatment plant or alternatively transport periodically by vacuum trucks and transferred to an approved sewage treatment plant to the site for treatment and disposal;
- The hydro test water need to be collected in the lined pond and the water to be tested for any contaminants. If the collected hydrotest water is found not to be contaminated, and further if the water quality conforms to land discharge standards, then the water can be discharged on to the land in small quantities. The discharge will be done in a way as to avoid drainage from large areas. However, if the water is found contaminated then it is to be evaporated in the pond, else it is to be treated in the wastewater treatment plant after the plant is operational.
- Accidental spillages of hazardous substances to be immediately remediated to prevent contaminated runoffs and potential contamination of soil and groundwater;
- Waste consignment notes to be prepared and documented for transportation of wastewater (sanitary and other wastewater), if any, to offsite treatment facilities.

Soil, spill containment and clean-up

- Spillage of any harmful substance shall be immediately reported to TTCL and owner representative in charge. Where the potential for spill is evident, the appropriate spill kit shall be provide and readily for use. The necessary training should be provided to ERT.

- All chemical substance that can leach out, as well as all liquid, shall be stored in such a way that any leaks shall not cause a risk of soil contamination (e.g. placement in a vat, double tanks, etc.).
- The used of any fueling device which may be locked open for hands free operation is prohibited. All fueling devices shall be carrying out with 100% hand control.
- If leak causes soil contamination, it shall be cleaned up immediately. The clean up costs (namely, carry out of analysis, soil drillings and the clean up operation itself) shall be paid for by the polluter. (PPP; Polluter Pay Principle).
- The moving of soil or modifying the level of the grounds is only permitted after written confirmation from owner representative in charge.
- The storage of chemical is not allowed on the site. The sole exception on this rule is made when the products are needed for executing activities. At the working point, a storage of max 24 hours is permitted given they are stored on a safe
  (e.g. fire, explosion, pollution etc.) and environmentally aware way (see soil). When the storage of big quantities imposes itself, this shall be discussed with and put down in writing by owner representative and TTCL person in charge and Environment Consultant Service Company.

Traffic Management Plan

The main aim of traffic management plan is to assist TTCL and subcontractor employees in complying with all applicable traffic and transportation requirements during construction state. Furthermore the propose of this plan is to provide the framework for movement of equipment, workers and local community to/from the project site.

- The employees including the drivers are to be trained on the driving requirement to be followed for the project;
- The movements of heavy vehicles and equipment are to be planned in such a way such as to avoid peak hours on main roads in order to minimize traffic congestion;
- Training on defensive driving are to be provided for drivers. The drivers are also to be trained on emergency response measures and requirements;
- Approved transporters are to be used for transportation of hazardous materials and heavy equipment/goods.
- TTCL shall provide security officer for 24 hours, who responsibly to monitor, check and control traffic of construction area.

4.3 PROJECT SITE SECURITY

TTCL shall arrange appropriate security system and develop site security plan for the project and lay down area.

5. HAZARD IDENTIFICATION, RISK ASSESSMENT AND ENVIRONMENTAL ASPECTS IDENTIFICATION& IMPACTS DETERMINATION

The identification of hazards, risk assessment/ environmental aspect identification& impact determination and management of the risk/ impact in order to achieve the HSE a goal is incorporated into the general management principles and working procedure. The system is

designed to identify hazards/ environmental aspects during associated with construction activities and execution of the work. In addition, the system is also designed to cover identification of hazard/ environmental aspect in the facilities.

The planning, identification and communication of risk assessment/ environmental aspect & impact determination and risk/ impact management takes place in a number of forums, e.g.

- Routine and non-routine activities.
- Department meeting.
- Supervision of work activities.
- Job Safety Analysis (JSA) and Hazard Identification system.
- Internal, second party and third party audits.
- Management review meetings.
- Planned inspection and patrol.
- Project and contract meetings

All project employees and line supervisors are responsible for identification and elimination of hazards/ environmental aspects.

Communications of hazards/ environmental aspects and controls: individuals identifying a hazard/ environmental aspect are responsible for taking immediate action and eliminate the hazard/environmental aspect it selves whenever possible. If unable to eliminate the hazard/ environmental aspect, the individual will ensure that the situation is highlighted as a warning to others and will notify concerned supervisor, HSE personnel or management to initiate the corrective action.
The recording of hazards/ environmental aspects identification and corrective actions taken or planned will be maintained in a number of ways, e.g. JSA records, Accident reports, HSE Audit Reports, Inspection reports, Minutes of meetings, Tool box Talk records, etc. The HSE Department will maintain these records and, in addition, will maintain a Corrective Action Log, which will summarize all corrections, which have been identified and indicate the current status of corrective actions.

All outstanding corrective actions with regard to HSE record in the various records will be assigned to a responsible person for close-out and will be followed up by the HSE Department to ensure that they are closed out in a timely manner.
All hazards and risks/ environmental aspects and impacts identified will be reviewed and objectives and priorities set for their resolution. Personal will be identified as responsible for successful resolution in a timely manner.

The determination of controls uses the results of risk assessment/ environmental impact determination for consideration which is given to reduce the risks/ environmental impacts according to the following hierarchy as Elimination, Substitution, operational controls, Signage or warnings, PPE etc.

6. HAZARD AND ENVIRONMENTAL ASPECT COMMUNICATION

TTCL shall communicate to all project personnel whom using or handle of chemical and hazardous substances.

7. HSE TRAINING

TTCL is responsible for conducting preliminary and continuous HSE training for all personnel in order to develop and maintain personal interest in the HSE program and to train personnel in the safe practices and work procedures.

TTCL shall identified the training need for Project persons, including subcontractors and other concerned, and initiate a training program to demonstrate that the person involved are suitably qualified and competent.

8. HSE INSPECTION AND AUDIT PROGRAM

8.1 PROJECT HSE INSPECTION AND MANAGEMENT PATROL

TTCL shall develop the HSE inspection and management patrol program which Site HSE inspection shall be conducted daily by TTCL and subcontractor Safety officer/Environmental Engineer.

In addition periodical management patrol, which performed by TTCL Site Managements, Superintendents, Supervisors, HSE personals and Subcontractor's representative should be conducted weekly, to observe and verify the effectiveness of
HSE control measure employed on site.

All discrepancies noticed during HSE inspection and Management Patrol shall be promptly report to TTCL Project Manager, Subcontractor Representatives and concerned HSE personnel who will take immediately correction and provide corrective / preventive action to prevent recurrence. The records shall be properly filed.

TTCL as well as owner representative has the right to stop any work or acts which are considered to be dangerous without any obligation. All TTCL and Subcontractors personnel shall promptly comply with the instructions of TTCL and/or owner representative at all times.

8.2 TTCL INTERNAL AUDIT

The "Internal Audit" shall be performed to verify the effective implementation of Occupational Health and Safety Management System (OHSAS 18001 / TIS 18001), Environmental Management System (EMS, ISO 14001) to ensure that the control measures applied to associate risk/ environmental impact and HSE activities are properly executed.

"Internal Audit" shall be performed in accordance with the predetermined schedule on the certain scope, taking the project activities into consideration.

The audit findings shall be recorded and the audit result shall be sent to the TTCL PM, and project organization concerned. In case Nonconformity has been found in the audit, the "Corrective Action Request" (CAR) shall be issued to concerned person for correction or rectification and prevention of recurrence.

8.3 CONSTRUCTION EQUIPMENT INSPECTION

Construction Equipment such as cranes, lifting equipment, electrical appliances and vehicles shall be inspected when brought into the site.

Related certification or third party / authority inspection documents (if any) shall be submitted and proven identification shall be displayed on the equipment. And also this construction equipment on the site shall be inspected by designated personnel at specified intervals (minimum 3 month / time). Inspection records on check lists shall be kept as evidences.

9. HSE MEETING

considers HSE meetings a highly important part of the HSE Management System in that they permit HSE communication to take place between management and employees, and vice versa.

AIMS AND PURPOSE OF HSE MEETINGS

- A team orientated and transparent communication tool.
- An economical use of time in disseminating HSE information.
- An opportunity to contribute ideas, suggestions for HSE improvements.
- A tool for continuing education and motivation of the workforce.
- A tool to maximize proactive HSE performance at work.
- To openly discuss sound HSE practice and emphasize areas that needs improvement.
- Better understanding of SITE related HSE issues for line Management/ supervision.

AGENDA

HSE meetings provide a communications flow on HSE matters. Topics to be discussed shall include, but are not limited to:-

- Review/ Discuss Management HSE concerns.
- Review/ Discuss Employee HSE concerns.
- Review/ Discuss Accident/incident investigation.
- Reporting and follow-up status of unsafe acts, conditions and practices with discuss action and corrective action (s) to expedite closure.
- Review/ Discuss all fire and emergency situations and potential hazards/ significant environmental aspects since the last HSE meeting.
- Review/ Discuss Work procedures.
- To remind the important objective of personal protective equipment.
- Additional Requisition HSE awareness training program.
- Propose the HSE Incentive program, and related campaign(s).
- Review/Discuss Site Security program.

ATTENDANCE

1) HSE Weekly Meeting

The meetings shall be attended by owner representative, TTCL and all subcontractors HSE representatives and consider to invite concerned Subcontractors Supervisors.

2) HSE Committee Monthly Meeting

The Committee meeting shall be attended by owner representative, TTCL PM /CM, HSEM, Safety officers/Environmental Engineer and all Subcontractor Representatives and HSE personnel.

The committee agenda shall focus on the following:

- Review of past months meeting minutes.
- Actions taken.
- High-risk work or activity/ high significant environmental aspects
- Current activities and problem areas.
- Accident review and corrective actions.
- Future activities.

HSE committee meeting attendance is mandatory for each Subcontractor.

MINUTES OF MEETING

Minutes of Meeting shall be recorded by TTCL Safety officer/Environmental Engineer, reviews by TTCL HSEM and approved by TTCL PM then distributed to all members. It shall be responsibility of all committee members to ensure that the topics discussed at these meeting's are, where required, disseminated appropriately and effectively. Subcontractors shall take the necessary action to promptly implement HSE committee directives and recommendations.

10. ACCIDENT/INCIDENT REPORT

All accident / incident, which occur at or in association with the Project, will be reported and investigated as following.

- Near miss and first aid reported by incident initial report
- Injury, illness, property damage, environmental accident and all fire incident case reported by incident initial report and followed with detail investigation report

TTCL shall develop the accident/incident investigation and report procedure for identify the primary causes to prevention the re-occurrence by root cause analysis method.

11. EMERGENCY PREPAREDNESS AND RESPONSE

TTCL shall develop the project emergency response plan and procedure which suitable for project requirements and situation.

Project's Emergency Response Team (ERT) would be appointed and trained and resourced with required rescues equipment.

Emergency drill including all fires case, spills, other environmental& safety related issues would be conducted once a year.

12. SUPPORTIVE PROCEDURES

Specific details of HSE implementation would be described in the following supportive procedures;

1. F050-MNL-047 : Risk Assessment, JSA &EIA Tool Box Talk Procedure

2. F050-MNL-049 : Confined Space Entry Procedure
3. F050-MNL-061 : Pressure Test Procedure
4. F050-MNL-048: Permit to Work Procedure
5. F050-MNL-051 : Control of Hazardous (Lockout/ Tagout) Procedure
6. F050-MNL-024 : Environmental Control and Management Plan
7. F050-MNL-026: Waste Management Plan
8. F050-MNL-029 : Site Security Procedure
9. F050-MNL-050 : Personal Protective Equipment Procedure

13. APPENDIX

APPENDIX 1: Project HSE Objective (English Version)

APPENDIX 2: Project HSE Objective (Thai Version)

APPENDIX 3: Typical Project Organization

APPENDIX 4: TTCL HSE Management and Control Organization

APPENDIX 1

บริษัท ทีทีซีแอล จำกัด (มหาชน)
TTCL PUBLIC COMPANY LIMITED

PROJECT TITLE

HSE OBJECTIVE

FOR PROJECT "LNG POWER PLANT (AHLONE) PROJECT''

JOB NO. "F-050"

The HSE Objectives, for Project "LNG POWER PLANT (AHLONE) PROJECT" are defined as follow;

1) *TTCL shall carry out project management and construction management activities in compliance with the applicable legal, and other HSE requirements as specified in the contract.*

2) *TTCL shall perform and manage construction work in safe manner to achieve the safety target of "No Lost time Accident"*

3) *Project incidence rates should not exceed the following value;*

   ***IFR** (incidence frequency rates), 3.7*

   ***ISR** (incidence severity rates), 37*

4) *TTCL shall perform construction work by taking into account for the environmental impact protection and complaint from the community shall be "**Zero**",*

.....

(.....)

Project Manager

TTCL Public Company Limited

APPENDIX 2

บริษัท ทีทีซีแอล จำกัด (มหาชน)
TTCL PUBLIC COMPANY LIMITED

PROJECT TITLE

วัตถุประสงค์ด้านอาชีวอนามัย ความปลอดภัยและสิ่งแวดล้อม

โครงการ "LNG POWER PLANT (AHLONE) PROJECT"

โครงการเลขที่ "F-050"

โครงการฯ ได้กำหนดวัตถุประสงค์ด้านอาชีวอนามัย ความปลอดภัยและสิ่งแวดล้อมของโครงการ "LNG POWER PLANT (AHLONE)PROJECT" ไว้ดังต่อไปนี้

1) บริษัท ทีทีซีแอล จำกัด (มหาชน) จะบริหารและดำเนินการก่อสร้างโครงการฯภายใต้การดำเนินการที่สอดคล้องกับกฎหมายและข้อกำหนดด้านอาชีวอนามัย ความปลอดภัยและสิ่งแวดล้อมอื่นๆที่บังคับใช้กับโครงการหรือตามที่ได้ตกลงกันไว้ในสัญญาจ้าง

2) บริษัท ทีทีซีแอล จำกัด (มหาชน) จะดำเนินการ ก่อสร้างโครงการฯ ให้เป็นไปด้วยความปลอดภัย โดยปราศจากอุบัติเหตุถึงขั้นหยุดงาน (No Los Time Accident)

3) บริษัท ทีทีซีแอล จำกัด (มหาชน) จะควบคุมค่าดัชนีด้านความถี่ และความรุนแรงของอุบัติเหตุในโครงการฯ ตามที่ได้ตั้งเป้าหมายไว้ ดังต่อไปนี้

IFR (ดัชนีความถี่ของอุบัติเหตุ), 3.7

ISR (ดัชนีความรุนแรงของอุบัติเหตุ), 37

4) บริษัท ทีทีซีแอล จำกัด (มหาชน) จะดำเนินการก่อสร้างโดยความตระหนักถึงความสำคัญในการบริหารจัดการ ด้านการป้องกันผลกระทบต่อสิ่งแวดล้อม ทั้งนี้จะต้องไม่มีข้อร้องเรียนจากชุมชน

.....

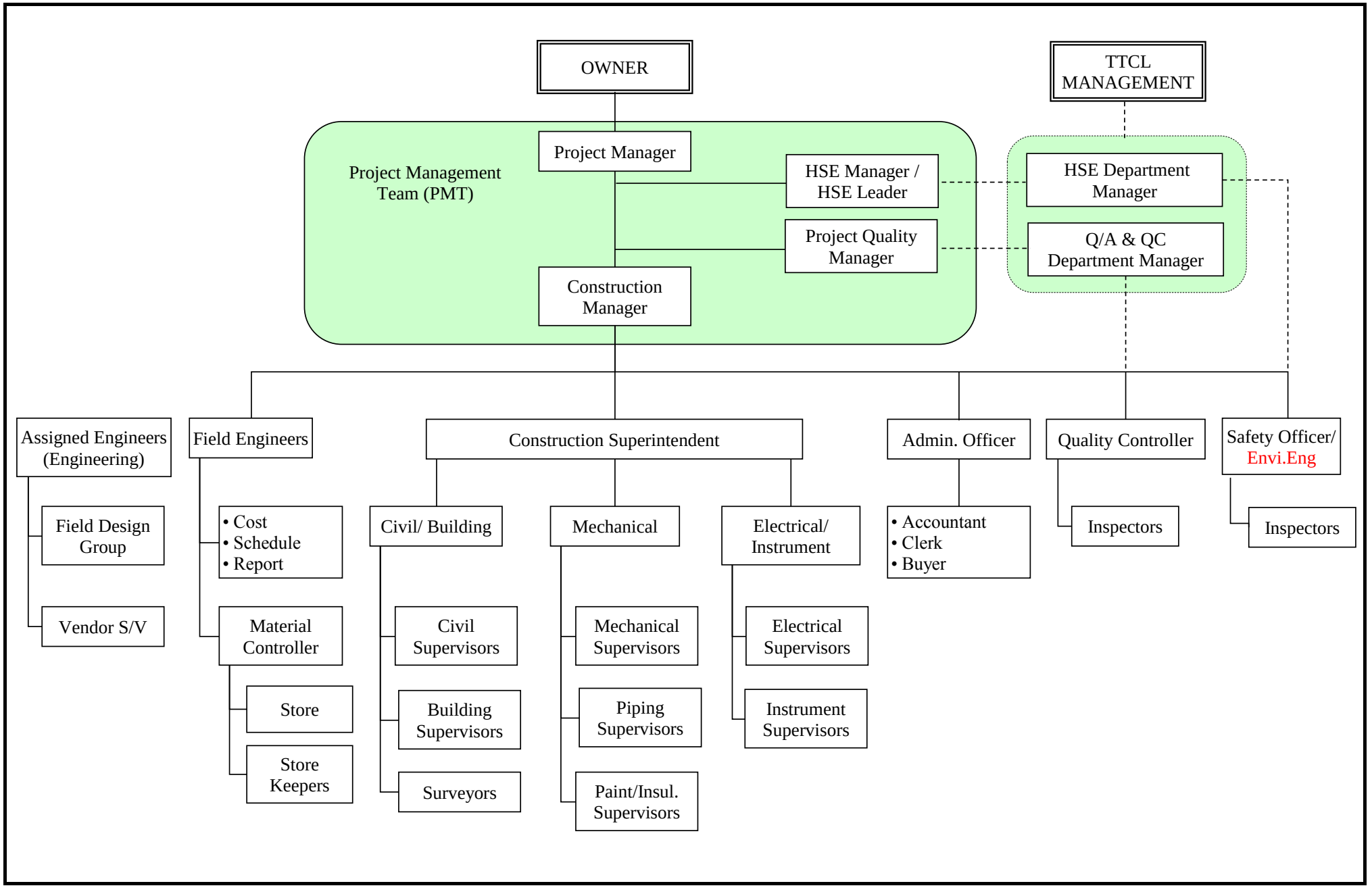
(.....)

ผู้จัดการโครงการ

บริษัท ทีทีซีแอล จำกัด (มหาชน)

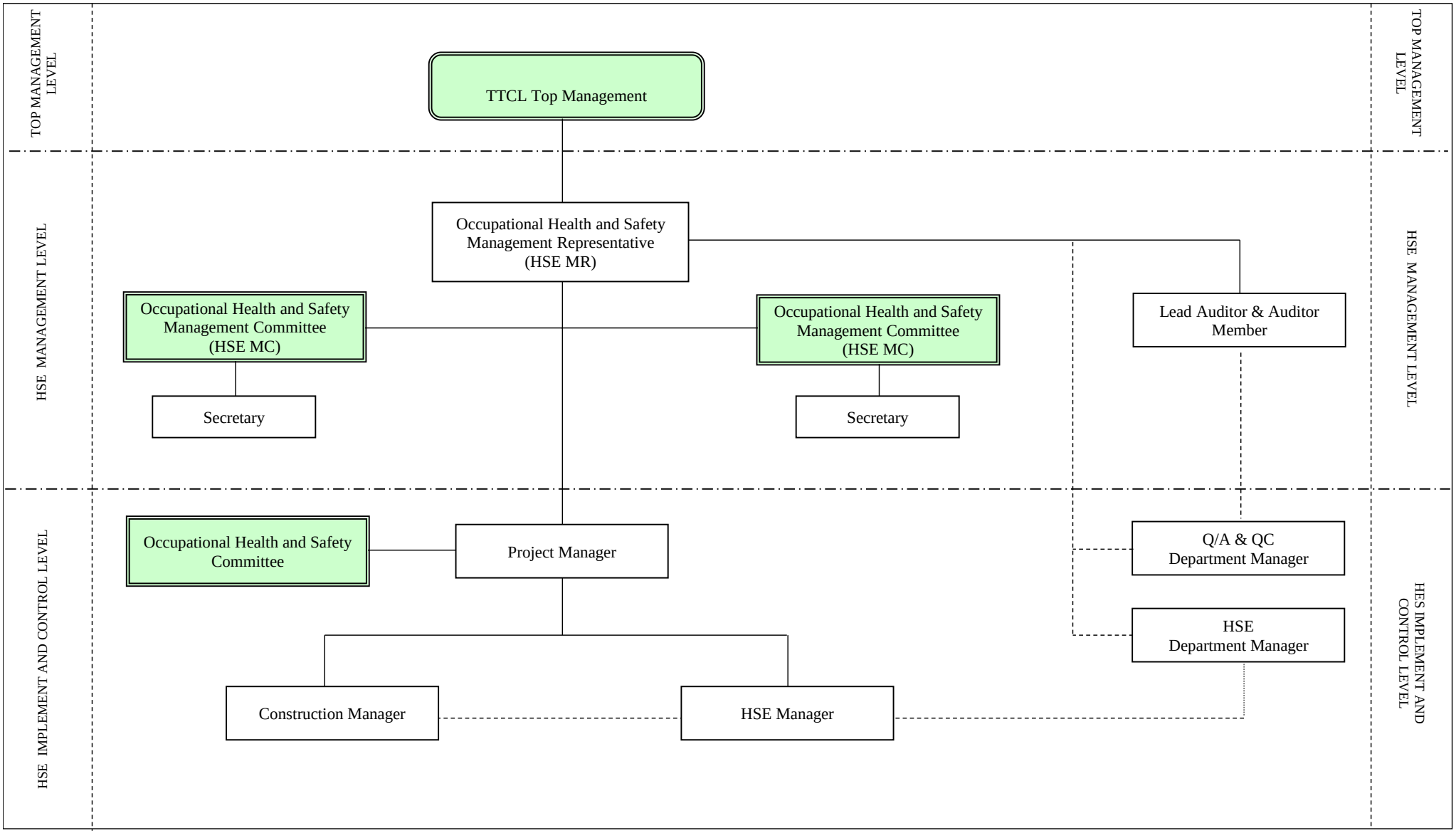
APPENDIX-3

Typical Project Organization



APPENDIX-4

TTCL Occupational Health and Safety Management and Control Organization



APPENDIX F PRELIMINARY PROJECT MASTER SCHEDULE

LNG POWER PLANT (AHLONE) PROJECT

Preliminary Project Master Schedule

Update : 11-Feb-19

Rev. 0g

Task Name	M-5	M-4	M-3	M-2	M-1	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28
Mile Stones																																	
Sign of Land Lease Agreement					Sign of Land Lease Agreement																												
PPA Effective date						PPA Effective Date																											
MIC Permit						MIC Permit																											
Jetty Completion																										Jetty Completion							
GTG #1 on Bed																					GTG#1 on Bed											
GTG #2 on Bed																						GTG#2 on Bed											
HRSG #1 on Bed (First Column)																				HRSG#1 on Bed												
HRSG #2 on Bed (First Column)																					HRSG#2 on Bed											
STG On Bed																						STG on Bed											
Power Receiving																								Power Receiving									
1st LNGC Received																									1st LNG Cargo								
Fuel Gas Available for Power Plant																											Fuel Gas Available						
1st Fired for GTG#1																											1st Fired GTG#1						
Steam Admission																														Steam Admission			
Completed commissioning&Start Test Activity																																Plant Test	
COD																																COD	
Engineering Power Plant																																	
Power & Process																																	
BEDD							1st Issue		Final Issue																								
PFD							1st Issue		Final Issue	AFP		AFD				AFD-1		AFC															
P&ID & Equipment List								1st Issue																									
Fluid List								1st Issue																									
Pump Schedule								1st Issue																									
Equipment Process Data Sheet								1st Issue																									
Instrument Process Data Sheet									1st Issue																								
Special Part for Process Data Sheet								1st Issue																									
Power Consumption									1st Issue																								
Line List									1st Issue																								
Water Balance Diagram									1st Issue																								
Heat Mass Balance									1st Issue																								
Piping																																	
Plot Plan								AFP		AFD			AFC																				
3D Model									30% Model Review (internal)			60% Model Review		90% Model Review																			
Isometric Drawing & GA																																	
Civil																																	
Piling Plan													AFC																				
Equipment & Building														Final Issue																			
Mechanical & Machinery																																	
Mechanical Drawing & Specification														Final Issue																			
Mechinery Data Sheet														Final Issue																			
Electrical & Instrument																																	
Single Line Diagram												AFD				AFC																	
Layout Drawing & Specification																Final Issue																	
Gas Pipeline Design & Drawing																																	
Procurement																																	
Order BOP							PO																										
1st GTG							PO																										
2nd GTG							PO																										
1st HRSG							PO																										
2nd HRSG							PO																										
STG							PO																										
LNG Storage Tank#1							PO	Plate order																									
LNG Storage Tank#2							PO	Plate order																									
Unloading Arm									PO																								
LNG Transfer Pump								PO																									
Regasification Unit									PO																								
BOG Compressor								PO																									
Re-Condenser Unit									PO																								
Gas Engine Generator									PO																								
Vapour Blower							PO																										
Jetty Facilities								PO																									
Gas Pipeline Bulk Material (Pipe, Flange and Fitting)																																	
Construction Power Plant																																	
Topography and Survey Work																																	
Relocate/Remove existing pipe & pit																																	
Site Preparation and Shore Protection																																	
Piling Work																																	
Civil Work																																	
- Foundation GTG#1 & Auxiliary																																	
- Foundation GTG#2 & Auxiliary																																	
- Foundation 1st HRSG																																	
- Foundation 2nd HRSG																																	
- Foundation STG																																	
- Foundation Pipe Rack																																	
- CEB																																	
- Cooling Tower																																	
- Foundation BOP Equipment																																	
Steel Structure																																	
- Fabrication																																	
- Installation Pipe Rack																																	
- Equipment Structure, Roof & Shade																																	
GTG #1 Erection Work																																	
GTG #2 Erection Work																																	
HRSG #1 Erection Work																																	
HRSG #2 Erection Work																																	
STG Erection																																	
BOP Equipment Installation Work																																	
- Site Erection Tank																																	
- Cooling Package & Pump																																	
- Demin. & Waste Water Treatment																																	
- Waste Water Package																																	
- HVAC																																	
Piping Work																																	
- Piping Fabrication																																	
- Piping Installation / Test																																	
Electrical																																	
- GIS and 115kV Equipment																																	
- Electrical in Substation																																	
- Electrical Cable Tray, Laying & Terminate																																	
- Modify Existing Ahlone Substation (Extension)																																	
Instrument																																	
- DCS and Control room works																																	
- Ins Ladder, Field Ins, Tube & Cable																																	

Concreting

Concreting

Concreting

Concreting

Concreting

UG Piping

A/G Piping

UG Piping

A/G Piping

Power Energiz

Test

DCS Power on / SAT by Construction Power

LNG POWER PLANT (AHLONE) PROJECT

Preliminary Project Master Schedule

Update : 11-Feb-19

Rev. 0g

Task Name	M-5	M-4	M-3	M-2	M-1	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28
Engineering LNG Terminal																																	
Power & Process																																	
BEDD							1st Issue			Final Issue																							
PFD							1st Issue			Final Issue																							
P&ID & Equipment List								AFP			AFD			AFD-1		AFC																	
HAZOP Review								HAZOP Review																									
Fluid List									1st Issue				Final Issue																				
Pump Schedule									1st Issue				Final Issue																				
Equipment Process Data Sheet									1st Issue				Final Issue																				
Instrument Process Data Sheet									1st Issue				Final Issue																				
Special Part for Process Data Sheet									1st Issue				Final Issue																				
Power Consumption									1st Issue				Final Issue																				
Line List								1st Issue						Final Issue																				
Water Balance Diagram									1st Issue					Final Issue																				
Heat Mass Balance									1st Issue					Final Issue																				
Piping																																	
Plot Plan								AFP			AFD			AFC																				
3D Model									30% Model Review			60% Model Review			90% Model Review																			
Isometric Drawing & GA																																	
Civil																																	
Piling Plan											AFC																						
Equipment & Building														Final Issue																				
Mechanical & Machinery																																	
Mechanical Drawing & Specification										1st Issue				Final Issue																				
Mechinery Data Sheet										1st Issue					Final Issue																			
Electrical & Instrument																																	
Single Line Diagram											AFD			AFC																				
Layout Drawing & Specification										1st Issue					Final Issue																			
Construction LNG Terminal																																	
Topography Survey Geotechnical Work																																	
Site Preparation																																	
Piling Work																																	
Jetty Work																																	
Civil Work																																	
- Foundation LNG Storage Tank #1																																	
- Foundation LNG Storage Tank #2																																	
- Electrical and Control Room																																	
- Admin Building																																	
- Fire Water Pond																																	
- Foundation Pipe Rack																																	
- Foundation Regasification Unit																																	
- Utilites																																	
Steel Structure																																	
- Fabrication																																	
- Installation Pipe Rack																																	
LNG Storage Tank #1 Erection																									M/C Tank#1								
LNG Storage Tank #2 Erection																										M/C Tank#2							
Mechanical Installation Work																																	
Piping Work																																	
- Piping Fabrication									U/G																								
- Piping Installation / Test										U/G																							
Electrical																																	
- Electrical in Substation																																	
- Electrical Cable Tray, Laying &Terminate																																	
Instrument																																	
- DCS and Control room works																																	
- Ins Ladder, Field Ins, Tube & Cable																																	
- Docking Aid System																																	
Construction of Gas Pipeline																																	
Pipeline work																																	
Piping Installation																																	
Tie-in pipe each HDD																																	
Warning tape, Concrete slab and Backfill																																	
Cathodic protection installation																																	
HDD Work																																	
HDD no.1-[700 m]_Yagon River																																	
HDD no.2-[500 m]_Tweante Canal																																	
Tie-in and Test																																	
Pre-commissioning																																	
Pipeline Drying and Purging by N2																																	
Jetty - Pre-Comm.																																	
LNG Storage Tank #1 (Dry out &Air purge by N2)																																	
LNG Storage Tank #2 (Dry out &Air purge by N2)																																	
RU - Pre-Comm.																																	
BOP - Pre-Comm.																																	
Utility for LNG - Pre-Comm.																																	
GTG #1 - Pre-Comm.																																	
GTG #2 - Pre-Comm.																																	
HRSG #1 - Pre-Comm.																																	
HRSG #2 - Pre-Comm.																																	
STG - Pre-Comm.																																	
Commissioning & Test																																	
LNG Terminal Commissioning																																	
Cool Down LNG System																																	
BOG com, Re-Con, HP Pump, RU																																	
Gas Pipeline cleaning by NG																																	
Commissioning (Combine Cycle)																																	
1st Firing																																	
Steam Blow																																	
Reinstate																																	
Commissioning																																	
Plant Test (Test on Completion)																																	

APPENDIX G FIRE PREVENTION PLAN FOR THE LNG RECEIVING TERMINAL

SECTION 14 FIRE PREVENTION PLAN

1. General

The aim of the fire protection and fire safety philosophy is to minimize loss of life or serious injury, contain and prevent the spread of a fire, extinguish it in the early stages if possible and thus to minimize the damage and financial loss caused by such an incident. This philosophy is to enhance the reduction of risk to As Low As Reasonably Practical (ALARP).

2. Applicable code and standard

- The Fire protection system should be designed in accordance with the national fire protection association (NFPA) code and standard where practical.
- All Fire Fighting Equipment and devices should prefer to be UL/FM listed, unless approval from TTCL Project / Plant operation team, due to it may concern to insurance policy.

Fire Fighting System & Fire Protection Design Basis

- NFPA 10 : Standard for Portable Fire Extinguishers
- NFPA 11 : Standard for Low-, Medium-, and High-Expansion Foam
- NFPA 15 : Standard for Water Spray Fixed Systems for Fire Protection
- NFPA 20 : Standard for the Installation of Stationary Pumps for Fire Protection
- NFPA 24 : Standard for the Installation of Private Fire Service Mains and Their Appurtenances
- NFPA 59A : Standard for the Production, Storage and Handling of Liquefied Natural Gas (LNG)

3. Fire Fighting Components

Fire water Hydrant, Water Monitor

Fire water hydrant and Fire water hydrant with monitor (with or without foam) or equivalent system are strategically provided to cover Process area, Central Control Building, Common Facilities area and Jetty area which contain combustible material. The spacing between hydrants coverage will not more than 90m for process area and utilities area.

Fire Water Main Ring Pipe

The fire water main ring pipe will be of closed loop designed and will be laid along the main road. The fire water main ring pipe will be laid underground looped for onshore area and aboveground pipe for jetty area. Pipe used in the fire water main ring pipe will be made of carbon steel for aboveground and will be made of HDPE pipe where install underground. Fire water main ring pipe will have sufficient post indicator valves so that it will be possible to take any leg of the reticulation out of service for maintenance or repair.

Fire Fighting Water Supply

The fire fighting system design will be based on the assumption that there will be only one major fire occur at a time.The estimated minimum capacity of fire water pump is based on highest fire water demand for one major fire area plus 230 m3/h (1,000 GPM) for hose stream demand according to NFPA 59A. The estimated minimum capacity of fire water required is totally 6,900 m3 (TBC) for biggest fire case at LNG storage area. The pressure of the fire water in the mains will be maintained at 10 BarG.

Water for fire fighting purposes is obtained from Fire Water Pond (TBC), capacity not less than 6,900 (TBC) m3 for firefighting demand 2 hours and fire pumps shall be as follows below;

5 Ea (TBC) Diesel Engine Fire pumps (duty) (690 m3/hr, discharge @10barg, TBC)

1 Ea Diesel Engine Fire pumps (standby) (690 m3/hr, discharge @10barg, TBC)

1 Ea Electrical Jockey pump (11.5 m3/hr, maintain 10 barg,TBC)

4. Scope of Design

The fire fighting facilities shall be designed generally covering the items below however the detail design will be verified during detail engineering period;

- Fire Water Main and their apparatus
- Fire Water Hydrant (Outdoor hydrant)
- Fire Water Hydrant with Monitor (with or without foam)
- Hose Cabinet and Accessory
- Fixed Water Spray System (Deluge System)
- Fixed Foam System
- Fire Extinguisher (Portable, Wheel Type)

5. Preliminary Summary Table of active Fire Protection System for Building and Equipment (Subject to be revised during design stage)

Fire Hazardous source	Fire Water Hydrant	Fire Water Hydrant with Monitor	Fixed Water Spray System	Fixed Foam System	Fire Alarm Detector	Fire Extinguisher	Remark
Jetty							
1. Jetty Platform		●		●		●	
2. Walkway & Mooring Dolphin							
3. Loading Arm(s)			●			●	
4. River Intake Pump						●	
4. Other (if any)							
Process Area							
1. LNG Storage Tank(s), transfer pump(s), LNG spill pit*		●	●**	●*		●	** Water spray system applies for roof and shell of LNG storage tanks. *Fixed foam system applies only on LNG spill pit for any LNG spillage
2. BOG Compressor(s)	●					●	
3.Regasification Unit(s)	●		●			●	
4.HP LNG Booster pump suction drum	●		●			●	
5.NG pre-heater	●					●	
6.Vent Stack	●					●	
7.Gas Engine Generator	●					●	
8. Air Compressor and Nitrogen System	●					●	

Fire Hazardous source	Fire Water Hydrant	Fire Water Hydrant with Monitor	Fixed Water Spray System	Fixed Foam System	Fire Alarm Detector	Fire Extinguisher	Remark
9.Fire Water Pumps	●					●	
Central Control Building							
- Electrical Room					●	●	
- Control Room					●	●	
- Transformer			●			●	
Common Facility Area							
1.Administration , First Aid and Canteen Building	●				●	●	
2. Main Gate Guardhouse	●				●	●	
2.Jetty Guardhouse	●				●	●	

Note :

1. Detail information can be changed during Engineering Stage.

2. Fire alarm detector shall be confirming in detail Design Stage.

APPENDIX H PROJECT INCIDENT AND EMERGENCY RESPONSE PLAN

AHLONE 2

ISSUED
29 MAY 2019
TTCL PUBLIC COMPANY LIMITED

PROJECT INCIDENT AND EMERGENCY RESPONSE PLAN

PROJECT DOC. NO. F050-MNL-030

FOR INFORMATION

LNG POWER PLANT (AHLONE) PROJECT

TTCL JOB NO. F-050

Total (Including this Page): 27 sheets

1	27-May-19	For Information	Wasutida J.		Khwankaew.C	
0	24-Sep-18	For Information	Original signed			
REV.	DATE	DESCRIPTION	MADE	CHECKED	APPROVED	AUTH'D

For Project Use only

Originator	Distribution	PW	PR	MA	ME	PP	EE	IN	CV	QC	PC	Proj	Site	Owner	Total
Project	No. of Copy	1	1	1	1	1	1	1	1	1	1	ORG.	1	1	12

บริษัท ทีทีซีแอล จำกัด (มหาชน)
TTCL PUBLIC COMPANY LIMITED

Revision History Sheet

Rev.	Date	Description
0	September 24, 2018	For Information
1	May 27, 2019	For Information (Revise as per mark 1)
		- LNG Power Plant (Ahlone) Project Included Power plant,
		LNG Terminal, Gas Pipeline and Transmission Line

CONTENTS

ATTACHMENT LIST

1. PURPOSE

1.1 To provide a clear understanding to all TTCL and TTCL/Subcontractors, with regard to Emergency situations requiring a response (either assembly point or full evacuation).

1.2 To give site personnel a clear understanding of the roles and responsibilities of both line management/supervision and the Emergency Response Team members role on the project in the unlikely event of a real Emergency Response Operation being put into effect.

1.3 To assign the duties and responsibilities of Emergency Response Team (ERT) in Site.

1.4 To enable Emergency Response Team members as well as the designated incident ground commander a clear identifiable communications method of reporting.

2. SCOPE AND RESPONSIBILITIES

2.1 This procedure is applicable to all LNG Power Plant (Ahlone) Project areas during Emergency situations.

2.2 This procedure addresses many of potential emergency scenarios, however it shall be understood by all power plant personnel that those scenarios listed are not exhaustive, and are indicative only.

2.3 As well as incidents that may occur within the Project site, there may be other incidents external to TTCL, which may require a response by TTCL. For example, external fire incidents could occur or there could be a security alert in the local area, whereupon TTCL could be asked for assistance.

2.4 The following items are addressed within this Emergency Preparedness Procedure:

- Contact list of local authority
- Site information
- Potential emergency Scenarios
- Duties and responsibilities
- Emergency Plan
- Evacuation Plan
- Training requirements
- Communications
- Emergency Response drills
- Emergency Evacuation Organization
- Alarm/ Signals

2.5 The Environment, Health and Safety Officer is responsible for the oversight and coordination of the plant's Emergency Response program.

3. SITE INFORMATION

3.1 Power Plant Location

Name: LNG Power Plant (Ahlone) Project

Location: No.39, Ahlone Power Station Compound, Kan Nar Road, Ayayarwaddy Quarter, Ahlone Township, Yangon.

Tel: +95(0) 9732 19873

3.2 LNG Receiving Terminal

Location: Dala township, Yanggon Region , Myanmar.

Tel: TBC

1

3.3 Emergency Contacts

In the event of an emergency in LNG Power Plant (Ahlone) Project, or in the event involving plant personnel off site, the following listed key contact numbers for Power Plant as *Attachment-1* are used for communication purposes and listed key contact number for LNG Receiving Terminal as *Attachment-4* .

1

TTCL provide Trunk walkie-talkie to key personnel of Power Plant including Managers, HSE Officer and Engineers for site communication and one channel shall be reserved for emergency communication.

During the day-time working hours (08.00 - 17.00), above TTCL project personnel should be contacted. Outside normal Project working hours, the Safety Officer will be contacted in the first instance. The attached communications chart will be the call-out procedure followed in all emergency situations.

These communication numbers shall be posted conspicuously in all site offices and worker areas.

4. POTENTIAL EMERGENCY SCENARIOS

4.1 Incident Type

There are a variety of potential emergency scenarios and incident types that exist. The following scenarios listed below are not exhaustive, and are indicative only:

(1) Person(s) fall from height – on land

(2) Material fall from height

(3) Vehicle collision with plant/equipment/ pedestrian(s)

(4) Vehicle incident offsite

(5) Collapse of scaffold – no person(s) present/ person(s) present

(6) Collapse of structure – no person(s) present/ person(s) present

(7) Collapse of stacked/stored material

(8) Collapse of deep excavations – person(s) present

(9) Fire/Explosion – electrics, substances

(10) Chemical spillage – on land

(11) Medical emergency – Mass Food poisoning/ Bird flu

(12) Medical emergency – contagious disease

(13) Uncontrolled flammable/toxic release

(14) Adverse weather conditions (flooding, lightning strike)

(15) Loss of services (water, sewerage, electricity)

(16) Radiation (Radiation Source Exposition)

(17) Other (Earthquake, terrorist act, bomb threat, trespassers)

4.2 Levels of Response

The level of response to an emergency must be appropriate to the level/type of incident occurring. By ‘scaling’ or ‘tiring’ the required level of response to an incident type, this should utilize the resources for an emergency response from both within and external to the Project, without unnecessary waste of such resources.

Example:

Level	Action Response
1	TTCL Project Emergency Response Team (Project-ERT)
2	Project-ERT and supported team by Owner.

3 Government Authority (i.e. Industrial Estate, Municipal)

4.3 Personnel Affected

The type and location of an incident will have a bearing upon who potentially may be affected. As well as TTCL Project personnel, the sub-contractor workforce, visitors, Owners' personnel could all potentially be involved with or be affected by an incident/accident that may occur within the Project site and surrounding construction areas.

Should an incident occur that involves project vehicles offsite, there is the potential for members of the local community/public to be affected.

4.4 Work Areas Covered

Project site construction areas include access roads to and from these areas back to the main security gates. Well-defined Assembly Points will be established in all of these areas.

4.5 Emergency Response Team (ERT)

Project-ERT shall consist of members of the TTCL HSE department and Construction Team, and a selection of personnel from the Subcontractor companies, such as scaffolding and mechanical operatives where applicable.

In the first instance, the Project-ERT shall respond to assist the Site Medic at the scene of any accident/incident. Once the site medic has made an assessment, assistance from other ERT members may be requested, with a minimum of 4 people required – site medic, incident controller, 2 persons to assist with Para-guard stretcher (if required).

The Project-ERT members ideally are trained and prepared to fulfill the roles required by the specific situation, wearing red safety helmet and red vest coat

To identify ERT team for Project site, a group of people who prepare for and respond to any emergency incident, such as fire or explosion. Emergency response teams are common in corporations as well. This team is generally composed of specific members designated before an incident occurs, although under certain circumstances the team may be an unplanned group of willing volunteers.

5. DUTIES AND RESPONSIBILITIES

5.1 Project Manager (PM)

Project Manager shall give all details of the TTCL Program to HSE Department for drafting TTCL Standard Safety Procedure "Emergency Preparedness".

Project Manager shall support TTCL Emergency Preparedness Procedure and support necessary documents and emergency evacuation tools and equipment to HSE Department for preparation and execution in case of emergency evacuation.

Project Manager shall be acted as Emergency Director for command and control of emergency situation in case of TTCL Emergency Evacuation Case.

5.2 HSE Manager / HSE Officer

HSE Manager / HSE Officer shall be responsible to draft the TTCL Emergency Preparedness Procedure and Plan to Project Manager for approval.

HSE Manager / HSE Officer shall be directly taken order from Project Manager in case of emergency situation by cooperation the evacuation order from Project manager to On-Scene Commander.

HSE Manager / HSE Officer shall prepare emergency evacuation tools and equipment, i.e. the designated Assembly Points, Emergency Route & Signs.

HSE Manager / HSE Officer shall step up the Emergency Response Team (ERT) for supporting in case of Emergency Evacuation Situation.

HSE Manager / HSE Officer shall set up Emergency Evacuation Training & Drills to be ready for the potential real case.

HSE Manager / HSE Officer shall be coordinated with the On-Scene Commander in case of Emergency Evacuation Situations.

5.3 Construction Manager (CM)

Construction Manager shall manage and control the Emergency Response Team (ERT) by this Emergency Response Procedure.

Construction Manager shall support HSE Department in case of Emergency evacuation in LNG Power Plant (Ahlone) Project who support for the emergency training and drills in their area responsibilities.

5.4 Emergency Response Team (ERT)

ERT will be consisted of followings:

- Fire Fighting Team
- Rescuing Team
- First Aid Team
- Head Counting Team
- Route Leader / Traffic Controller

ERT will be strictly followed by On-Scene Commander order in case of Emergency evacuation situation.

ERT will be received the emergency training & drills as HSE requirement regarding the sequence of the evacuation steps including the emergency Route and the Assembly point locations.

6. EMERGENCY PLAN

6.1 Pre-Emergency Plan consists of 3 main items as followings:

(1) Inspection and monitoring Plan

To conduct the area inspection and monitoring by assigning the responsible person as in charge of inspection to their areas:

(2) Emergency Evacuation Training & Drills Plan

To conduct the emergency training and drills by HSE Department and assign ERT for response in case of the Emergency Situations.

To manage and conduct the Fire or Emergency Training & Drills to TTCL. They shall be trained the basic fire prevention and basic fire suppression course at least 40 % of all the employees.

6.2 Fire & Emergency Campaign;

(1) To manage and conduct the Fire & Emergency campaign to TTCL area. The Campaign Posters shall be displayed in TTCL areas.

(2) The Non-smoking zones shall be strictly established, fire extinguishers shall be located to all pre-defined locations.

6.3 Fire Fighting & Rescue Plan consists of 2 plans as followings;

(1) Fire Fighting Plan

To assign the Fire Fighter Team with the trained persons

(2) Rescue Plan

To assign the Rescue Team with the trained persons to rescue the victims in case of emergency

7. EVACUATION PLAN

7.1 The Evacuation Plan shall be established and covered to all Site areas.

7.2 Project Manager shall confirm the emergency situation from area inspector and then information will be conducted to On-Scene Commander at Central Control Room (CCR) by Two way Radio Walkie/Talkie Emergency Channel

7.3 TTCL Central Control Room (CCR) will be immediately signaling to Alarm Siren that is installed on central pipe rack and inform ERT by Radio Walkie/Talkie Emergency Channel.

7.4 All TTCL personnel shall be conducted to designated Assembly Points and then Head counting will be carried out.

8. EMERGENCY EVACUATION ORGANIZATION

8.1 Emergency Director (Project Manager)
Duties and Responsibilities
(1) Immediately attended to the location of Emergency
(2) Assess the situation and order call for Assistance as necessary (Outsource Fire Fighting, Police, and Ambulance etc.)
(3) Order for shutting off main power switches as necessary
(4) Direct control and supervise emergency actions to the emergency response team members.
(5) Order to barricade the affected area (if necessary)
(6) Issue command for evacuation to assembly point

8.2 On-Scene Commander (Construction Manager)
Duties and Responsibilities
(1) Immediately attended to the location of emergency
(2) Assess the situation together with Emergency Director or HSE Manager/ Officer
(3) Follow as Emergency Director's command for controlling emergency situation
(4) Control and supervise ERT on scene
(5) Report the status of emergency situation to Emergency Director

8.3 First Aid Coordinator (HSE Manager/ Officer)
Duties and Responsibilities
(1) Proceed to the scene immediately
(2) Assess the situation together with Emergency Director or On-Scene Commander.
(3) Advise any firefighting technique on scene to Fire Fighting Team
(4) Advise any patient movement technique in scene to rescue team
(5) Stand-by for any medical assistance required
(6) Prepare emergency medical kits

8.4 Emergency Response Team (ERT)
Duties and Responsibilities

(1) Route Leader / Traffic Controller
- Control the traffic condition on power plant
- Navigate all personnel to designated Assembly point

(2) Fire Fighting Team
- Follow as an On-Scene Commander order for controlling emergency situation
- Proceed to control fire appropriately as training course
- Communicate to On-Scene Commander periodically

(3) Rescue Team
- Proceed to search and rescue the injured person who cannot go out of emergency area by himself/herself to safe location
- Provide basic first aid to injured person (if necessary)
- Communicate to On-Scene Commander periodically

(4) Head Counting Team
- Proceed to head counting at Assembly Point
- Inform the present head count number to On-Scene Commander / Emergency Director
- Control all evacuated personnel at Assembly Point until emergency situation is completed.

9. RETURN TO WORK

Return to work can only occur once a situation has been made safe, and a return deemed acceptable by the Emergency Director (ED) for serious incident or the TTCL Emergency Control Manager (EM) for minor incident. No other person such as a Line Manager or Supervisor can communicate a 'return to work' status.

If the incident is such that the level of response requires the interaction of outside agencies, they may require certain areas to be cordoned off for investigation purposes. Should this occur, no work will be allowed in those areas, until such time as the "*ALL CLEAR*" has been given by the relevant agency.

Upon the return to work being notified, all permits are to be revalidated by the TTCL permit controller.

10. INVESTIGATION PROCESS

All accidents and incidents resulting in an Emergency Response shall require full investigation. The level of investigation should be appropriate with the level of response to the accident/incident. For most level 1 or 2 responses, members of the TTCL HSE teams will collate information as an attachment to the main accident/incident report. This shall de submitted to the Owner in a timely manner immediately following the Incident/Accident Emergency.

Where the seriousness of the event raises the level of response to level 2 or 3, then a formal investigation and report will be required. This may involve post event investigation meetings and lesson learned briefings with all Site Project Management team members.

All emergencies investigated shall be documented in accordance with F050-MNL-039: Incident Investigation Procedure.

11. LESSONS LEARNED

11.1 Overview

Whether there have been 'Near Miss' reports or a major incident with multiple casualties, there are always lessons that can be learned, and steps taken to reduce future potential.

All incidents, including 'near miss' reports, are to be logged and tracked, to identify any trends forming. If trends are identified, then appropriate steps are taken to reduce the likelihood of such re-occurring. These shall be recorded on the TTCL action tracking register.

11.2 Findings from the Investigation

After high potential accidents/incidents that may or have affected strategic Project work, meetings shall be held with all the relevant parties to run through all items that have occurred during that particular operation, including any accidents and incidents. This should enable improvements to be made, where applicable, to create safer working practices for future tasks.

11.3 Continual Improvement

Any items identified from investigations or lessons learned meetings should result in the requirement for Procedures to be amended or for method statements and risk assessments to be reviewed and updated. This is part of the 'continual improvement' cycle, where any item no matter how small could potentially have a negative impact upon the process, and therefore should be considered and included in the revision of relevant Project documents.

12. TRAINING AND AWARENESS

12.1 Training

All members of the Project-ERT will attend relevant training in the appointed team person role, use of emergency equipment and basic first aid course.

Additional training identified through the course of the Project will also be provided if considered integral to the efficiency and effectiveness of the Project-ERT.

12.2 Communication to Project Personnel

Information relating to general Emergency Response, safe working and accidents/incidents on site will be communicated to Project personnel via the initial Project Induction process, toolbox talks, safety alerts, posters etc.

12.3 Emergency Drills

Individual Emergency scenarios will be worked out through the life of the Project/s; however TTCL intend to carry out 2 Emergency drills each calendar year in co-operation with Owner.

A schedule shall be prepared indicating the proposed times for general practice runs as wells as planned full-scale emergency drills, where applicable involving the Owner and TTCL Project-ERT.

A report shall be prepared hi-lighting the findings from such drills, with amendments/additions being made to required documentation as part of the lessons learned/continual improvement process.

13. ALARM / SIGNAL

In case of Fire Emergency Evacuation, the emergency siren sound will be continuous for 30 seconds (Only 1 Times)

For Finishing Emergency Situation, the Siren sound will be activated for 3 times (15 Seconds/time)

ATTACHMENT-1

EMERGENCY CONTACT FOR POWER PLANT 1

TTCL PUBLIC CO., LTD.
"LNG POWER PLANT (AHLONE) PROJECT"
หมายเลขโทรศัพท์แจ้งเหตุฉุกเฉิน EMERGENCY CALLS

OWNER	
TTCL Power Myanmar Company Limited (TPMC)	
Name	Tel. No.

CONTRACTOR		
TTCL Public Company Limited (TTCL)		
Name	Position	Tel. No.
Mr. Manasphong Pattarakorn	Project Maneger	TBC
Mr. Jakkrit Tipmak	Construction Maneger	TBC
Ms. Khwankaew Choochuen	Project Engineering Maneger	TBC

SUBCONTRACTOR	
Name	Tel. No.

สถานีตำรวจ POLICE STATIONS, EMERGENCY CALL 191	
	Tel. No.
Police Station	191

โรงพยาบาล HOSPITALS	
	Tel. No.
Asia Royal Hospital	951538055

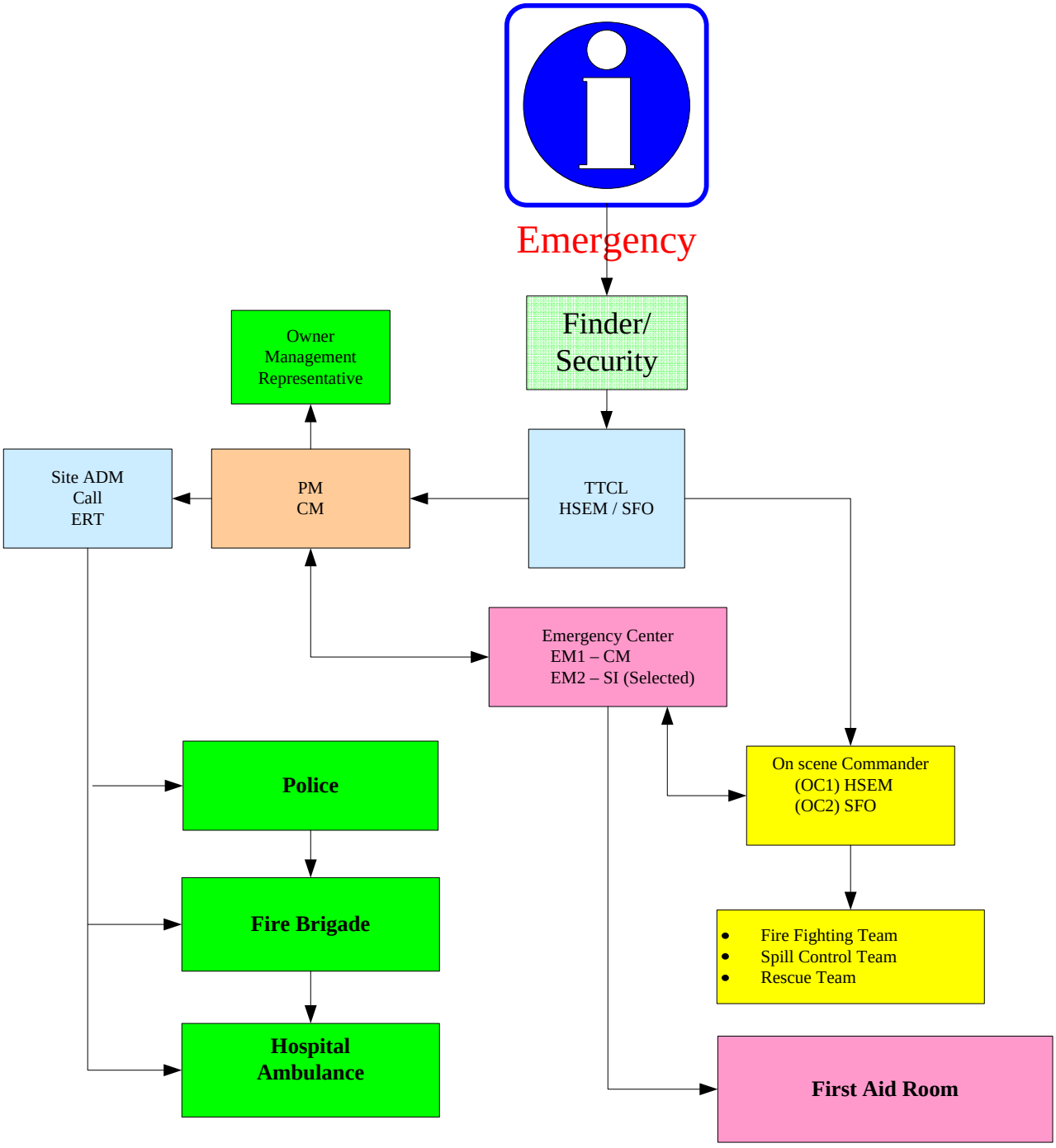
สถานีดับเพลิง A Fire Station	
	Tel. No.
Fire Station	252011, 252022

สถานีไฟฟ้าย่อย Substation	
	Tel. No.
Ahlone Sucstaion	2300469

ATTACHMENT-2

EMERGENCY COMMUNICATION FLOW CHART

Site Emergency Communication Flow Chart



ATTACHMENT-3

EMERGENCY EVACUATION ROUTES FOR POWER PLANT 1

DWG NO. F050-AD-00-010-02

TN
PN 0°
270° 90°
180°

AREA NO.	DESCRIPTION	GRID NO.	REMARKS
01	STG AREA	F-5	
02	GTG AREA FOR UNIT 1 & 2	G-6	
03	HRSG AREA FOR UNIT 1 & 2	F-5, G-5	
04	BOILER FEED WATER PUMP AND DEAERATOR	F-5	
05	RIVER PONTOON AREA	E-1	
06	WATER TREATMENT AREA AND DEMIN AREA	H-4, F-3	
07	COOLING TOWER AREA	E-5	
08	AIR COMPRESSOR AREA	G-4	
09	COMMON AND FACILITY AREA	H-6, J-8	
10	EXISTING SETTLING POND AREA	H-8	
20	PIPE RACK AREA	F-5	
21	COMMON ROAD AND PAVING	I-6	
22	GAS METERING AREA	D-4	

LEGEND

- POWER PLANT BOUNDARY
- U/G FUEL GAS EXISTING LINE
- PIPE RACK
- U/G CABLE TRENCH

NOTE :

1) ALL DIMENSIONS AND ELEVATIONS ARE IN MILLIMETER UNLESS INDICATED OTHERWISE.
2) ALL COORDINATES ARE IN MILLIMETER UNLESS INDICATED OTHERWISE.
3) GL EL.0 mm = EL.0 mm of TTPMC PLANT = +4,420 mm MSL = +7,250 mm CDL
4) EXISTING FUEL GAS LINE MAY BE MODIFIED.
5) EXISITNG RIVER WATER LINE FOR 121 MW COMBINED CYCLE POWER PLANT PROJECT SHALL BE MODIFIED.
6) REFER TO THAI REGULATION, AREA UNDER 20 M FROM 230 kV TRANSMISSION LINE IS PROHIBITED TO CONSTRUCT BUILDING, RESIDENCE, ETC.
7) RESERVED AREA FOR PIPE AND CABLE INTERCONNECTING ROUTE FOR 121 MW COMBINED CYCLE POWER PLANT PROJECT.

ASSEMBLY POINT

SMOKING AREA

FIRE EXTINGUISHER

TOTAL REQUIRED AREA
36,300 m2 or 8.97 Acres

REV.	DESCRIPTION	DWN.	CHK'D	CHIEF	MGR	APVD	AUTH	ISSUE	DATE MM/DD/YY
								C L F V	/ /
								C L F V	/ /
								C L F V	/ /
1 B	APPROVED FOR PLANNING-1	PISUT						C L F V	04/24/18
0 A	APPROVED FOR PLANNING	PISUT	(ORIGINAL SIGNED)					C L F V	03/05/18

356 MW COMBINED CYCLE POWER PLANT PROJECT

TTCL Power Myanmar Company Limited

ABBR. FOR ISSUE
C = CUSTOMER
L = LICENSOR
F = FIELD
V = VENDOR

บริษัท ทีทีซีแอล จำกัด (มหาชน)
TTCL PUBLIC COMPANY LIMITED

TTCL JOB NO. F-050 | ACCOUNT | CUSTOMER'S ORDER NO.

ISSUE MARK: B
04/24/18 MM/DD/YY

GENERAL PLOT PLAN

SCALE : 1/400 | DWG. NO. F050-AD-00-010-02

ATTACHMENT-4

EMERGENCY CONTACT FOR LNG RECEIVING TERMINAL 1

TTCL PUBLIC CO., LTD.

"LNG POWER PLANT (AHLONE) PROJECT"

หมายเลขโทรศัพท์แจ้งเหตุฉุกเฉิน EMERGENCY CALLS

OWNER	
TTCL Power Myanmar Company Limited (TPMC)	
Name	Tel. No.

CONTRACTOR		
TTCL Public Company Limited (TTCL)		
Name	Position	Tel. No.
Mr. Manasphong Pattarakorn	Project Maneger	TBC
Mr. Jakkrit Tipmak	Construction Maneger	TBC
Mrs. Wilailak Kraisut	Project Engineering Maneger	TBC

SUBCONTRACTOR	
Name	Tel. No.

สถานีตำรวจ POLICE STATIONS, EMERGENCY CALL 191	
	Tel. No.
Pyaw Bwe Police Station	956449006

โรงพยาบาล HOSPITALS	
	Tel. No.
Pyaw Bwe Gyi Hospital	TBC

สถานีดับเพลิง A Fire Station	
	Tel. No.
Pyaw Bwe Fire Station	956449022

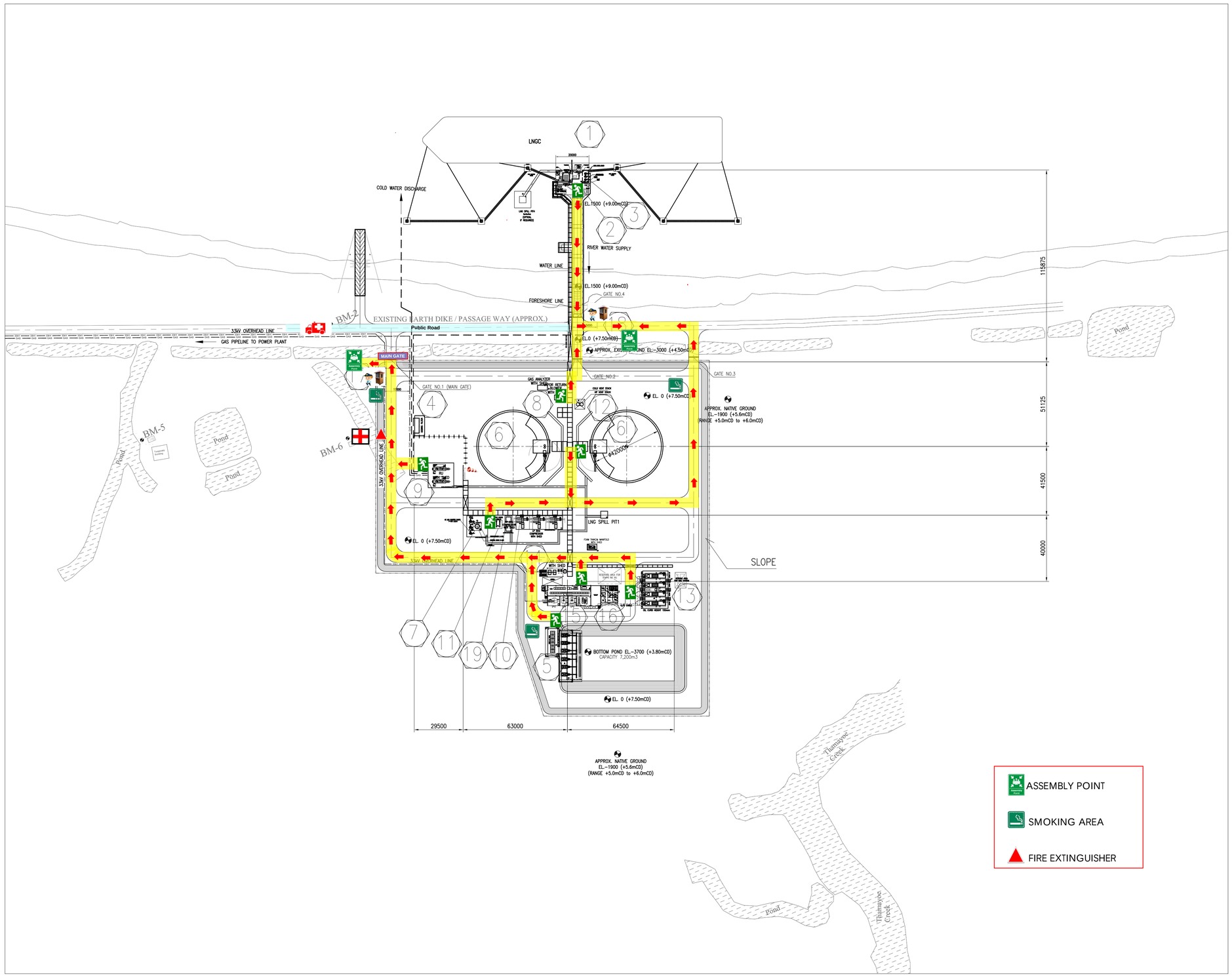
สถานีไฟฟ้าย่อย Substation	
	Tel. No.
Pyaw Bwe Substaion	TBC

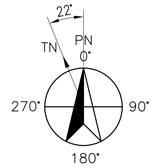
ATTACHMENT-5

EMERGENCY EVACUATION ROUTES
FOR LNG RECEIVING TERMINAL

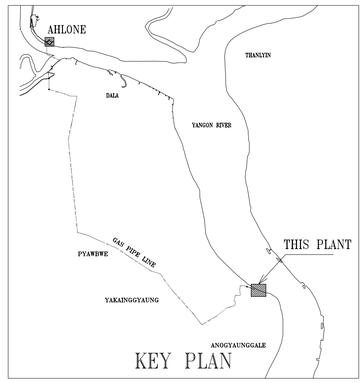
1

DWG NO. –





EQUIPMENT LIST	
ITEM NO.	EQUIPMENT NAME
1	LNG CARRIER
2	JETTY AREA
3	RIVER WATER PUMP
4	DEBRIS FILTER
5	FIRE WATER PUMPS AND FIRE WATER POND
6	LNG STORAGE TANK 1 & 2 WITH LNG TRANSFER PUMPS
7	HP LNG BOOSTER PUMPS, LNG SUCTION DRUM, &RECONDENSER
8	VAPOR RETURN BLOWERS
9	REGASIFICATION UNIT
10	LP BOG COMPRESSOR
11	NG PRE-HEATER
12	HIGH PRESSURE STACK AND COLD VENT STACK
13	GAS ENGINE GENERATOR
14	AIR COMPRESSOR,AIR RECIVER, AND NITROGEN SYSTEM
15	ELECTRICAL ROOM, EDG, AND CONTROL ROOM BUILDING
16	ADMIN, FIRST AID AND CANTEEN BUILDING
17	MAIN GATE GUARD HOUSE
18	JETTY GUARD HOUSE
19	HP BOG COMPRESSOR



ASSEMBLY POINT

SMOKING AREA

FIRE EXTINGUISHER

REV.	DESCRIPTION	DWN.	CHKD	A/E	CHIEF	MGR.	APPR.	ISSUE	DATE MM/DD/YY
								C L F V	/ /
								C L F V	/ /
								C L F V	/ /
								C L F V	/ /
								C L F V	/ /
								C L F V	/ /
								C L F V	/ /
	FOR INFORMATION							C L F V	12/28/18

LNG POWER PLANT(AHLONE) PROJECT

TTCL Power Myanmar Company Limited

ABBR. FOR ISSUE
C = CUSTOMER
L = LICENSOR
F = FIELD
V = VENDOR

บริษัท ทีทีซีแอล จำกัด (มหาชน)
TTCL PUBLIC COMPANY LIMITED

TTCL JOB NO. F-050 | ACCOUNT | CUSTOMER'S ORDER NO.

ISSUE MARK –

12/28/'18

PLOT PLAN LNG RECEIVING TERMINAL FOR LNG POWER PLANT(AHLONE) PROJECT 1/1

SCALE – | DWG. NO. –

ATTACHMENT-6

EMERGENCY EVACUATION ROUTES
FOR GAS PIPELINE

1

DWG NO. –

N 0° 90° 180° 270°

PROPOSED AREA
FOR LNG RECEIVING TERMINAL

THANLYIN

GWA-YWA

YANGON RIVER

ANOGYAUNGGALE

DALA-DANODE Road

DALA-DANODE Road

YAKAINGGYAUNG

DALA-DANODE Road

KYAUKTADA

GAS PIPE LINE APPROXIMATE 25km

DALA

PYAWBWE

LNG POWER PLANT
(AHLONE) PROJECT

MIP Port

DALA-DANODE Road

Assembly Point

- ASSEMBLY POINT
- SMOKING AREA
- FIRE EXTINGUISHER

REV.	DESCRIPTION	DWN.	CHKD	A/E	CHIEF	MGR.	APPR.	ISSUE	DATE MM/DD/YY
								C L F V	/ /
								C L F V	/ /
								C L F V	/ /
								C L F V	/ /
								C L F V	/ /
								C L F V	/ /
								C L F V	/ /
0 A	FOR INFORMATION							C L F V	05/22/'19

LNG POWER PLANT(AHLONE) PROJECT

TTCL Power Myanmar Company Limited

ABBR. FOR ISSUE
C = CUSTOMER
L = LICENSOR
F = FIELD
V = VENDOR

บริษัท ทีทีซีแอล จำกัด (มหาชน)
TTCL PUBLIC COMPANY LIMITED

TTCL JOB NO. F-050 | ACCOUNT | CUSTOMER'S ORDER NO.

ISSUE MARK A 05/22/'19

OVERALL PLOT PLAN FOR LNG POWER PLANT(AHLONE) PROJECT

1/1

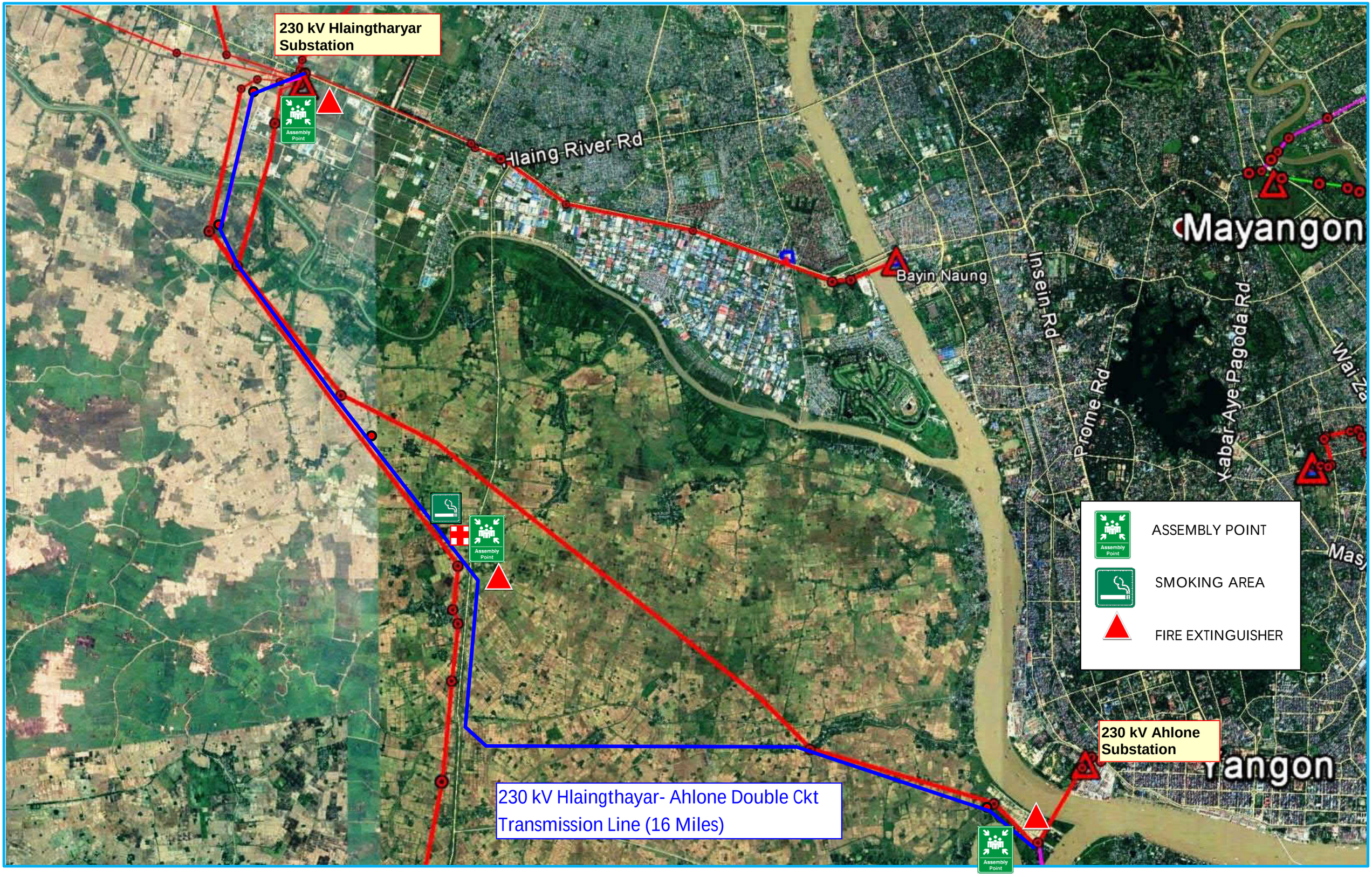
SCALE – | DWG. NO. –

ATTACHMENT-7

EMERGENCY EVACUATION ROUTES
FOR TRANSMISSION LINE

1

230 kV Hlaingtharyar-Ahlone Transmission Line (16 Miles)



APPENDIX I SITE SECURITY PROCEDURE

AHLONE 2

ISSUED
04 FEB 2019
TTCL PUBLIC COMPANY LIMITED

SITE SECURITY PROCEDURE

PROJECT DOC. NO. F050-MNL-029

FOR INFORMATION

LNG POWER PLANT (AHLONE) PROJECT

TTCL JOB NO. F-050

Total (Including this Page): 50 sheets

0	21-Jan-19	For Information				for
REV.	DATE	DESCRIPTION	MADE	CHECKED	APPROVED	AUTH'D

For Project Use only

Originator	Distribution	PW	PR	MA	ME	PP	EE	IN	CV	QC	PC	Proj	Site	Owner	Total
Project	No. of Copy	1	1	1	1	1	1	1	1	1	1	ORG.	1	1	12

บริษัท ทีทีซีแอล จำกัด (มหาชน)
TTCL PUBLIC COMPANY LIMITED

Revision History Sheet

Rev.	Date	Description
0	January 21, 2019	For Information

CONTENTS

APPENDIX LIST

ATTACHMENTS LIST

1. PURPOSE

It is the policy of the company that each location shall establish a Security Program designed to provide a secure working environment. Every employee has the responsibility to conduct themselves in such a way as to protect the company's assets. This document describes the various elements of the security plan and the details within each element.

This document is to define the control access into and out of secured areas and all access into restricted zones inside secured areas. So, it shall provide the protection of property from theft and fire.

2. SCOPE

This document is designed to cover the Project Site Security Plan for the Project site. Every employee shall be training and understand the Project Safety Rules.

3. DEFINITIONS

Security Area	Project site is concerning in working area, Power Plant, LNG Receiving Terminal, Gas Pipeline, Transmission Line and warehouse that shall be entry restricted and/or secured for unauthorized person entry and project asset lost prevention purpose.
Restricted Zone	Construction area which is being hazard exists during working such as an areas of scaffolding erection, crane operation, machine, electrical operation and process operation which accidental protection and/or property stolen prevention purpose.
Security Officer (SCO)	The employee who is responsible for security matters which is protect unauthorized person entry and loss of project asset in working area, gate pass control for entrance & exit of personal, material or equipment in project site.
Chief Security Guard	The Subcontractor employees who were employ by security service provider (subcontractor) for Security Supervisor duty. He shall works in shift operation and responsibility for routine security matters during on duty.

4. RESPONSIBILITY

4.1 TTCL PROJECT MANAGER (PM)

(a) PM is responsible for assuring implementation of Site Security Procedure to ensure that security operation are performed by TTCL, Subcontractors and other concerned parties in the project.

(b) Lead by an example, modeling the behavior expected from all personnel performing work at the jobsite.

4.2 TTCL CONSTRUCTION MANAGER (CM)

(a) CM is responsible for construction execution of Site Security Procedure that make collaboration by TTCL employees, Subcontractors employees including visitors and concerned persons.

(b) Lead by an example, modeling the behavior expected from all personnel performing work at the jobsite.

4.3 TTCL HSE MANAGER (HSEM)

HSEM is responsible to execute an effective Site Security covering construction area, warehouse, parking, lay down, except TTCL Site office (which will be control by TTCL Admin) as following;

(a) Establish Site Security Procedure covering project activities risk.

(b) Ensuring effective compliance with this Site Security Procedure.

(c) Ensuring that this procedure is administered properly and develop Site Security Procedure where necessary.

(d) Ensure that all site personal (TTCL and Subcontractor employees) are received "Site Safety Rules and Regulation procedure" training and adhere to its entire requirement.

(e) Lead by an example, modeling the behavior expected from all personnel performing work at the jobsite.

4.4 TTCL SECURITY OFFICER (SCO)

TTCL Security Officer is responsible for;

(a) Provide direction and oversight to the site security contractor / subcontractor and to facilitate interface with local security and police officials for all activities associated with the Project.

(b) Manage, control and co-ordinate with security guards for security provisional activities and being the universal guard / site security center for his entire site area.

(c) Overall security and the implementation of the Secure Assets work processes and appropriate supporting work processes.

(d) Ensuring that all employees process ID badges and report to the site with picture ID badge displayed visibly on their body.

(e) Ensuring only construction material delivery employees equipped with Basic PPE; steel toe cap safety shoes, long sleeve shirt, full length trousers, approved safety glasses, and hard hat can be allowed to enter the site.

(f) Perform random searches on employees (lunch boxes and carry-on items) to prevent employee from bringing alcohol, firearms or illegal drugs onto the jobsite or to prevent theft of project materials as employees leave the site.

(g) Ensuring that all vehicles and equipment have a valid inspection and access pass to gain access to the project site.

(h) Ensuring that vendors delivery vehicle is in safe operating condition in order to be allowed on the project.

4.5 TTCL Site Admin

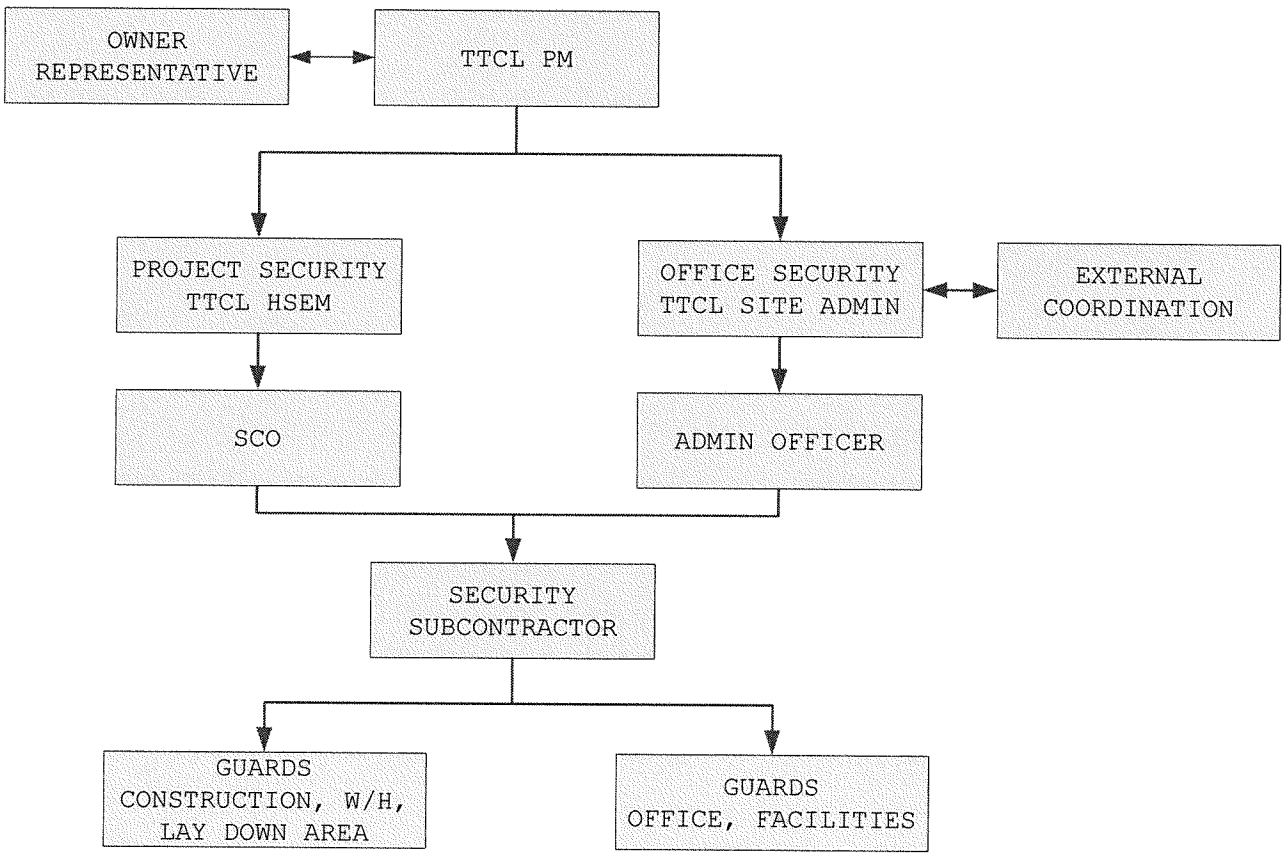
TTCL Site Admin is responsible for external coordination project security matters and TTCL Site office security such office building, office facilities and being the spare key keeper for regularly or emergency entire site office.

4.6 TTCL / SUBCONTRACTOR EMPLOYEES

Conduct themselves in such a way as to protect the Company's assets. Each Subcontractor is responsible for the security of his own tools, equipment and material.

Understand Security processes and their individual role in protecting the assets of the Company; for example, confidential information, travel to high risk areas and reporting (crime and theft).

5. SECURITY ORGANIZATION



6. SYSTEM REQUIREMENTS

The main components of this system are:

A. Physical barriers (Fence, Gates).

B. Badge (Personal access control)

C. Mobilization and demobilization of employees

D. Asset control

E. Guards

F. Vehicle policy

G. Security supervision

H. Photography control

A. PHYSICAL BARRIERS

(1) Fences

Outer (perimeter) & Inner temporary fences shall be installed for Project boundary and to separate construction area and site office area for security & safety purpose.

(2) Gates

(a) TTCL PM in conjunction with TTCL HSEM shall determine project access requirements for construction activities and locate suitable temporary gates to support the construction effort.

(b) These gates shall be controlled by the Security guards. (TTCL Security Officer and Subcontractor guards)

(c) Security guards shall ensure at the gate that employees authorized personnel, visitor, vehicle, material and equipment shall be effective entry and exit control;

i. Authorized employees – Personal badge

ii. Visitor – ID card swap to Temporary personal gate pass

iii. Authorized vehicle – Vehicle gate pass sticker

iv. Vehicle – Generally driving license card swap to Temporary personal and vehicle gate pass when required inspection (if applicable) is satisfied as following;

- Mobile Crane: load test certificate and project inspection are required
- Delivery truck: check general condition by Guard. Any doubt be found then call Project Inspector for advise
- Pickup Truck: check general condition by Guard. Reversing alarm is required to access construction area. Unroofed pickup truck is not allowed personnel transportation (person can be only in the cabin) in the site.

(d) Security guards shall perform random checks at the gate on personnel and vehicles requesting entry to ensure contraband (drugs, alcohol, firearms, photographic equipment etc.) are not brought into project site.

B. BADGE (PERSONAL ACCESS CONTROL)

(1) All employees who work for the project shall have own personal badge after passed safety indoctrination training. This course shall be carried out by TTCL trainer. The personal badge shall allow access to project site permission zone.

(2) Personal badge shall be issued in English and shall contain minimum information as following:

Name – surname	Issue date	Sex / Age
Company	Expire date	Entry permission zone
Badge register no.	Blood group	Photo, etc.

(3) Project groups classification shall be identified by different colors badge such;

i. Owner / Consultant (with photo)
ii. Main contractor (with photo)
iii. Subcontractor (with photo)
iv. Temporary worker (without photo)
v. Visitor (without photo)

Remark: Identify badge colors shall be designed on kick off meeting.

(4) Personal badge shall be prominent displayed at all times while within the project area.

(5) For Visitors, they shall inform entry purpose to security guard.

(6) In case of personal contact, Guard needs to be confirmed by destination person prior entry permission.

(7) In case of 1st time visit, Visitor shall entry with destination personal escort.

After entry request is granted,

i. Visitor shall fill up his information in Visitor Log Book.
ii. Read and understand through the "Proper entry and instruction for Visitor"
iii. Change his personal ID card to "Visitor" badge
iv. Prominent post "Visitor" badge prior entry to project site.

C. MOBILIZATION AND DEMOBILIZATION OF EMPLOYEES

(1) Prior TTCL and Subcontractor employee mobilization to project site. Safety & Security system shall be ready prepared to implementation.

(2) Safety training (approx. 1:30 hrs.) & Personal badge making shall be conducted to all employees.

(3) TTCL Discipline and Subcontractor Management Representative shall three (3) days in advance submit employees name list which is approved by TTCL discipline to training center. After that, Safety trainer shall arrange training day and time for them.

(4) TTCL Discipline and Subcontractor Management Representative are responsible for enforcement they nominated employees to attend booked up course.

(5) Employee without personal badge shall not be allowed entry to project site.

(6) Employee whom is not yet done Safety training shall not be allowed to work on project site.

(7) Incase short term period working or temporary working in an office, Safety brief training course shall be conduct by TTCL Safety Officer. (15 minutes brief)

(8) Employee, who has completed of work, transferred to other project or terminated and demobilization from project site shall return his personal badge to TTCL HSEM.

(9) Subcontractors Management Representative is responsible to return individual employee personal badge and vehicle gate pass sticker (if any) to TTCL HSEM in case of individual employee is demobilization from project site.

D. ASSET CONTROL

(a) Procedures are required to control and document material entering and leaving the Project site. Typical activities include purchasing, shipping, receiving, storage, salvage, donations, employee sales, scrap and waste.

(b) Separation of authority shall be in place for the following functions: authorizing, approving, shipping and receiving. Exceptions shall be documented and approved.

(c) Compliance audits are required to assure policies are followed and controlled.

(d) All packages for delivery to personnel on site shall be inspected by the security guards at the access gates. The addressee shall be informed about the arrival of the package prior to inspection. After inspection, the package may be collected by the addressee or stored in the Security office, depending on the addressee's advice or the contents of the package.

(e) All vehicles leaving the work site with materials of any description (except for waste) shall be required to submit an authorized Material Gate Pass to the Gate House. The authorized list for Material Gate Pass signatories shall be provided to all concerned parties. For the procedure how to transport waste see the F050-MNL-026 Waste Management Plan.

(f) All incoming deliveries of supplies, materials and equipment for the project shall be accompanied by a material entry pass or a delivery note, if from a vendor. Security shall examine the material and/or equipment and compare with the delivery note or material entry pass and notify TTCL Project management which concerns of the delivery. Security shall retain a copy of the material entry pass or delivery note if necessary.

(g) The Material Gate Pass (see *Attachment 4*) shall:

i. State the date on which the materials are to be removed.
ii. State the full description of the materials, including quantities.
iii. Be signed by the authorized person concerned.

(h) Be endorsed by an approved authorized signatory. The LIST OF AUTHORIZED SIGNATURES shall be provided and retain at egress Gate House.

(i) The Gate Guards shall check that the quantity and nature of the materials detailed on the material gate pass matches those contained within the vehicle and where any discrepancies are found, the vehicle shall not be allowed to leave/enter the work site.

(j) Material gate passes shall be prepared by the Remover authorized personal. The original material gate pass form shall be submitted to the gatehouse and a copy shall be retained by the Remover authorized personal.

(k) The original of each material gate pass shall be give daily to the TTCL SCO by the Security Guard.

(l) Employees, vendor, visitor, etc., who bringing their own personal equipment (or non project owned) into the jobsite shall be inform and / or register with the Gate Guards.

E. SECURITY GUARDS

(a) Security guards shall be sufficient provided by TTCL for overall security matters execution and the implementation of the secure assets work process lay down area and appropriate supporting work processes for LNG POWER PLANT (AHLONE) PROJECT on 24 hours per day, 7 days/week.

(b) Ensuring that all employees process ID badges and report to the site with picture ID badge displayed visibly on their body.

(c) Ensuring employees equipped with Basic PPE, wear long sleeve shirt and full length trousers; can enter the construction site.

(d) Perform random searches on employees (lunch boxes and carry-on items) to prevent employee from bringing alcohol, firearms or illegal drugs onto the jobsite or to prevent theft of project materials as employees leave the site.

(e) Ensuring that all vehicles and equipment have a valid inspection and access pass to gain access to the project site.

(f) Ensuring that vendors make deliveries to the project with vehicles that are in safe operating condition in order to be allowed on the project.

(g) Fire alarm trigger and first attack fire fighting volunteer.

(h) Guard is responsibility in *Appendix B*, INSTRUCTIONS FOR SECURITY GUARDS.

F. TRAFFIC CONTROL POLICY

Traffic Regulations - The following traffic rules are in place on the Project site.

(a) Driver's license

Motor vehicle drivers and equipment operators shall be qualified and licensed in accordance with the regulations. Vehicle drivers shall be in possession of a valid Myanmar driver's license and equipment operators shall be in possession of a valid Myanmar equipment operator license specific to the type of equipment operated and a competency certificate issued by management.

(b) Warning flags and lights

Red flags shall be used during hours of daylight and red lights during the hours of darkness on any load that extends beyond the front, side or rear of any vehicle.

(c) Traffic signs

All traffic signs and signals, whether fixed or portable, shall be obeyed and drivers shall cooperate with representatives appointed to direct traffic.

(d) Speed limit

All vehicles shall be operated within the 20-kilometer per hour posted speed limits on the project. Within the Construction area speed limit is 10 km/hr (walking speed)

(e) Walks and Roadways

All personnel and / or subcontractors will use only designated walk path. The use of short cuts or undesignated pathways is prohibited.

(f) Driving and parking

- Motorcycles are not allowed to enter the site.
- All vehicles need to switch on headlights whilst driving in the project site.
- Parking will be permitted in designated area only and not be parked so as to block or interfere with the use of fire hydrants or emergency equipment.

- Reversed parking rule shall be respected for all Vehicles.
- Vehicles shall not be left unattended with the motor running.
- All vehicles parking in the project with his/her own risk.
- Overtaking is prohibited on the project site.

(g) Right-of-way

All motor vehicles shall give right-of-way to pedestrians, ambulances and fire fighting equipment and other emergency vehicles. All drivers of motor vehicles shall practice extra ordinary driving courtesy.

(h) Passengers

- Passengers shall be limited to the number according to the design of the vehicle and manufacturer specification and the vehicle shall not be overcrowded.
- Drivers of motor vehicles shall not permit passengers to ride on fenders, running boards, tops or bumpers of motor vehicles.
- Passengers shall keep all parts of their bodies inside the cab or body of vehicles and must be seated while vehicle is in motion.
- Tailgates must be kept closed. Passengers shall not get on or off a vehicle while it is in motion.

(i) Windshield or window obstruction

Vehicles having nontransparent window materials, which interfere with clear visibility through any side window or windshields with cracks in the windshield shall not be operated on the project. All vehicles shall be equipped with adequate rear-view mirrors.

(j) Back-up alarm

All construction vehicles and motorized equipment shall be equipped with a back-up alarm that is audible at a distance of 10 meters. And a flag man is required to assist in construction area and/or in narrow pass.

(k) Obstructing streets, roads and fire equipment or fire fighting facilities. Roads/streets shall not be blocked without permission from TTCL CM. When work obstructs a road or street, approved lights, barriers, warning devices, and/or signalmen shall be provided. Parked vehicles shall not block fire equipment, fire fighting facilities and fire hydrants.

(l) Regularly Vehicles Gate Pass

- In the interests of safety and security, the number of vehicles permitted entry onto the work site shall be minimized. Normal means to move to the worksite will be walking.
- In case vehicle movements are required, all subcontractors shall be required to submit transport plans which will be reviewed by TTCL CM to ensure that the maximum usage is made of pool car such as buses and van.
- TTCL / Subcontractor employee driving vehicles onto the project shall be required to submit an application (see *Attachment-9*) for a project vehicle pass to the TTCL SCO for 3 days in advance prior to requesting admittance to the site. TTCL SCO shall screening reasonable permission gate pass prior submit for approve by TTCL CM. these included subcontractors pick up or trucks to transport materials as well. Defensive Driving training requirements for people driving on site shall be arrange as necessary.
- Vehicle gate pass applications (see *Attachment-9*) shall be inspection required by TTCL HSE dept. prior submitted completed correctly with valid copies of driver license and/or equipment operator's competency certification and equipment, third party inspection certificate where required, license plate number and description of vehicle and current insurance documents.
- All vehicles and equipment entering the project site and lay-down facilities shall be in safe operating condition and will therefore be subjected to a safety inspection by TTCL project HSE department. The inspection shall at a minimum include the proper safe working of (1) brakes; (2) lights; two headlights; taillights, brake light; (3) horn; (4) muffler; (5) safety glass; (6) windshield wiper and rear view mirror.

- The vehicle passes shall be displayed on the inside of the windshield on the left side. Equipment passes shall be displayed on the outside to the right side of the equipment. Vehicles and equipment without a valid pass shall not be allowed access to the site or lay-down facilities.
- Vehicle passes and equipment passes shall not be issued if documentation is incomplete or if all requirements are not met.

(m) Temporary Vehicle Gate Pass

- Temporary gate passes can be obtained at the security main gates.
- Vehicle driver shall inform entering purpose to the Guard.
- After check and approved, Driver shall issue and swap driving license with temporary personal and vehicle gate passes.
- This vehicle gate passes shall be displayed clearly visible inside the windshield on the vehicle right side.
- The validation period is 1 day max.
- When Driver is return to the Main gate for exit, Temporary personal and gate passes shall be swap back with previous driving license.

(n) The guards will collect the badge and temporary vehicle gate pass for checking in case of an emergency occurred.

(o) Depending on the Security level, searches shall be performed by the Security Guards (use of mirrors and inspection of hood and rear trunk will be performed) on incoming and outgoing vehicles to check all waste, material and goods being transported are in line with the appropriate process and documentation. Metal detectors shall be used for that.

G. SECURITY SUPERVISION

TTCL shall security supervision by install lighting at the Project site construction and Lay down area in order to enhance surveillance and deter theft. Security guards shall make scheduled and unscheduled patrol security survey. The patrol timing, frequency and routing shall be report to TTCL HSEM.

H. PHOTOGRAPHY CONTROL

(a) Photographic equipment which to be use in the LNG Power Plant (Ahlone) Project (included process/lay down areas) shall get permission by TTCL CM. (except HSE team)

(b) Photography permission shall be prepared by photographer according with camera permit form (see *Attachment-5*).

(c) All cameras or camcorders shall be inspection by TTCL HSE Department and get approved sticker on camera or camcorder prior brings to use.

(d) Cellular phones which build-in camera are not allowed to take photography at site, if not following above (a) and (b) items. It is hard security control for ignite explosive atmosphere or easily interfere electronic control system.

(e) Approved photographic equipment shall be used only by authorized photographer.

(f) A list of the regularly authorized photographer shall be approved by TTCL CM.

(g) The Regularly authorized photographer shall be maintained and provided camera permitted card (see *Attachment-5*) by the TTCL SCO.

(h) For Temporary photographer such visitors, vendors, etc., shall be get approved by TTCL CM prior taking photographic equipment in to site construction. Photographic equipment shall be pass inspection according with item (b).

(i) Temporary photographer such visitors, vendors, etc., shall be passed safety precaution training or briefing by TTCL HSE Department prior photography commencement.

7. GENERAL GUIDELINE FOR SECURITY

7.1 GROUP MEETING

(a) Daily meeting shall be carrying out for each shift security. Updated information shall be communicated to coming fresh shift. Otherwise, guards number and health examine shall be observe.

(b) Weekly meeting shall be conduct between TTCL SCO and Security Subcontractor Representative. Meeting purpose is for security problem discussion, problem solving and review the shift security performance. In case of decision making required, TTCL HSEM shall be decision maker.

7.2 SECUIRTY REPORT

(a) Daily security report log book shall be conduct by individual guard. It is guard responsibility to first contact with visitor, personal-vehicles entry-exit registration and control, security check, inspection, observe, verification or investigation any abnormal event (which called security incident) and shall be immediate verbal report to Chief Security Guard (Subcontractor employee shift supervisor) and record those incident detail in his written daily report log book.

(b) In case of abnormal event which called security incident occurred, Incident Initial Report shall be apply according with Project Incident and Emergency Response Plan (F050-MNL-030)

(c) Chief Security Guard shall review and completed information with quality on written daily report log book and Incident Initial Report prior submits to TTCL SCO for next step execution.

7.3 SECURITY COMMUNICATION

(a) Hand-held radio transmitter (CB radio), including a charger, shall be provided by security subcontractor and located at each gate, check points and equipped for patrol guard to establish effective project security system and facilitate project radio communication network.

(b) Guards shall immediately report any incident found by radio to Chief Security Guard (Subcontractor employee shift supervisor). A Message shall be short (with radio code), meaningful and polite.

(c) Chief Security Guard shall review and completed information with quality on brief description and report to TTCL SCO by radio for problem solving or decision making. A Message shall be short (with radio code), meaningful and polite.

(d) There is no secret on radio transmission; therefore company or project confidential message shall not be transmitted via CB radio. Cellular phone shall be use if necessary.

(e) Security transceivers shall standby in specified channel only.

(f) For explosion prove zone and/or secure transmission; Trunk radio (Intrinsically safe type) shall be considered, not CB radio.

(g) During Emergency; Incident Controller may give instruction/command via radio. Security guards shall give full support accordingly.

(h) All Transceivers shall comply with standard Radio Amateur Ethics requirements.

(i) Before Push-to-Talk (PTT); Transmitter shall be waiting 5 seconds to ensure there is nobody sending message then start calling.

(j) Maximum 3 calls per a transmission, if no reply then wait for a few minutes to let other use.

(k) Everyone shall respect other more priority message especially emergency message shall be transmitted as first priority.

(l) Guards shall not talkative or chatty behavior without work concerns. A Message shall be short (with radio code), meaningful and polite. Violator guard shall be rejecting from project site.

APPENDIX A

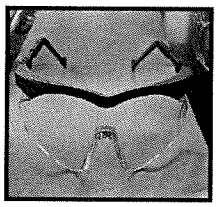
GENERAL BASIC RULES FOR VISITOR

TTCL PUBLIC COMPANY LIMITED
LNG POWER PLANT (AHLONE) PROJECT (F-050)

General Basic Rules for Visitors

All site visitors will be escorted by project personnel at all time when outside the OWNER/ TTCL Office Zone.

1. Visitor is prohibited to visit the site alone unless accompanied by the assigned project personnel and shall wear safety shoe/ Safety helmet/Safety glasses and long sleeve shirt with long trousers.


2. The vehicle speed in site is limited at 20 km/hr. Within the Construction area speed limit is 10 km/hr (walking speed).
3. During the visit, photographing is forbidden.
4. Smoking and toilet shall be limited to the specified place.
5. Keep away from working mobile equipment and vehicles.
6. Never cross over or enter a barricaded or red flag area.
7. Immediately report any type of accident, injury or hazard.
8. If any accident happen go to designated "Muster Point" obey instruction from TTCL management, supervisors and security personnel.
9. Ensure that you report to security before entering and leaving.
10. After the visit, please change back visitor ID card with entrance permit.

APPENDIX B

INSTRUCTION FOR SECURITY

INSTRUCTIONS FOR SECURITY GUARD

1. GENERAL INSTRUCTIONS

1.1 Company Image Conservation

Security guard is a front line for public impression and good company image. They are company representative employees who contributing public and essential display the spirit, friendliness, courtesy, cooperation and businesslike appearance. Nevertheless, they shall behave in a manner to command respect. Security guards shall be firm, calm and courteous in enforcing the project rules adopted by the management in this procedure or set force.

Security guard was expected to use his judgment in uncertain situations e.g. assisting another guard or injured person or dealing with a dangerous condition requiring their immediate attention.

1.2 Property Loss Prevention

Security guards shall be thoroughly familiar with the property that they are protecting, including name or number designation of lay down areas, buildings, doors and fire exits. They shall be aware of the locations of materials, offices, warehouses and other physical project site assets.

1.3 Fire Prevention and Protection

Security guards shall patrol they responsible area for finding potential fire situation. They shall familiar with portable fire extinguisher location and usage, fire hoses, hydrant, sprinkler and other parts of project own fire protection system included basic fire fighting method.

2. EMERGENCY RESPONSE

2.1 Emergency Procedure

(a) Security guards shall familiar with the project emergency procedure and Emergency Response Team (ERT). Security guards shall support ERT and automatic perform function according with emergency plan when emergency situation announcement.

(b) Security guards shall not leave their assigned duties except in an emergency situation. In such cases, they shall either notify their superior or other guards as soon as possible and send a prearranged signal to a constantly attended location.

2.2 Trigger on Fire Alarms

Security guards shall know the exact fire alarm push button to report fire incident or other emergencies. Where appropriate, they shall report exact fire locations, fire extension and direct responding parties / appropriated equipment for scene, etc.

2.3 First Attach Fire Fighting

Security guard shall given an alarm prior first attach fire fighting and shall take appropriate action as only one person present when fire is discovered. He shall fire fighting with proper fire extinguisher when his experience tells him that it can be effectively.

2.4 Incident Reporting

Security guard shall prepare an emergency call phone number of project management key personnel for day and night reporting purpose. In such case, Security guard shall report the serious incident or uncertain situations to TTCL HSEM first.

3. RESPONSIBILITIES

3.1 Main gate security guard (Subcontractor employee shift supervisors)

Security guard who is assigned at project main entrance gate shall;

(1) Essential display a spirit, friendliness, courtesy, cooperation and businesslike appearance with visitors, employees. Nevertheless, Security guards shall behave in the manner to command respect.

(2) Firm, calm and courteous in enforcing the project rules adopted by the management in this procedure or set force and courteously challenge suspicious persons.

(3) Make thorough personnel check for all coming to the site and keep a list of disable badges for screening their unauthorized use.

(4) Service and coordination for visitor personal or business contact.

(5) Security check vehicle entering to site for ensure contraband (drugs, alcohol, firearms, etc.) are not brought into project site.

(6) Security inspection for all vehicles which are leaving from site, including driver cab and trunk or pickup truck. If anything unauthorized is found, they shall be confiscated, immediately inform Chief Security Guard and record.

(7) Recognized company or project management personnel.

(8) Recognized project management personal who has authorized admit during an emergency situation.

(9) Follow emergency response plan about pre-arranged information in the functions of direct outsiders contact such press release, government officer or social public personal to prevent mistake or company image.

(10) Know how to direct traffic during emergency.

3.2 Patrol security guard

Security patrol guard is a nominated Security guard in a shift. Security guard shall;

(1) Prepare and checking his necessary accessories prior commence his round trip. It shall include available flashlight, vest-light reflector, communication tools (walkie-talkie and mobile phone), patrol check list, logbook etc.

(2) Perform security operations on each round are as:

(a) Visit and confirm each security check point is an available and effective.

(b) Office building windows and doors were closed checking during off-hour working periods.

(c) Observe adequate lighting to prevent material stolen and improvement report if any.

(d) Observe building escape doors obstruction and report or remove it if necessary.

(e) Observe building fire fighting equipment was obstruction or damaged and report.

3.3 Chief Security Guard (Subcontractor employee shift supervisor)

Security Guard who is assigned for Chief of security shift operation shall;

(1) Assure security operations shall comply with items 3.1 & 3.2.

(2) If any abnormal situation found, Chief Security Guard shall immediately inform HSEM and written security incident reports.

(3) Know how to direct outside fire department responding to a fire.

(4) Familiar with the general fire plans, especially which entrance is to be opened to admit fire truck and fire fighting team.

3.4 TTCL Security Officer (SCO)

TTCL HSE employee, who was assign for security matters. TTCL SCO shall;

- Assure security operation shall comply with items 3.1, 3.2 & 3.3.
- Provide direction and oversight to the site security subcontractor and to facilitate interface with local security for all activities associated with the Project.
- Manage, control and co-ordinate with project employees, visitor, owner and security guards for security provisional activities and being the universal guard / site security center for his entire site area.

4. ROUTINE DUTY

4.1 Reporting

Security guards shall report for duty at times specified by their superior. When a guard is unable to report for duty due to illness, injury or other causes, Guard shall notify his superior as soon as possible. Unnecessary delay in such notification is justification for disciplinary action.

4.2 Shift transmission

Guards shall remain on duty until shift relief. Guards shall transmit any special orders or pertinent information to their relief.

Guards shall not accept relief by another guard who is not in a condition to work for any reasons. Guard shall assume responsibility for reasonable diligence in judging that relief guard is fit for duty.

4.3 Notice board

Any fresh orders or updated instructions shall be posted on a notice board at Guard Houses. Guards shall frequently check a notice board for any fresh orders or updated instructions. Written orders or instructions are to be removed, replaced, erased or torn by Security chief. Disciplinary action shall take against Guards who disregard this rule. If any Guards fail to carry out orders or instructions posted on the notice board, Guard shall be penalized. After three times warnings, that Guard shall be dismissed.

5. GOOD PRACTICES AND IMAGE APPEARANCE

5.1 Good Practices

(1) Information giving

In information giving matter, Guards shall certain accurate. Guards shall not discuss details of their assignments except with authorized persons.

(2) Conversations

Conversation with fellow guards or other persons shall be only in the line of duty except during rest periods.

(3) Alertness

Guards shall be fit for duty and alert at all times. Sleeping during taking duty is prohibited.

(4) Smoking and Eating

Guards shall smoke, eat and drink in designated areas only. In some very dangerous for fire and explosion hazard locations, even carrying matches or cigarettes lighters shall be restricted for accident prevention.

5.2 Image Appearance

(1) Security guards good looking

(a) Guards shall wear uniform clothing specified for their particular assignment. Uniform shall be clean and in good condition. Such requirements which apply to wearing coats buttoned, ties not loosened, shoe polished and other features to make the guard's appearance professional.

(b) Guards shall wear basic PPE such Safety helmet, Safety glass and Safety shoes at all times while on site, carry a whistle on a lanyard while on duty and carry a flash light on night shift.

(c) Guards shall have the following at all times;

i. Safety helmet

ii. Safety Shoes

iii. Eye Protection

iv. Whistle

v. Flash light

(d) Guards shall not throw any paper or cigarette butts in any place except in the paper bin or ash tray.

(e) Guard House shall be maintaining tidy and good housekeeping at all time.

ATTACHMENT 1

VISITORS LOG

TTCL PUBLIC COMPANY LIMITED

LNG POWER PLANT (AHLONE) PROJECT (F-050)

VISITORS LOG

PRINT LEGIBLY	PLEASE USE MILITARY TIME
PROJECT NUMBER : F-050	PROJECT NAME : LNG POWER PLANT (AHLONE) PROJECT

I have read and agree to abide by the Project SAFETY & SECURITY RULES and any others which may be communicated to me while visiting or working at the project site.

NAME	COMPANY	DISTINATION OR PERSON TO SEE	TIME IN	TIME OUT	PPE ISSUED?	VEHICLE/VISITOR PASS NUMBER

ATTACHMENT 2

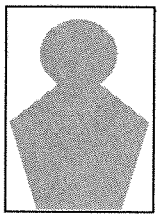
ACCESS BADGES

LNG POWER PLANT (AHLONE) PROJECT (F-050)

ACCESS BADGE (1/3)

TTCL PUBLIC CO., LTD.

LNG POWER PLANT (AHLONE) PROJECT (F-050) → BLUE



NAME:

CHOKEDEE MEECHAI

BADGE No. TTCL-XXX

POSITION: SAFETY OFFICER

COMPANY: TTCL PUBLIC CO., LTD.

DATE OF ISSUE	DATE OF EXPIRE
XX-XXX-XX	XX-XXX-XX

Approved by _____

SUGGESTION

1. Display badge at all time while being in Project site.
2. Follow HSE regulations of Project site.
3. Return this badge to TTCL Admin when employee finished.

For "TTCL Public Company Limited."

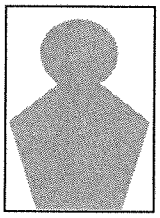
LNG POWER PLANT (AHLONE) PROJECT (F-050)

ACCESS BADGE (2/3)

TTCL PUBLIC CO., LTD.

LNG POWER PLANT (AHLONE) PROJECT (F-050)

→ GREEN



NAME:

CHOKEDEE MEECHAI

BADGE No. TTCL-XXX

POSITION:

COMPANY: (Owner Company)

DATE OF ISSUE	DATE OF EXPIRE
XX-XXX-XX	XX-XXX-XX

Approved by _____

SUGGESTION

1. Display badge at all time while being in Project site.
2. Follow HSE regulations of Project site.
3. Return this badge to TTCL Admin when employee finished.

For "Owner"

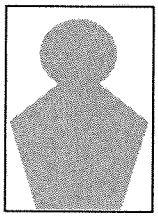
LNG POWER PLANT (AHLONE) PROJECT (F-050)

ACCESS BADGE (3/3)

TTCL PUBLIC CO., LTD.

LNG POWER PLANT (AHLONE) PROJECT (F-050)

→ **RED**



NAME:

CHOKEDEE MEECHAI

BADGE No. **TTCL-XXX**

POSITION:

COMPANY: **(Subcontractor Company)**

DATE OF ISSUE	DATE OF EXPIRE
XX-XXX-XX	**XX-XXX-XX**

Approved by _____

SUGGESTION

1. Display badge at all time while being in Project site.
2. Follow HSE regulations of Project site.
3. Return this badge to TTCL Admin when employee finished.

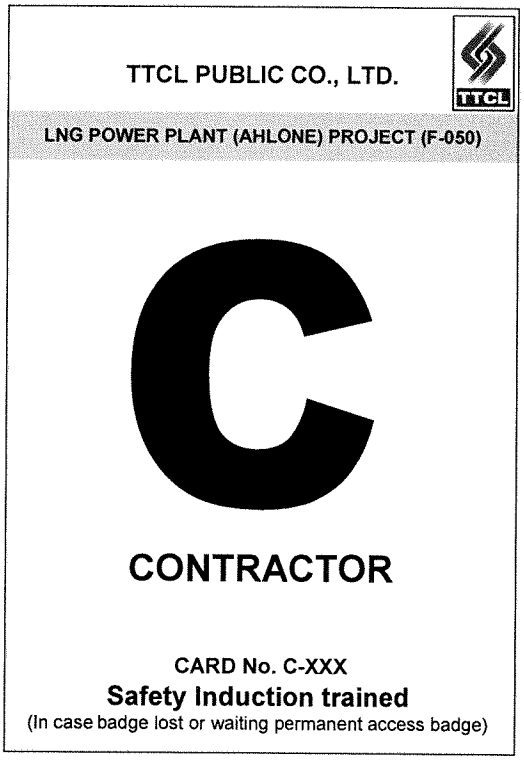
For "Subcontractor"

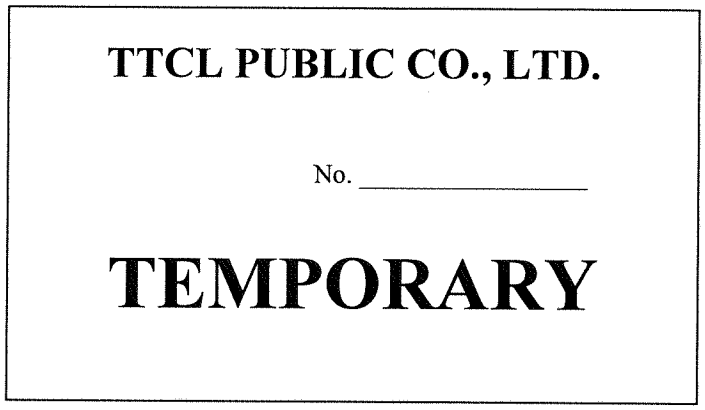
ATTACHMENT 3

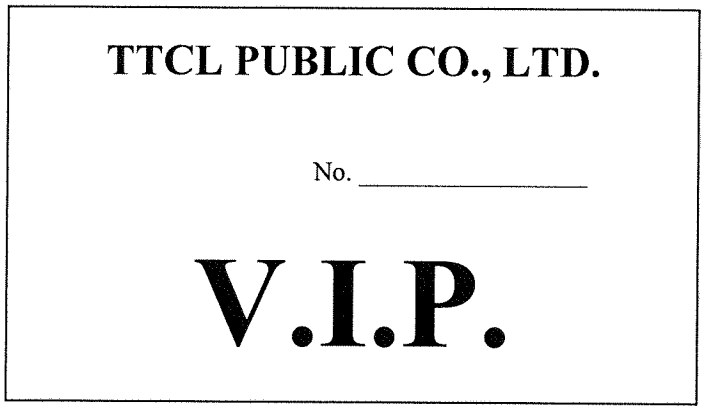
VISITOR BADGES

LNG POWER PLANT (AHLONE) PROJECT (F-050)

Visitor/ Temporary Worker and Government Authority badge







ATTACHMENT 4

MATERIAL EQUIPMENT GATE PASS

TTCL PUBLIC COMPANY LIMITED
LNG POWER PLANT (AHLONE) PROJECT (F-050)

DATE:_____/_____/_____.

MATERIAL / EQUIPMENT REMOVAL GATE PASS

MATERIAL / EQUIPMENT	QUANTITY	REASON FOR REMOVAL FROM SITE

METHOD OF REMOVAL FROM SITE : TRUCK TRAILER OTHER_____(SPECIFY)

DRIVER NAME :	**DRIVER I.D. CARD NO. :**
NAME OF COMPANY :	**VEHICLE REG. NO. :**

REQUESTER : **TTCL / SUBCONTRACTOR**	**APPROVED :** **(TTCL'S DEPARTMENT IN CHARGE)**	**APPROVED :** **(TTCL'S SITE REPRESENTATIVE)**
DISTRIBUTION: **ORIGINAL - SECURITY OFFICER** **PINK - DEPARTMENT IN CHARGE BLUE - REQUESTER / DRIVER**		**CHECK & SIGN.:** **(TTCL'S SECURITY OFFICER)**

ATTACHMENT 5

CAMERA PERMIT

TTCL PUBLIC COMPANY LIMITED

LNG POWER PLANT (AHLONE) PROJECT (F-050)

CAMERA PERMIT

SERIAL No:	**DATE:**
PROJECT NAME:	
USERNAME:	**BADGE NUMBER:**
☐ **TTCL EMPLOYEE** ☐ **SUBCONTRACTOR** ☐ **VENDOR RESPESENTATIVE** ☐ **VISITOR**	
THIS PASS VALID FROM:	**TO:**
PLANNED USAGE:	
RESTRICTIONS:	
REQUESTED BY:	**DATE:**
APPROVED BY:	**DATE:**

TTCL PUBLIC COMPANY LIMITED
LNG POWER PLANT (AHLONE) PROJECT (F-050)

CAMERA PERMIT

Serial No. _____

Badge No. _____

Username. _____

Expiry Date _____

ATTACHMENT 6

VEHICLE GATE PASS

LNG POWER PLANT (AHLONE) PROJECT (F-050)

VEHICLE GATE PASS

TTCL PUBLIC COPANY LIMITED

LNG POWER PLANT (AHLONE) PROJECT

Job No. : F-050_____

TEMPORARY VEHICLE PASS

TTCL PUBLIC COMPANY LIMITED

LNG POWER PLANT (AHLONE) PROJECT

VEHICLE GATE PASS

ISSUED TO : _____

COMPANY : _____

VEHICLE REG. : _____

VEHICLE TYPE: _____

VALIDITY : _____ TO _____

APPROVED BY: _____

ATTACHMENT 7

SAFETY INDUCTION REQUEST

TTCL PUBLIC COMPANY LIMITED
LNG POWER PLANT (AHLONE) PROJECT (F-050)

SAFETY TRAINING / ID CARD REQUEST

DATE: / /

APPLICANT'S NAME (BLOCK CAPITALS)	: _____
POSITION	: _____
APPLICANT'S SEX	MALE FEMALE BLOOD TYPE : _____
DATE OF BIRTH	: _____ / _____ / _____ / RELIGION : _____ DAY MONTH YEAR
NATIONALITY	: _____
HOME ADDRESS	: _____ _____
PRESENT ADDRESS	: _____ _____
EMERGENCY CONTACT	: _____ _____
I.D. or PASSPORT NO.	: _____
COMPANY'S NAME	: _____
TELEPHONE No.	: _____
HEALTH CHECK UP STATUS	: _____
CONGETAL DISEASE	☐ High Blood Pressure ☐ Diabetes ☐ Heart disease ☐ Other _____
SIGN (COMPANY'S REPRESENTATIVE)	SIGN (APPLICANT)

NOTE: TWO (2) PHOTOGRAPHS (2cm X 3cm) AND ONE COPY OF I.D. CARD TO BE ATTACHED.
IF APPLICANT IS FOREIGN NATIONAL, ONE COPY OF WORK PERMIT TO BE ATTACHED.

FOR TTCL CERTIFICATION OF SAFETY INDUCTION
DATE OF SAFETY INDUCTION :

_____/_____/_____

CERTIFIED BY

TTCL USE ONLY.

I.D.CARD No.: _____

CHECKED	APPROVED

ATTACHMENT 8

VISITOR GATE PASS FORM

บริษัท ทีทีซีแอล จำกัด (มหาชน)
TTCL PUBLIC COMPANY LIMITED

DATE :_____/_____/_____

VISITOR GATE PASS

VISITOR'S NAME :		COMPANY :
PERSON / COMPANY TO BE VISITED :		
PURPOSE OF VISIT :		
VISITOR I.D. NO. /		TEMPORARY VEHICLE PASS NO.
TIME (IN) : _____:_____AM/PM	TIME (OUT) : _____:_____AM/PM	ISSUED BY :
SIGN (VISITOR)		SIGN (PERSON VISITED)

❋ TO BE SIGNED UPON COMPLETION OF THE VISIT, AND SUBMITTED BY THE VISITOR TO THE GATE HOUSE UPON LEAVING.

บริษัท ทีทีซีแอล จำกัด (มหาชน)
TTCL PUBLIC COMPANY LIMITED

DATE:_____/_____/_____

REGULAR VEHICLE GATE PASS REQUEST

COMPANY NAME		VEHICLE TYPE
Requested Category of Gate Pass : A : Office Area only (Private Vehicle of Office Staff) ☐ ☐ B : A + Const. Area (Const. Vehicle and Vehicle for access to Site)		
MODEL COLOR		VEHICLE REG. NO.
ENGINE TYPE DIESEL / PETROL		REQUESTED BY

For TTCL use only.

PASS NO.:_____

Checked	Approved

THE FOLLOWING DOCUMENT TO BE ATTACHED:

1. DRIVING LICENSE'S PHOTO COPIED
2. ROAD TAX REGISTRATION'S PHOTO COPIED
3. INSURANCE'S PHOTO COPIED

NOTE : THE REGULAR VEHICLES GATE PASS SHALL BE DISPLAYED INSIDE THE WIND SHIELD AT ALL TIMES

APPENDIX J PERSONALE PROTECTIVE EQUIPMENT PROCEDURE

AHLONE 2

PERSONALE PROTECTIVE EQUIPMENT PROCEDURE

PROJECT DOC. NO. F050-MNL-050

FOR INFORMATION

LNG POWER PLANT (AHLONE) PROJECT

TTCL JOB NO. F-050

Total (Including this Page): 15 sheets

0	04-Oct-18	For Information				
REV.	DATE	DESCRIPTION	MADE	CHECKED	APPROVED	AUTH'D

For Project Use only

Originator	Distribution	PW	PR	MA	ME	PP	EE	IN	CV	QC	PC	Proj	Site	Owner	Total
Project	No. of Copy	-	-	-	-	-	-	-	-	๑	-	ORG.	1	1	4

บริษัท ทีทีซีแอล จำกัด (มหาชน)
TTCL PUBLIC COMPANY LIMITED

Revision History Sheet

Rev.	Date	Description
0	October 04, 2018	For Information

CONTENT

1. PURPOSE

The purpose of this procedure is to establish specification, decision criteria and guidance complied with Notice by Department of Labour Protection and Welfare B.E. 2554 for selection and use of Personal Protective Equipments (PPE) in an effective and safety manner under their limitations. The PPE do not eliminate the working hazards or substitutes for effective engineering, other hazard control measures and safe working conditions, but they are essential for protecting of the individual worker from injury and occupational health illness.

2. SCOPE

This Personal Protective Equipment (PPE) procedure is applied to all personnel entering to the **LNG POWER PLANT (AHLONE) PROJECT** construction site and facilities e.g. warehouse, workshop, or where PPE zone is classified. This procedure shall be used in conjunction with the TTCL HSE, regulations and other HSE procedures that require wearing PPE when performing particular job.

The requirements of this procedure adhere to Local Regulation as the minimum requirement.

3. DEFINITION

Personal Protective Equipment (PPE) Any clothing or equipment that used to shield or isolate individuals from chemical, physical and biological hazards that may be encountered in the work place. This includes, but is not limited to, the following types of equipment:

(a) Hard Hat Safety Helmet

(b) Safety glasses, goggles and shields

(c) Prescription Safety Glasses for personnel who need corrected lenses

(d) Safety Shoe

(e) Safety Gloves

(f) Hearing protection device

(g) Fall arrest harness

(h) Respiratory protection device

(i) Chemical resistance clothing and aprons

PPE Zone — Any area where the wearing PPE are specified and the mandatory PPE wearing signs existed, except the specific area or walkway in the work shop or warehouse and normal office work which does not require PPE.

Chemical Hazard — This arises from excessive airborne concentration of mist, vapors gases, or solids that are in the form of dusts or fumes. In addition to the hazard of inhalation, many of these materials may act as skin irritants or toxic by absorption through the skin or swallow.

Physical Hazard — This kind of hazard includes noise, thermal stress, vibration, darkness, light, radiation and electrical that can adversely affect employee health safety and productivity.

Biological Hazard — This includes insects, molds, fungi, bacterial and virus contamination, Bird-Flu, mosquitoes, rodents, ant, cockroach, fly and infectious microorganisms.

4. RESPONSIBILITY

Proper selection, use and maintenance of PPE are essential for employee safety. All TTCL employees and subcontractors shall be aware of their individual responsibilities.

4.1 TTCL PROJECT MANAGER (PM)

(a) Responsible for assuring implementation of Site Safety Rules and Regulations concerning with PPE is properly implement by TTCL, Subcontractors and other concerned parties in the project.

(b) To ensure that TTCL staffs and subcontractors are provided and equipped with a proper PPE use at all times while performing jobs in Project construction area.

(c) To ensure that visitors have their proper PPE and comply with this procedure.

(d) Lead by an example, modeling the behavior expected from all personnel performing work at the jobsite.

4.2 TTCL CONSTRUCTION MANAGER (CM)

(a) CM is responsible for construction execution of Site Safety Rules and Regulations that make safe operation by TTCL employees, Subcontractors employees including visitors and concerned persons.

(b) To ensure that TTCL staffs and subcontractors are provided and equipped with a proper PPE use at all times while performing jobs in Project construction area.

(c) To ensure that the PPE in Project construction area is maintained in sanitary and reliable condition.

(d) Lead by an example, modeling the behavior expected from all personnel performing work at the jobsite.

4.3 TTCL HSE MANAGER (HSEM)

HSEM is responsible to develop an effective this procedure as following;

(a) To ensure that TTCL staffs and subcontractors are provided and equipped with a proper PPE use at all times while performing jobs in Project construction area.

(b) Provide the PPE training program for TTCL staffs and/or Subcontractors follow with project requirements.

(c) To ensure that the PPE in Project construction area is maintained in sanitary and reliable condition.

(d) To establish and implement the use of PPE to employees under supervision before doing work-training program to know when PPE are necessary; what types are necessary; how they are to be worn; and what their limitations are.

(e) Determine hazardous zones that required the use of PPE to be presented or likely.

(f) Ensure that this procedure is administered properly and develops this procedure where necessary.

(g) Develop and revise standards, work instructions that related to PPE program.

(h) Define and maintain an update TTCL PPE General requirement and specification.

(i) Recommend an appropriate PPE used base on government mandatory notice by Department of Labour Protection and Welfare B.E.2554 concerning with PPE standard.

(j) Lead by an example, modeling the behavior expected from all personnel performing work at the jobsite.

4.4 TTCL PROJECT SITE ADMIN

TTCL Project Site Admin is responsible to provide and maintain sufficient inventory PPE and safety sign complying with specifications and standards.

4.5 SUBCONTRACTOR MANAGEMENT REPRESENTATIVE

Subcontractor Management Representatives is responsible to;

(a) Provide their own PPE and that PPE meet the local regulations and accepted standards specifications.

(b) Ensure that Subcontractor employees absolutely follow Site Safety Rules and Regulations.

(c) Ensure that all supports as need with PPE requirements are appropriate response and collaborations.

(d) Ensure that subcontractor employees are provided and equipped with a proper PPE use at all times while performing jobs in project construction area.

(e) Monitoring their employee safety performance concerning with PPE and take appropriate corrective / preventive action as need.

(f) Ensure that subcontractor employees are provided with and receive training in the selection and use of PPE.

(g) Ensure that PPE for employees is maintained in sanitary and reliable condition.

(h) Lead by an example, modeling the behavior expected from all personnel performing work at the jobsite.

4.6 EMPLOYEES / WORKERS

(a) All employees/ workers at all levels are involved in Site Safety Rules and Regulations procedure. The objectives are preventing accidents, avoiding hazards to health and environmental impact protection.

(b) Know, understand and carry out duty in accordance with Site Safety Rules and Regulations, work instructions and permit to work system that related to PPE.

(c) To make a full and proper use of all PPE provided by company.

(d) To ensure that PPE are maintained properly.

(e) To inspect PPE prior to use and routinely afterwards. Notify supervisor and find the replacement when any equipment is found to be unsatisfactory condition and need to be removed from Project construction area.

4.7 VISITOR

(a) Visitor is responsible to comply with PPE Policy and Instructions with this procedure.

(b) Project Site Admin shall temporally provide their PPE for Visitor and Visitor shall return their PPE to Project Site Admin after used.

(c) Project Site Admin is responsible to be sanitary cleanness their PPE for next usage purpose.

5. INSTRUCTION

The employer is responsible for requiring the wearing of appropriate Personal Protective Equipment in all operations where there is an exposure to hazardous conditions or where this procedure is indicates the need for using such equipment to reduce the hazards to the employee.

Types of PPE cover Head, Hearing, Eyes, Face, Respiratory, Hand/Arm, Body and Foot / Leg Protection. Uses of PPE depend on the potential hazards to be encountered.

5.1 BASIC PPE

Basic PPE is a minimum requirement which complies with Project Safety Rules in the Project Construction, warehouse and workshop areas are follows;

(a) Safety hat safety Helmet

(b) Safety glasses.

(c) Safety Shoes

(d) Long sleeve shirt and pants.

5.2 SPECIFIC PPE

Specific PPE is an additional requirement on basic PPE usage. Specific PPE is depending on tape of work or specific hazard in construction area or rise by JSA or Risk Assessments identification or other activities to meet the desirable degree of protection. The particular jobs which are required specific or additional PPE refer to the risk assessments such as but not limit to;

- Hearing loss Protection (ear plugs or ear muffs)
- Respiratory protection (dust, mist, fume, gases)
- Work at Height protection (Please see the SP-650-017 " Fall Protection Procedure")

- Working in Confined Space. (Please see SP-650-001 "Confined Space Entry Procedure")
- Hot work (Safety shoes, welder's Goggles, welding helmets or welding goggles ,Rubber Gloves or cotton Gloves, Fireproof Blue collar)
- Etc.

In addition, PPE shall be used according to PPE zone where wearing specific PPE are specified.

5.3 PPE SELECTION

All PPE specification (basic and specific) that to be used in TTCL premises shall be complied with Notice of Department of Labour and Welfare B.E.2554 as defined in Attachment 1 – TTCL PPE Standard Reference. The desirable degree of protection is considered as specified in Job Safety Analysis, Risk Assessment and encounter hazards appearance. If there is any constrain selection of the PPE occurred, foreseeable emergency situations have also to be evaluated. PPE have to be correctly fit and adjust for effective and maximum comfort. PPE fit test shall be conducted in regularly period. There is a lot of type and number available, thus providing individual choice and thereby encouraging use purpose.

5.4 PROCUREMENT & STORAGE

(a) All PPE that to be purchasing shall be defined specification in accordance with Attachment 1 - TTCL PPE Standard Reference and Attachment 2 - TTCL PPE General Requirements and Specifications.

(b) Basic PPE (included full body safety harness) have to be kept by Project Site Admin department with a minimum stock to be ready for service request.

(c) Special PPE (included SCBA but excluded full body safety harness) that need where there is an exposure to hazardous condition or for particular jobs such as working in confine space, loud noise working environment, respiratory hazardous atmosphere, etc. have to be kept and usage controlled by Project HSE department.

5.5 CARE AND MAINTENANCE

(a) The expected degree of protection shall not be achieved in practice unless PPE was cleaned and well maintained.

(b) Each employee is responsible for the proper cleaning and sanitizing of own protective clothing and personal protective equipment.

(c) All PPE which worn on face, eyes, respiratory system or in contact with the skin have to be thoroughly cleaned and sanitized after being used .

(d) The common borrowing PPE for visitor, Project Site Admin shall temporally provide their PPE for them and return their PPE after used. Site Admin shall maintain in sanitary and reliable condition their PPE prior another use. Typical items include:

- Safety hat,
- Ear Plugs / Ear Muffs,
- Spectacles or goggles,
- Safety shoes,
- Lather gloves,
- Rubber Boots,
- Half mask for respiratory protection,
- Protective clothing.

(e) Safety helmet shall never be painted, as the paint or solvent shall damage the helmet.

(f) Safety helmet shall never be drilled a hole, as a hole on the hat shall possible decrease protective strength resistant of helmet.

(g) Direct exposed sunlight or excessive heat for storage or placement the Safety helmet shall be avoided because it shall be distorted and damaged to helmet shell. It may split and crack or decrease hardness which is lead to loss of impact resistant characteristic.

(h) Lather gloves, rubber gloves, cotton gloves shall be keep at ambient temperature away from the light, moisture, solvents and chemicals.

(i) Chemical Protective Clothing or Suit shall be keep at ambient temperature, good ventilation and away from direct sunlight, excessive heat or moisture. Any contamination on the suit shall be washed or wiped off immediately where practicable or on completion of the jobs or on the end of working day. Water and mild detergent is usually adequate usage but contaminated solution shall properly containment and disposal.

(j) Safety harness, lanyard and all restraining lines shall be cleaned and regularly examined comply with manufacturer advice.

(k) Respirators shall be always thoroughly cleaned after use. It shall be stored in a clean, dry condition and close receptacle away from direct sunlight. A clean plastic bag is suitable for this purpose. Repairing of PPE shall be followed by manufacturer guideline. Employees shall immediately discontinue using of any malfunction or defected PPE.

5.6 INSPECTION and REPLACEMENT

Each employee is responsible for routing inspection of PPE prior use and after used. Inspection guidelines are as following but not limit to.

(a) All PPE components and accessories, if any, shall be visually inspected daily for sign of dents, cracks, penetration and damage/defect due to impact, rough provided.

(b) The manufacturer instructions are recommended to use as a guideline for inspection and replacement. Replacement of PPE should take place when the PPE are found expired or damaged / defected and not fit for use.

(c) The manufacturer instructions are recommended to use as a guideline to define PPE expiration.

(d) For safety helmet, practical experience suggests that the replacements for polyethylene and polycarbonate helmet are 2-3 years and 5-6 years respectively. Additionally, safety helmet should be smooth and shiny to reflect solar heat. However, if the safety helmet has been subjected to a heavy impact as well as its visible damage occurred, the helmet should be replaced.

(e) For Respiratory Protection, according to the recommendation from manufacturer is the replacement period of respiratory protection PPE should be considered as follows;

1) Face piece (Rubber made)

- Physical damaged of face piece accepts for head straps due to it can replace with spare part
- Does not fit to face. (fit test result)
- Inhalation valve is not work or damaged

2) Face Piece (silicone made), normally 1 or 1.5 years if on shelf but the following finding observed shall be replaced;

- Physical damaged of face piece (Accepts head straps. It can be replaced with spare part
- Does not fit to face. (fit test result)
- inhalation valve is not work or damaged

3) Air Purify element or filter, the following finding observed shall be replaced;

- Physical damage filter cartridge.
- 6 months expired after packing was open.
- Saturated filter with get smell inside respirator. (breakthrough filter)

5.7 DISPOSAL

Contaminated, expired, damaged, defected and unfit for use of PPE shall be suitably disposed as define in (SP-650-021 _Waste Management Plan) by Authorized Waste Disposal Service Company. Therefore, each employee shall individual dispose own non used PPE as above. It shall not be disposed in general garbage bin.

6. APPENDIX

APPENDIX A PPE SPECIFICATION AND STANDARD REFERENCE

APPENDIX A

TTCL PUBLIC COMPANY LIMITED
LNG POWER PLANT (AHLONE) PROJECT

PPE SPECIFICATION AND STANDARD REFERENCE

No	Personal Protective Equipment	Standard
1.	**Head Protection**	
	- Helmet	TIS 368-1995 /ANSI/ISEA Z89.1-2009, EN 397:1995
	- Face shield	ANSI/ISEA Z87.1-2003, EN 166
2.	**Hand Protection**	
	- Gloves	EN 420
3.	**Eye Protection**	
	- Safety Glasses	ANSI Z87.1-2003, EN 166 FT CE
	- Goggle	
4.	**Hearing Protection**	
	- Ear plug	ANSI S12.6-1984
	- Ear muff	
5.	**Fall Protection**	ANSI A10.32
	- Safety Belt	
	- Safety Harness	ANSI A10.32/CE 120 EN 361
	- Land yard	ANSI A10.32/CE 120 EN 354
6.	**Respiratory Protection**	
	- Disposable Respirator	ANSI Z88.6 Respirator Use
	- Air purify Respirator	ANSI Z88.7-2001
	- SCBA & Supplied Air Respirator	ANSI Z88.2-1992
7.	**Chemical Protective Clothing**	ASTM F2061/EN943.1-1997
8.	**Safety Shoe**	
	- Safety Shoe	TIS 523-1985 / ANSI Z41-1991, EN345

Remark: These PPE standards shall be comply with Notice by Department of Labour Protection and Welfare B.E. 2554 for the specific PPE standards requirements.

APPENDIX K PHYSICAL IN-SITU SAMPLING DURING DRY SEASON FROM SEM

Physical Baseline Studies Report (Dry Season)

For

The Extension of Power Generation Activities (TTCL)

In Ahlone and Dala Townships

TABLE OF CONTACTS

List of Table

List of the Figure

PHYSICAL ENVIRONMENT BASELINE
For Dry Season

1.1 Outline

The actual physical baseline survey for environmental impact assessment was surveyed at/near gas turbine power plant, Ahlone and Dala Township, Yangon Region. Ten air quality and noise monitoring locations, three locations of groundwater, fourteen locations of surface water quality, nine locations of soil quality and six locations of sediment survey were measured and collected. The summary of physical environmental survey is shown in Table 1.1-1, and sampling points for environmental survey are shown in Figure 1.1-1.

Table 1.1-1 Summary of Physical Environmental Survey for Dry Season

Air Quality & Meteorology	Parameter	1) Nitrogen Dioxide, 2) Nitric Oxide, 3) Sulphur Dioxide, 4) Particulate Matter PM10, 5) Particulate Matter PM 2.5, 6) Carbon Monoxide, 7) Relative Humidity, 8) Temperature, 9) Wind Speed, and 10) Wind Direction
	Period	10 points for one time within three continuous days
	Location	Residential and rural areas
Noise Level	Parameter	LAeq (A-weighted loudness equivalent)
	Period	One time at 10 locations within two continuous days
	Location	Residential and rural areas
Surface Water Quality	Parameter	1)Water Depth, 2) Flow rate, 3) Water temperature, 4) pH, 5) Salinity, 6) Electrical Conductivity, 7) Dissolved Oxygen, 8) Total Dissolved Solid, 9) Turbidity, and 10) Color
	Period	One time at 14 locations
	Location	River and Stream
Ground Water Quality	Parameter	1)Tube well Depth, 2) Water temperature, 3) pH, 4) Salinity,5) Electrical Conductivity, 6) Dissolved Oxygen, 7) Total Dissolved Solid, and 8) Color
	Period	One time at 3 locations
	Location	Wells
Soil Quality	Parameter	In-situ
	Period	One time at 9 locations
	Location	Residential and rural areas
Sediment	Parameter	In-situ
	Period	One time at 6 locations
	Location	River

Source: Field Survey, May 2018

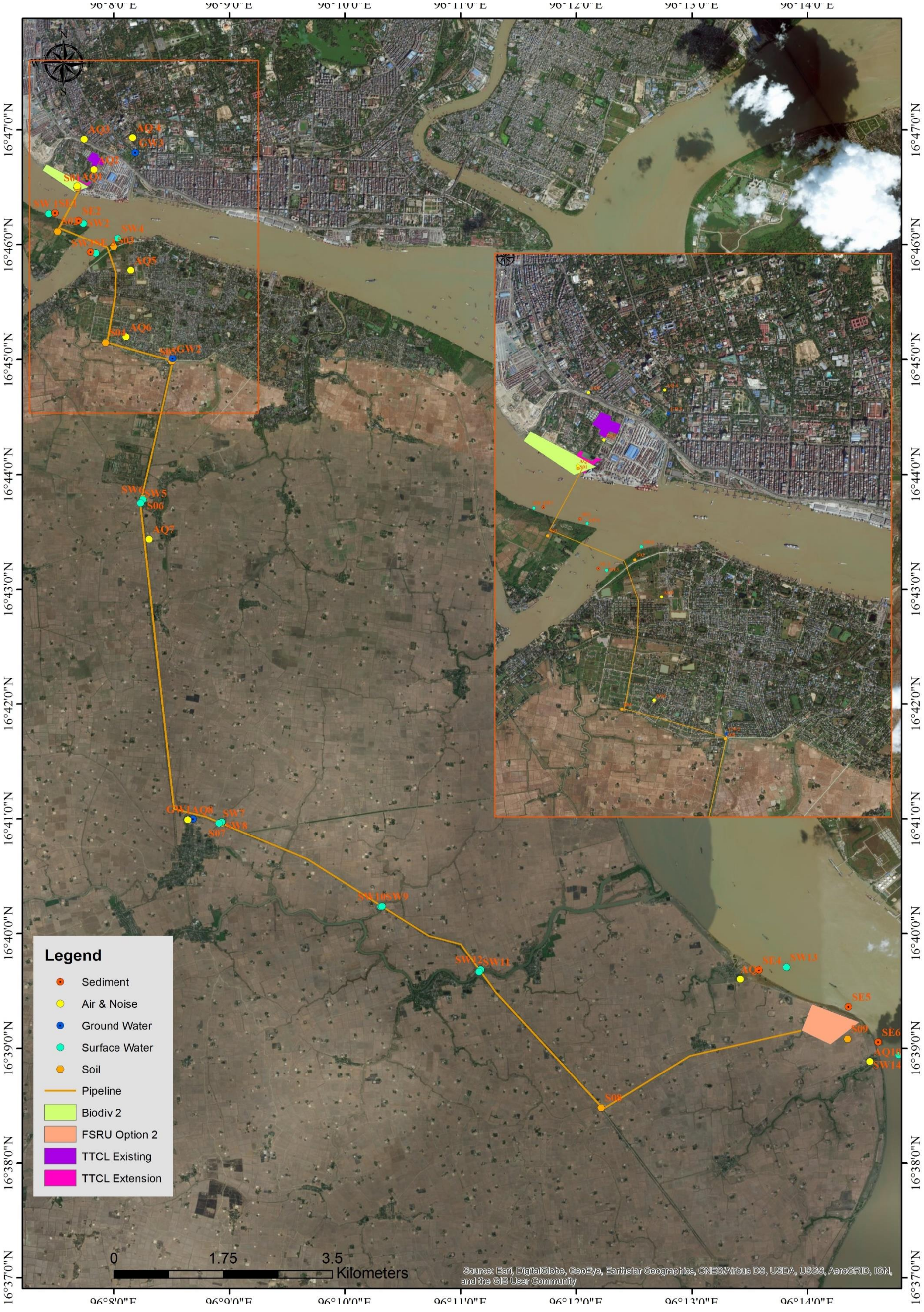


Figure 1.1-1 Location map of water, air, noise and soil quality survey

1.2 Air Quality

1.2.1 Survey Item

Myanmar National Environmental Quality (Emission) Guidelines were announced on 29th December, 2015 and guideline values for air pollution level are shown in Table 1.2-1.

Table 1.2-1 Myanmar National Environmental Quality Guideline values for survey parameters of air quality

No	Parameter	Averaging Period	Guideline Value	Units
1.	Nitric oxide	-	-	µg/m3
2.	Nitrogen dioxide	1-hour	200	µg/m3
3.	Sulphur dioxide	24-hour	20	µg/m3
4.	Particulate matter PM_{10} [a]	24-hours	50	µg/m3
5.	Particulate matter $PM_{2.5}$ [b]	24-hours	25	µg/m3
6.	Carbon Monoxide	-	-	-
7.	Relative Humidity	-	-	%
8.	Temperature	-	-	℃
9.	Wind Speed	-	-	-
10.	Wind Direction	-	-	-

Remark: PM_{10} [a] = Particulate matter 10 micrometers or less in diameter

$PM_{2.5}$ [b] = Particulate matter 2.5 micrometers or less in diameter

1.2.2 Survey Location

The coordinate location of air quality monitoring survey in detail are shown in Table 1.2-2.

Table 1.2-2 Sampling location for air quality survey

Sampling Points	Coordination	Description of Sampling Point
AQ1/N1	16°46'30.69"N 96° 7'41.11"E	In the compound of Combined Cycle Power Plant (at project area) located in Ahlone Township, Yangon Region
AQ2/N2	16°46'39.33"N 96° 7'49.79"E	Same as the AQ1/N1
AQ3/N3	16°46'55.17"N 96° 7'44.70"E	In the compound of Aung Mingalar Monastery (near the Kannar Road) located in Ahlone Township, Yangon Region
AQ4/N4	16°46'56.00"N 96° 8'10.00"E	In the compound of Church (near the Thakhinmya Park) which located in Ahlone Township, Yangon Region
AQ5/N5	16°45'46.67"N 96° 8'8.97"E	In the compound of No. (22) Basic Education Primary School which located in Dala Township, Yangon Region
AQ6/N6	16°45'11.99"N 96° 8'6.46"E	In the compound of Yadanarayeyeikthar Monastery located in Kyansitthar Ward, Dala Township, Yangon Region
AQ7/N7	16°43'26.10"N 96° 8'18.40"E	In the Nuaung Ngok To Village, in Dala Township, Yangon Region
AQ8/N8	16°40'59.48"N 96° 8'38.41"E	In the compound of Pyasu Monastery which located in Pyaw Bwe Gyi Village, Dala Township, and Yangon Region
AQ9/N9	16°39'36.00"N 96°13'25.32"E	In the compound of Aung Mingalar Monastery which located in That Kai Kwin Village, Dala Township, and Yangon Region
AQ10/N10	16°38'53.04"N 96°14'32.48"E	In the Chaung Oo Village which located in Dala Township, Yangon Region

AQ1/N1

AQ1/N1 was measured in the compound of Combined Cycle Power Plant Project (Ahlone) which located in Ahlone Township, Yangon, and the project area. It is also situated in the left bank of Hlaing River and behind the Ahlone gas turbine power plant. The shrub land and Mangrove Forest encircled are occurred at the location. The possible pollution source might be emitted from gas turbine power plant funnel. The unusual noises may be come out of the gas turbine power plant generator and the traffic activity of boats and ships in 24 hours. The activities of AQ1/N1 is shown in Figure 1.2-1.


Figure 1.2-1 Air quality monitoring survey at AQ1/N1

AQ2/N2

AQ2/N2 was observed in the compound of Combined Cycle Power Plant Project (Ahlone) which located in Ahlone Township, Yangon, and the project area. The area is flat terrain with bushes and near power plant generator. The possible air pollution source may be come from gas turbine power plant funnel. As the power plant generator is running the whole day, the noise source may also be come from it. The activities of AQ2/N2 is shown in Figure 1.2-2.

Figure 1.2-2 Air quality monitoring survey at AQ2/N2

AQ3/N3

AQ3/N3 was surveyed in the compound of Aung Mingalar Monastery (near the Kannar Street) and about monitoring point is set up at upstairs of monastery with 6 feet in height. There is a generator room behind the monastery and it generally works two times per day. The location is encircled by residential houses. It is possible that pollution source emitted from the human activities. The unusual noises may be come out generator and traffic activity by cars and lorry in 24 hours. The activities of AQ3/N3 is shown in Figure 1.2-3.

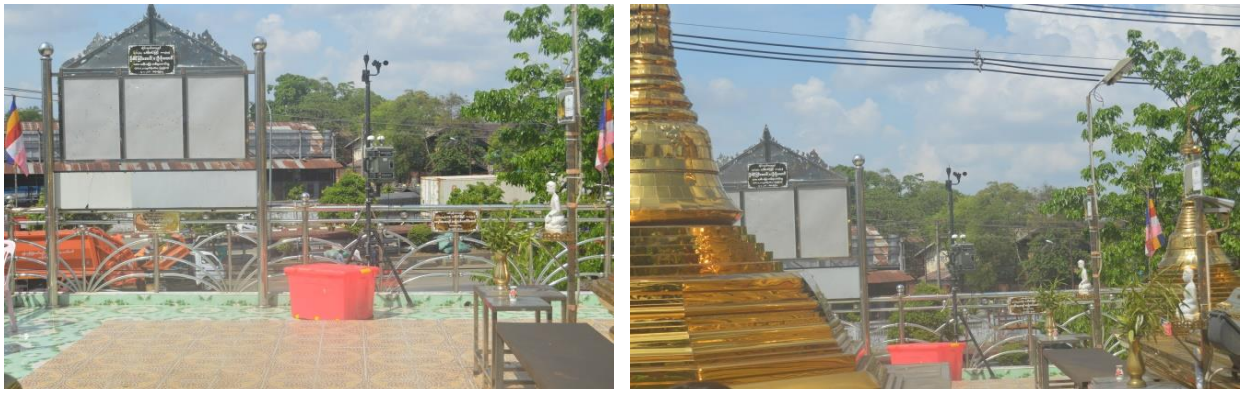


Figure 1.2-3 Air quality monitoring survey at AQ3/N3

AQ4/N4

AQ4/N4 was surveyed in the compound of Church (near the Thakhinmya Park) which located in Ahlone Township, Yangon Region and lies about 1.03 kilometers at northeast of power plant. It is possible that pollution source emitted from the human activities. The unusual noises may be come out traffic activity by motorbike in the day time. The activities of AQ4 is shown in Figure 1.2-4.

Figure 1.2-4 Air quality monitoring survey at AQ4/N4

AQ5/N5

AQ5/N5 was measured in the compound of No. (22) Basic Education Primary School which located in Dala Township, Yangon Region. It situated 0.22 kilometers away from proposed gas pipeline. The location is encircled by many residential houses. It is possible that pollution source emitted from the human activities. The unusual noises may be come out traffic activity by motorbike in the day time. The activities of AQ5/N5 is shown in Figure 1.2-5.

Figure 1.2-5 Air quality monitoring survey at AQ5/N5

AQ6/N6

AQ6/N6 was monitored in the compound of Yadanarayeyeikthar Monastery which located in Kyansitthar Ward, Dala Township, and Yangon Region and fared about 0.17 kilometers at north of gas pipeline. The location is surrounded by residential houses. The possible pollution source may be emitted from residences activities. The unusual noises may be come out the activities of human. The activities of AQ6/N6 is shown in Figure 1.2-6.

Figure 1.2-6 Air quality monitoring survey at AQ6/N6

AQ7/N7

AQ7/N7 was observed in the Nuaung Ngok To Village, Dala Township, Yangon Region and situated about 0.07 kilometers away from proposed gas pipeline. The location is at flat terrain and encircled with residential houses. It is possible that pollution source emitted from the human activities. The unusual noises may be come out traffic activities of motorbike in the day time. The activities of AQ7/N7 is shown in Figure 1.2-7.

Figure 1.2-7 Air quality monitoring survey at AQ7/N7

AQ8/N8

AQ8/N8 was surveyed in the compound of Pyasu Monastery in Pyaw Bwe Gyi Village, Dala Township. It lies about 0.11 kilometers away from proposed gas pipeline. There is a grain mill in front of monastery and it works in the day time. The location is surrounded by many residential houses. It is possible that pollution source emitted from crematorium and the human activities. The unusual noises may be come out grain mill and traffic activity by cars and motorbike in the day time. The activities of AQ8/N8 is shown in Figure 1.2-8.

Figure 1.2-8 Air quality monitoring survey at AQ8/N8

AQ9/N9

AQ9/N9 was measured in the compound of Aung Mingalar Monastery, That Kai Kwin Village, Dala Township, Yangon Region. It lies about 1.02 kilometers away from proposed gas pipeline. The measured point is situated near bushes, trees, and paddy field. The location is surrounded by residential houses. It is possible that pollution source emitted from the residents' activities. The unusual noises may be come out wind blowing sound and tiny bell sound on the pagoda. The activities of AQ9/N9 is shown in Figure 1.2-9.

Figure 1.2-9 Air quality monitoring survey at AQ9/N9

AQ10/N10

AQ10/N10 was monitored in the Chaung Oo Village, Dala Township, Yangon Region and sited about 0.59 kilometers at southeast of proposed FSRU Option 2. It situated near paddy field and by the right band of Yangon River. The location is encircled by many residential houses. It is possible that pollution source emitted from the human activities. The unusual noises may be come out traffic activity by motorbike, boats and ships in 24 hours. The field activities of AQ10/N10 is shown in Figure 1.2-10.

Figure 1.2-10 Air quality monitoring survey at AQ10/N10

1.2.3 Survey Period

Air quality survey was conducted from 2nd - 15th of May 2018 for baseline studies. Each sampling duration is described in Table 1.2-3.

Table 1.2-3 Sampling Duration for Air Quality Survey

Point	Period
AQ1 **AQ2** **AQ3**	May 2nd – 5th, 2018 (72 hours)
AQ5 **AQ6** **AQ7**	May 6th – 9th, 2018 (72 hours)
AQ8 **AQ9** **AQ10**	May 9th – 12nd, 2018 (72 hours)
AQ4	May 12nd – 15th, 2018 (72 hours)

1.2.4 Survey Method

Methodology

Sampling and analysis of ambient air pollutants were conducted by referring to the recommendation of United States Environmental Protection Agency (U.S. EPA). The Haz-Scanner EPAS Wireless Environmental Perimeter Air Station was used to collect Ambient Air Monitoring data.

Table 1.2-4 Sampling and Analysis Method for Air Quality

No.	Parameter	Analysis Method
1	Nitric oxide (NO_x)	On site reading
2	Nitrogen dioxide (NO2)	On site reading
3	Sulphur dioxide (SO2)	On site reading
4	Particulate matter 10 (PM10)	On site reading
5	Particulate matter 2.5 (PM2.5)	On site reading
6	Carbon Monoxide	On site reading
7	Relative Humidity	On site reading
8	Temperature	On site reading
9	Wind Speed	On site reading
10	Wind Direction	On site reading

1.2.5 Survey Result

AQ1

Average values of ambient gaseous levels at AQ1 are shown in Table 1.2-5. NO_2, PM10 and SO_2 concentrations are within the standard while PM2.5 concentrations occur higher than the standard for two days in 72 hours continuous monitoring. So, it generally means the area had few particulates sources at the area. Hourly results of AQ1 described in appendix.

Table 1.2-5 Daily Ambient air quality results at AQ1

Date	**Time**	**CO**	**NO2**	**NO**	**PM2.5**	**PM10**	**RH**	**SO2**	**TmpC**
D.M.Y	**hours**	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	**%**	µg/m3	**Deg. C**
2-3 May, 2018	24	61.16	20.94	0.01	11.78	17.91	79.28	12.18	28.60
3-4 May, 2018	24	60.26	28.58	0.01	30.04	41.39	83.57	4.52	29.56
4-5 May, 2018	24	110.66	25.79	0.01	47.44	49.14	82.41	9.52	29.30
Myanmar emission guideline value (24 hours)		-	200 (1 hour)	-	25	50	-	20	-

AQ2

Average values of ambient gaseous levels at AQ2 are shown in Table 1.2-6. NO_2, PM2.5, PM10 and SO_2 concentrations are within the standard expect PM2.5 for last day of survey period. Generally, it can say the area is lower than the standard except one day period for PM2.5 at the area. Hourly results of AQ2 described in appendix.

Table 1.2-6 Daily Ambient air quality results at AQ2

Date	**Time**	**CO**	**NO2**	**NO**	**PM2.5**	**PM10**	**RH**	**SO2**	**TmpC**
D.M.Y	**hours**	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	**%**	µg/m3	**Deg. C**
2-3 May, 2018	24	60.15	20.93	15.32	8.38	9.16	68.07	5.96	28.99
3-4 May, 2018	24	59.36	28.34	13.93	25.79	30.15	74.12	4.49	29.26
4-5 May, 2018	24	80.28	25.64	18.71	35.76	42.63	73.62	8.66	28.60
Myanmar emission guideline value (24 hours)		-	200 (1 hour)	-	25	50	-	20	-

AQ3

Average values of ambient gaseous levels at AQ3 are shown in Table 1.2-7. NO_2, PM2.5, PM10 and SO_2 concentrations are within the standard. Hourly results of AQ3 described in appendix.

Table 1.2-7 Daily Ambient air quality results at AQ3

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	**hours**	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	**%**	µg/m3	**Deg. C**
2-3 May, 2018	24	230.34	71.42	0.00	24.36	29.24	74.19	12.54	28.62
3-4 May, 2018	24	291.27	62.96	0.05	2.25	7.28	80.48	19.88	27.51
4-5 May, 2018	24	313.26	43.47	0.06	2.20	7.69	73.45	28.03	28.47
Myanmar emission guideline value (24 hours)		-	200 (1 hour)	-	25	50	-	20	-

AQ4

Average values of ambient gaseous levels at AQ4 are shown in Table 1.2-8. CO and NO_x values are not specified in Myanmar emission guideline. NO_2, PM2.5, PM10 and SO_2 concentrations are within the standard according to the baseline monitoring survey. Hourly results of AQ4 described in appendix.

Table 1.2-8 Daily Ambient air quality results at AQ4

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	**hours**	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	**%**	µg/m3	**Deg. C**
12-13 May, 2018	24	344.42	47.60	0.00	2.24	7.21	84.04	27.68	25.77
13-14 May, 2018	24	183.65	56.95	0.0004	2.45	8.57	74.62	10.36	28.08
14-15 May, 2018	24	224.91	60.19	0.036	2.12	7.57	82.28	14.89	26.76
Myanmar emission guideline value (24 hours)		-	200 (1 hour)	-	25	50	-	20	

AQ5

Average values of ambient gaseous levels at AQ5 are shown in Table 1.2-9. CO and NO_x values are not specified in Myanmar emission guideline. NO_2, PM2.5, PM10 and SO_2 concentrations are within the standard according baseline monitoring survey. Hourly results of AQ5 described in appendix.

Table 1.2-9 Daily Ambient air quality results at AQ5

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	**hours**	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	**%**	µg/m3	**Deg. C**

06-07 May, 2018	24	121.72	50.59	0.018	2.15	7.10	73.13	8.77	29.55
07-08 May, 2018	24	143.51	58.58	0.025	2.38	9.45	71.73	5.94	30.11
08-09 May, 2018	24	147.02	59.53	0.026	2.44	7.65	71.52	6.50	30.25
Myanmar emission guideline value (24 hours)		-	200 (1 hour)	-	25	50	-	20	

AQ6

Average values of ambient gaseous levels at AQ6 are shown in Table 1.2-10. CO and NO_x values are not specified in Myanmar emission guideline. NO_2, PM2.5, PM10 and SO_2 concentrations are within the standard. Hourly results of AQ6 described in appendix.

Table 1.2-10 Daily Ambient air quality results at AQ6

Date	**Time**	**CO**	**NO2**	**NO**	**PM2.5**	**PM10**	**RH**	**SO2**	**TmpC**
D.M.Y	**hours**	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	**%**	µg/m3	**Deg. C**
06-07 May, 2018	24	58.92	19.94	22.13	20.59	22.06	70.36	12.82	30.72
07-08 May, 2018	24	80.74	26.89	21.70	21.05	22.62	66.67	11.36	30.16
08-09 May, 2018	24	77.61	26.67	19.98	25.08	26.74	68.06	8.78	31.95
Myanmar emission guideline value (24 hours)		-	200 (1 hour)	-	25	50	-	20	

AQ7

Average values of ambient gaseous levels at AQ7 are shown in Table 1.2-11. NO_2, PM2.5, PM10 and SO_2 concentrations are within the standard. Hourly results of AQ7 described in appendix.

Table 1.2-11 Daily Ambient air quality results at AQ7

Date	**Time**	**CO**	**NO2**	**NO**	**PM2.5**	**PM10**	**RH**	**SO2**	**TmpC**
D.M.Y	**hours**	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	**%**	µg/m3	**Deg. C**
06-07 May, 2018	24	114.96	58.86	0.010	24.36	29.24	75.99	2.77	32.23
07-08 May, 2018	24	129.54	59.82	0.569	24.18	24.89	74.43	5.15	33.17
08-09 May, 2018	24	144.84	74.29	0.012	21.73	29.09	74.01	7.48	33.68
Myanmar emission guideline value (24 hours)		-	200 (1 hour)	-	25	50	-	20	

AQ8

Average values of ambient gaseous levels at AQ8/N8 are shown in Table 1.2-12. NO_2, PM2.5, PM10 and SO_2 concentrations are within the standard. Hourly results of AQ8 described in appendix.

Table 1.2-12 Daily Ambient air quality results at AQ8/N8

Date	**Time**	**CO**	**NO2**	**NO**	**PM2.5**	**PM10**	**RH**	**SO2**	**TmpC**
D.M.Y	**hours**	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	**%**	µg/m3	**Deg. C**
09-10 May, 2018	24	109.20	63.04	0.02	2.12	8.63	79.19	6.63	28.28
10-11 May, 2018	24	128.88	59.94	0.01	2.35	7.33	85.17	5.51	26.07
11-12 May, 2018	24	152.42	76.32	0.01	2.94	8.51	89.38	6.43	25.00
Myanmar emission guideline value (24 hours)		-	200 (1 hour)	-	25	50	-	20	

AQ9

Average values of ambient gaseous levels at AQ9 are shown in Table 1.2-13. NO_2, PM2.5, PM10 and SO_2 concentrations are within the standard. Hourly results of AQ9 described in appendix.

Table 1.2-13 Daily Ambient air quality results at AQ9

Date	**Time**	**CO**	**NO2**	**NO**	**PM2.5**	**PM10**	**RH**	**SO2**	**TmpC**
D.M.Y	**hours**	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	**%**	µg/m3	**Deg. C**
09-10 May, 2018	24	69.01	40.10	0.01	20.63	25.93	72.89	9.09	35.41
10-11 May, 2018	24	111.79	23.69	0.01	25.82	40.89	84.30	11.51	29.17
11-12 May, 2018	24	66.81	41.46	0.00	22.47	26.46	86.00	3.42	29.72
Myanmar emission guideline value (24 hours)		-	200 (1 hour)	-	25	50	-	20	

AQ10

Average values of ambient gaseous levels at AQ10 are shown in Table 1.2-14. NO_2, PM2.5, PM10 and SO_2 concentrations are within the standard. By the one calculated result, concentration of PM2.5 is fairly higher than the standard for first day. Hourly results of AQ10 described in appendix.

Table 1.2-14 Daily Ambient air quality results at AQ10

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	**hours**	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	**%**	µg/m3	**Deg. C**
09-10 May, 2018	24	60.90	36.20	15.75	28.10	27.31	71.55	15.64	30.28
10-11 May, 2018	24	48.27	24.16	13.20	20.86	26.63	75.56	4.94	28.42
11-12 May, 2018	24	54.16	43.83	13.09	25.22	31.68	74.12	10.50	28.60
Myanmar emission guideline value		-	200 (1 hour)	-	25	50	-	20	

Wind Speed and Wind Direction

The average wind speed and direction were collected for 72 hours continuous in each location. According to the wind rose diagram, average wind speed of varies from 0.01 to 6.50 m/s in covering the all stations. Generally, Prevailing wind direction of all quality station are blowing from north, northeast and southeast and southwest direction. By the wind rose diagram, the dominant wind direction are southeast and southwest quadrant. Wind speed and direction diagram of each stations are shown in Figure 1.2-11 to 1.2-15.

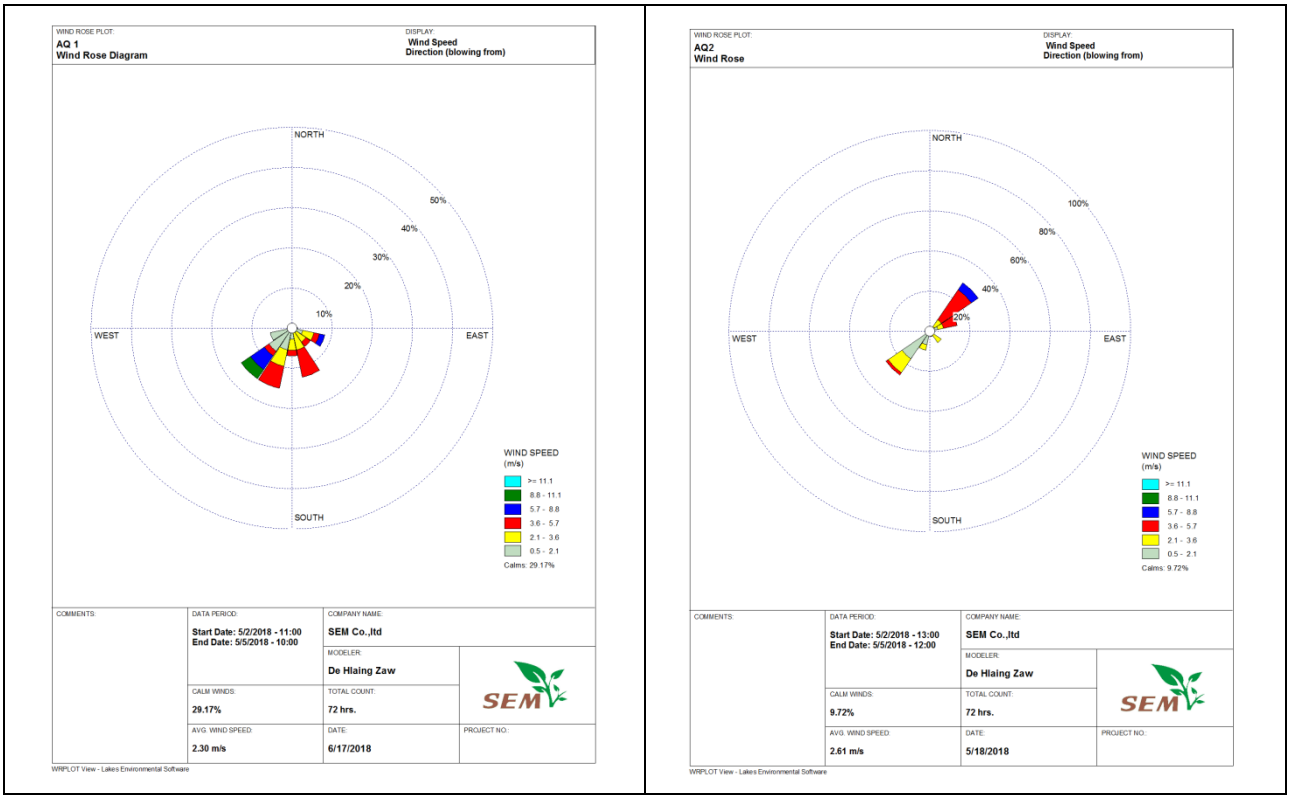


Figure 1.2-11 Wind speed and direction diagram at AQ1 and AQ2

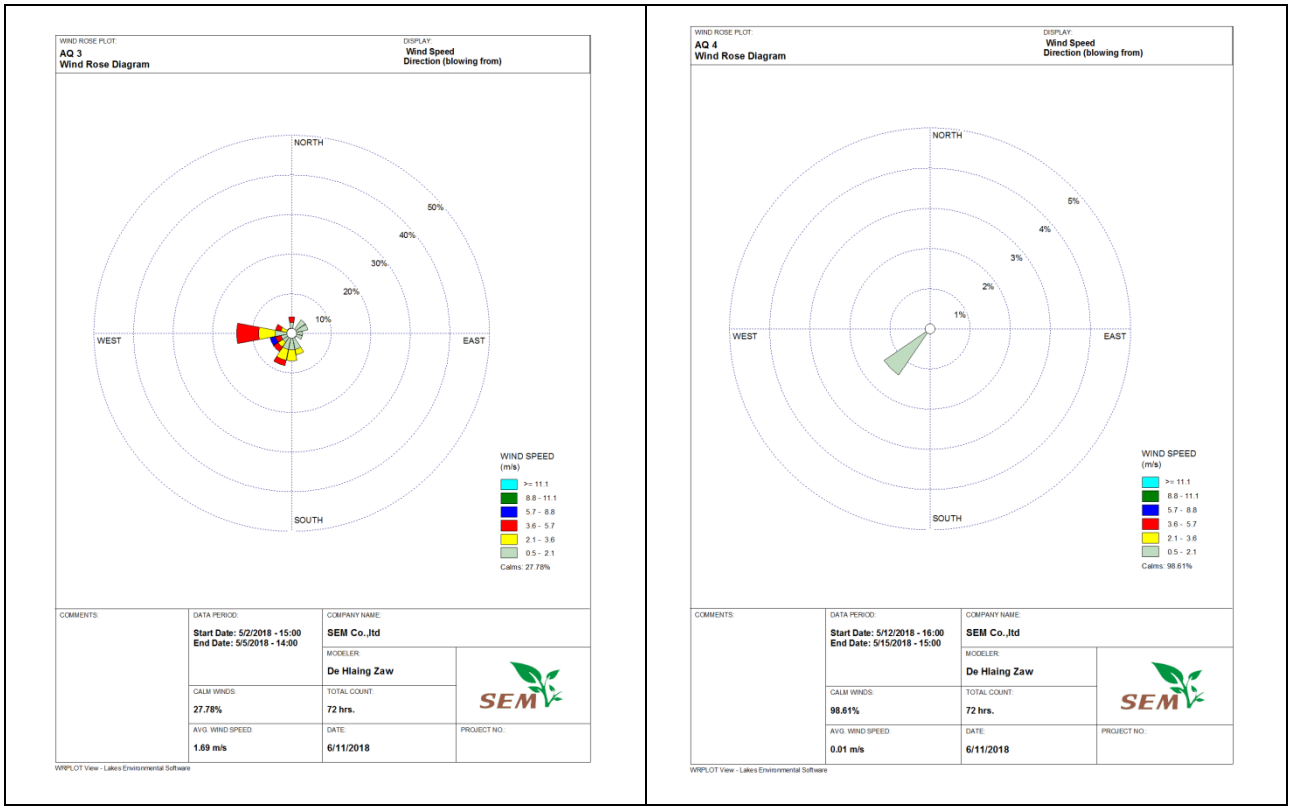


Figure 1.2-12 Wind speed and direction diagram at AQ3 and AQ4

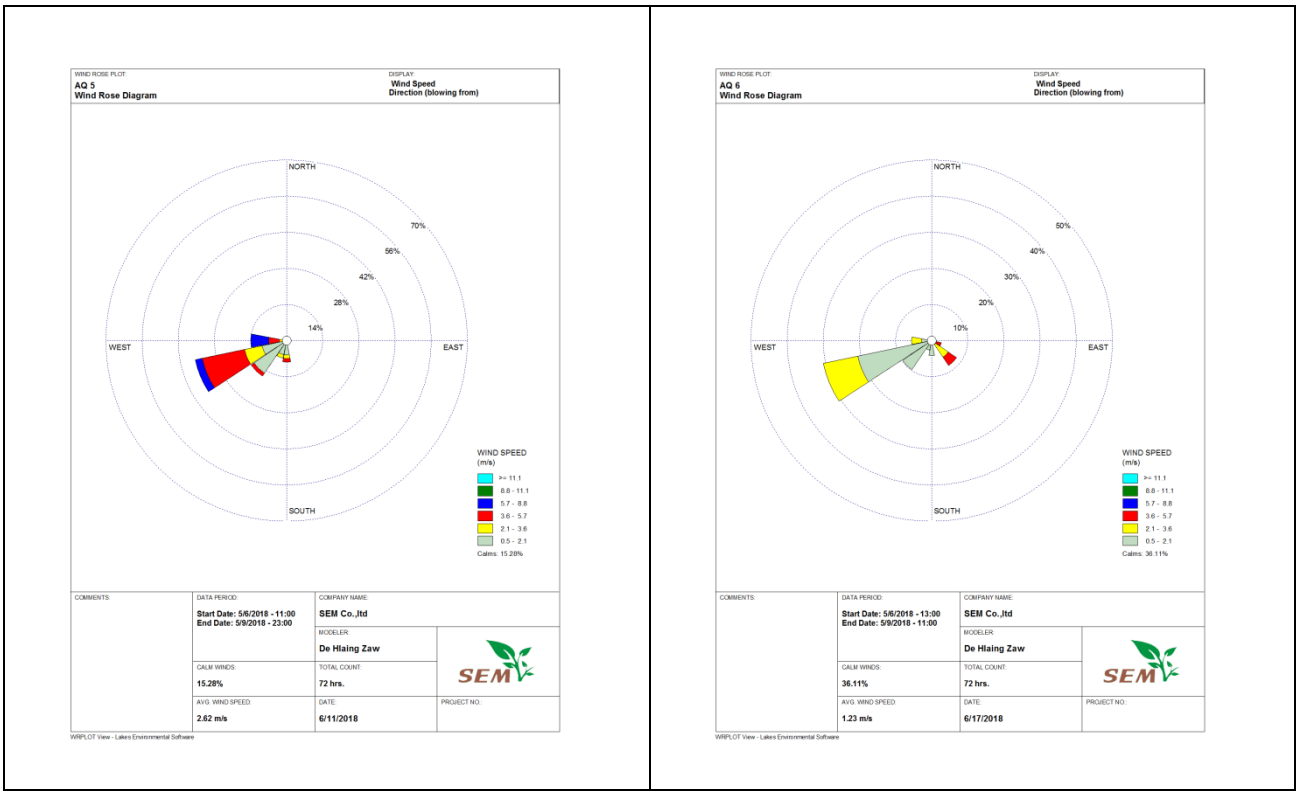


Figure 1.2-13 Wind speed and direction diagram at AQ5 and AQ6

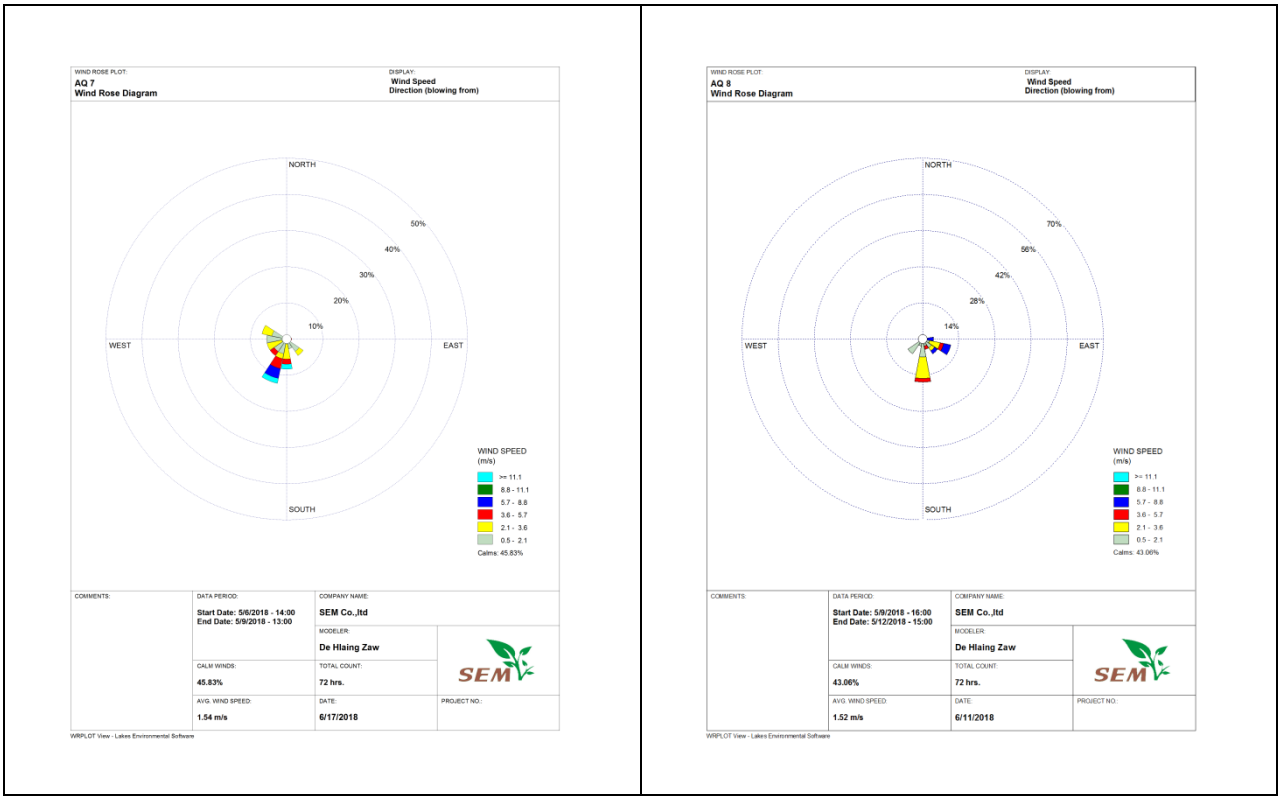


Figure 1.2-14 Wind speed and direction diagram at AQ7 and AQ8

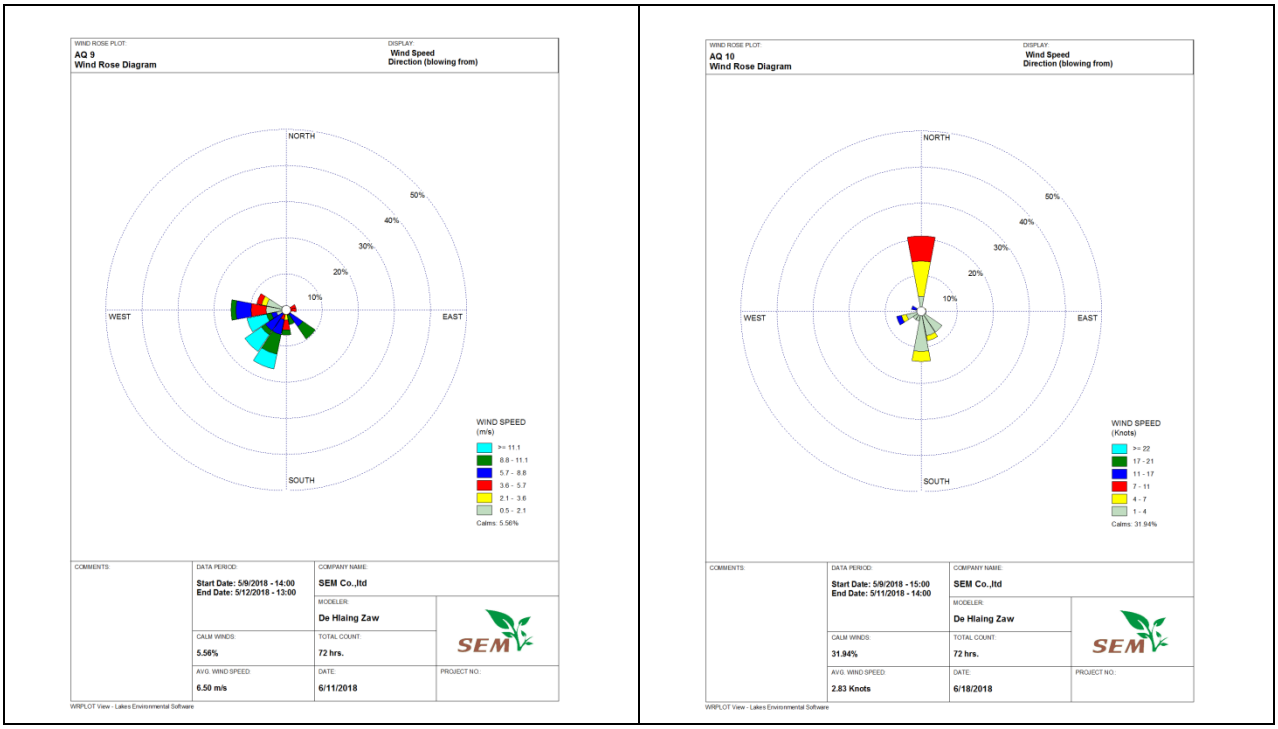


Figure 1.2-15 Wind speed and direction diagram at AQ9 and AQ10

1.3 Noise Level

1.3.1 Survey Item

Myanmar National Environmental Quality (Emission) Guidelines were announced on 29th December, 2015 and guideline value for noise level is as shown in Table 1.3-1.

Table 1.3-1 Guideline Value of Noise Level

No.	Parameter	Unit	Environmental Standard (Myanmar)		
			Category	Day time 7:00-22:00	Night time 22:00-7:00
1	A-weighted loudness equivalent (L_{Aeq})	dB	Residential, educational, institutional	55	45
			Industrial, commercial	70	70

Source: National Environmental Quality (Emission) Guidelines, 2015
Remark: a LAeq = Equivalent continuous sound level in decibels

1.3.2 Survey Location

The locations of Noise Level monitoring survey are as same as the air quality monitoring survey. The details of sampling points are described as Table 1.3-2.

Table 1.3-2. Locations of Noise Level monitoring station.

Sampling Points	Description of Sampling Point
N1	Same as the AQ1
N2	Same as the AQ2
N3	Same as the AQ3
N4	Same as the AQ4
N5	Same as the AQ5
N6	Same as the AQ6
N7	Same as the AQ7
N8	Same as the AQ8
N9	Same as the AQ9
N10	Same as the AQ10

1.3.3 Survey Period

Noise level survey was conducted on 48 hours consecutively. The measurement duration is shown in Table 1.3-3.

Table 1.3-3 Sampling Duration for Noise Level Survey

Point	Period
N1 **N2** **N3**	May 2nd – 4th, 2018 (48 hours)
N5 **N6** **N7**	May 6th – 8th, 2018 (48 hours)
N9	May 10th – 12nd, 2018 (48 hours)
N8 **N10**	May 9th – 11st, 2018 (48 hours)
N4	May 12nd – 14th, 2018 (48 hours)

1.3.4 Survey Method

Measurement of environmental sound level was conducted by referring to the recommendation of International Organization for Standardization (ISO), i.e. ISO 1996-1:2003 and ISO 1996-2:2007. The instrumentation used for noise quality survey is shown in the following Table 1.3-4.

Noise meter was set up to record the log as ten minutes intervals during an hour for one consecutive day.

Table 1.3-4 Instrumentation for noise survey

Instrumentation	Description
Sound level meter	Sound level meter with SD Card, Model SL-4023SD

Source: Sustainable Environment Myanmar Co., Ltd.

Figure 1.3-1 Lutron sound level meter

1.3.5 Survey Result

Noise level (L_{Aeq}) is shown in Table 1.3-5. Within 48 hours was higher than the noise level of Myanmar National Environmental Quality (Emission) guideline as shown in Table 1.3-5 to 1.3-15.

By using the following array formula in the excel sheet was calculated one day L_{Aeq}. This formula is firstly used for hourly L_{Aeq} and then for the 24 hours L_{Aeq}.

10*LOG10 (AVERGAE (10^ ((RANGE)/10)))

As the monitoring is conducted for the residential areas, the results are compared with "Residential, Educational, Institutional" environment of Myanmar National Emission Guideline.

By means of the calculated results, day and night time noise level at N7 is within the standard for 48 hours and day time noise result at N8 is also within the standard for first day. Sampling points (N1, N2, N3, N4, N5, N6, N8, N9 and N10) of day and night time L_{Aeq} are higher than the environmental standard. Generally, the results indicated that area had unusual noises. The origin of sources may come out (power plant generator, traffic activities, human activities and raining) during the survey period.

Measurement of environmental sound level was conducted by referring to the recommendation of Myanmar National Emission Guideline.

Table 1.3-5 A-weighted loudness Equivalent (LAeq) Level

	N1 (2nd -3rd, May 2018)		**N1 (3rd - 4th, May 2018)**	
	Day time	Night time	Day time	Night time
Result	59	57	59	59
	N2 (2nd -3rd, May 2018)		**N2 (3rd - 4th, May 2018)**	
	Day time	Night time	Day time	Night time
Result	74	73	72	73
	N3 (2nd -3rd, May 2018)		**N3 (3rd - 4th, May 2018)**	
	Day time	Night time	Day time	Night time
Result	71	66	70	67
	N4 (12th -13th, May 2018)		**N4 (13th -14th, May 2018)**	
	Day time	Night time	Day time	Night time
Result	55	49	54	48
	N5 (6th -7th, May 2018)		**N5 (7th -8th, May 2018)**	
	Day time	Night time	Day time	Night time
Result	59	57	59	59
	N6 (6th -7th, May 2018)		**N6 (7th -8th, May 2018)**	
	Day time	Night time	Day time	Night time
Result	58	53	57	49
	N7 (6th -7th, May 2018)		**N7 (7th -8th, May 2018)**	
	Day time	Night time	Day time	Night time
Result	48	45	46	40
	N8 (9th -10th, May 2018)		**N8 (10th -11st, May 2018)**	
	Day time	Night time	Day time	Night time
Result	54	47	58	55
	N9 (10th -11nd, May 2018)		**N9 (11th -12nd, May 2018)**	
	Day time	Night time	Day time	Night time
Result	60	53	60	54
	N10 (9th -10th, May 2018)		**N10 (10th -11st, May 2018)**	
	Day time	Night time	Day time	Night time
Result	63	47	63	51
NEQG standard	**55**	**45**	**55**	**45**

Remark: Shaded area is higher than the standard.

Table 1.3-6 Hourly LAeq value in noise monitoring stations (N1)

Unit: dBA

Time	2-3 May, 2018	3-4 May, 2018
7:00-8:00	58	60
8:00-9:00	61	57
9:00-10:00	56	58
10:00-11:00	58	53
11:00-12:00	57	55
12:00-13:00	58	62
13:00-14:00	59	57
14:00-15:00	60	62
15:00-16:00	59	60
16:00-17:00	68	67
17:00-18:00	61	64
18:00-19:00	60	56
19:00-20:00	55	55
20:00-21:00	57	59
21:00-22:00	60	55
Day L_{Aeq}	59	59
22:00-23:00	55	52
23:00-24:00	52	55
24:00-01:00	52	55
01:00-02:00	51	60
02:00-03:00	56	64
03:00-04:00	59	57
04:00-05:00	62	68
05:00-06:00	63	58
06:00-07:00	62	60
Night L_{Aeq}	57	59

Table1.3-7 Hourly (LAeq) value in noise monitoring stations (N2)

Unit: dBA

Time	2-3 May, 2018	3-4 May, 2018
7:00-8:00	74	73
8:00-9:00	73	73
9:00-10:00	71	71
10:00-11:00	72	71
11:00-12:00	73	71
12:00-13:00	73	71
13:00-14:00	76	73
14:00-15:00	75	72
15:00-16:00	75	72
16:00-17:00	74	73
17:00-18:00	75	72
18:00-19:00	75	72
19:00-20:00	73	72
20:00-21:00	73	73
21:00-22:00	72	73
Day L_{Aeq}	74	72
22:00-23:00	72	73
23:00-24:00	72	72
24:00-01:00	73	72
01:00-02:00	71	73
02:00-03:00	73	72
03:00-04:00	74	72
04:00-05:00	74	72
05:00-06:00	74	73
06:00-07:00	73	78
Night L_{Aeq}	73	73

Table1.3-8 Hourly (in LAeq) value noise monitoring stations (N3)

Unit: dBA

Time	2-3 May, 2018	3-4 May, 2018
7:00-8:00	75	71
8:00-9:00	68	70
9:00-10:00	69	68
10:00-11:00	70	69
11:00-12:00	69	72
12:00-13:00	69	70
13:00-14:00	81	71
14:00-15:00	70	71
15:00-16:00	73	70
16:00-17:00	70	70
17:00-18:00	70	79
18:00-19:00	67	71
19:00-20:00	69	69
20:00-21:00	76	66
21:00-22:00	66	68
Day L_{Aeq}	71	70
22:00-23:00	66	73
23:00-24:00	67	69
24:00-01:00	72	67
01:00-02:00	64	68
02:00-03:00	62	62
03:00-04:00	67	69
04:00-05:00	65	62
05:00-06:00	66	66
06:00-07:00	70	68
Night L_{Aeq}	66	67

Table1.3-9 Hourly (LAeq) value in noise monitoring stations (N4)

Unit: dBA

Time	12-13 May, 2018	13-14 May, 2018
7:00-8:00	55	56
8:00-9:00	55	56
9:00-10:00	60	55
10:00-11:00	56	52
11:00-12:00	54	57
12:00-13:00	60	53
13:00-14:00	56	54
14:00-15:00	53	55
15:00-16:00	54	55
16:00-17:00	58	53
17:00-18:00	55	55
18:00-19:00	52	55
19:00-20:00	49	52
20:00-21:00	50	51
21:00-22:00	52	50
Day L_{Aeq}	55	54
22:00-23:00	49	48
23:00-24:00	48	48
24:00-01:00	47	48
01:00-02:00	47	46
02:00-03:00	48	43
03:00-04:00	48	43
04:00-05:00	51	45
05:00-06:00	56	56
06:00-07:00	52	55
Night L_{Aeq}	49	48

Table1.3-10 Hourly (LAeq) value in noise monitoring stations (N5)

Unit: dBA

Time	2-3 May, 2018	3-4 May, 2018
7:00-8:00	58	60
8:00-9:00	61	57
9:00-10:00	56	58
10:00-11:00	58	53
11:00-12:00	57	55
12:00-13:00	58	62
13:00-14:00	59	57
14:00-15:00	60	62
15:00-16:00	59	60
16:00-17:00	68	67
17:00-18:00	61	64
18:00-19:00	60	56
19:00-20:00	55	55
20:00-21:00	57	59
21:00-22:00	60	55
Day L_{Aeq}	59	59
22:00-23:00	55	52
23:00-24:00	52	55
24:00-01:00	52	55
01:00-02:00	51	60
02:00-03:00	56	64
03:00-04:00	59	57
04:00-05:00	62	68
05:00-06:00	63	58
06:00-07:00	62	60
Night L_{Aeq}	57	59

Table1.3-11 Hourly LAeq value in noise monitoring stations (N6)

Unit: dBA

Time	2-3 May, 2018	3-4 May, 2018
7:00-8:00	56	58
8:00-9:00	59	55
9:00-10:00	54	55
10:00-11:00	82	50
11:00-12:00	48	54
12:00-13:00	58	53
13:00-14:00	46	79
14:00-15:00	55	75
15:00-16:00	51	49
16:00-17:00	62	56
17:00-18:00	65	53
18:00-19:00	57	56
19:00-20:00	60	51
20:00-21:00	61	52
21:00-22:00	50	56
Day L_{Aeq}	58	57
22:00-23:00	65	48
23:00-24:00	49	47
24:00-01:00	48	47
01:00-02:00	46	46
02:00-03:00	57	45
03:00-04:00	47	48
04:00-05:00	47	50
05:00-06:00	59	56
06:00-07:00	59	59
Night L_{Aeq}	53	49

Table1.3-12 Hourly LAeq value in noise monitoring stations (N7)

Unit: dBA

Time	6-7 May, 2018	7-8 May, 2018
7:00-8:00	45	47
8:00-9:00	44	45
9:00-10:00	44	42
10:00-11:00	51	43
11:00-12:00	43	47
12:00-13:00	46	45
13:00-14:00	54	52
14:00-15:00	48	47
15:00-16:00	55	51
16:00-17:00	48	46
17:00-18:00	57	54
18:00-19:00	55	51
19:00-20:00	41	41
20:00-21:00	44	38
21:00-22:00	38	36
Day L_{Aeq}	48	46
22:00-23:00	38	35
23:00-24:00	38	36
24:00-01:00	55	36
01:00-02:00	38	37
02:00-03:00	36	36
03:00-04:00	36	38
04:00-05:00	43	39
05:00-06:00	69	51
06:00-07:00	50	49
Night L_{Aeq}	45	40

Table1.3-13 Hourly LAeq value in noise monitoring stations (N8)

Unit: dBA

Time	9-10 May, 2018	10-11 May, 2018
7:00-8:00	59	66
8:00-9:00	58	66
9:00-10:00	52	60
10:00-11:00	49	58
11:00-12:00	70	53
12:00-13:00	55	56
13:00-14:00	51	52
14:00-15:00	52	59
15:00-16:00	51	52
16:00-17:00	55	52
17:00-18:00	53	55
18:00-19:00	57	53
19:00-20:00	46	48
20:00-21:00	52	79
21:00-22:00	44	64
Day L_{Aeq}	54	58
22:00-23:00	44	87
23:00-24:00	44	61
24:00-01:00	44	48
01:00-02:00	47	47
02:00-03:00	44	46
03:00-04:00	46	48
04:00-05:00	45	49
05:00-06:00	58	53
06:00-07:00	55	58
Night L_{Aeq}	47	55

Table1.3-14 Hourly LAeq value in noise monitoring stations (N9)

Unit: dBA

Time	10-11 May, 2018	11-12 May, 2018
7:00-8:00	58	60
8:00-9:00	61	63
9:00-10:00	61	63
10:00-11:00	59	70
11:00-12:00	59	61
12:00-13:00	58	58
13:00-14:00	59	59
14:00-15:00	67	62
15:00-16:00	55	68
16:00-17:00	66	57
17:00-18:00	64	66
18:00-19:00	57	51
19:00-20:00	48	49
20:00-21:00	64	55
21:00-22:00	66	55
Day L_{Aeq}	60	60
22:00-23:00	51	50
23:00-24:00	66	57
24:00-01:00	47	48
01:00-02:00	47	49
02:00-03:00	48	49
03:00-04:00	47	49
04:00-05:00	48	52
05:00-06:00	61	68
06:00-07:00	61	66
Night L_{Aeq}	53	54

Table1.3-15 Hourly LAeq value in noise monitoring stations (N10)

Unit: dBA

Time	9-10 days	10-11 days
7:00-8:00	69	60
8:00-9:00	64	60
9:00-10:00	65	72
10:00-11:00	57	64
11:00-12:00	56	62
12:00-13:00	75	57
13:00-14:00	62	64
14:00-15:00	59	60
15:00-16:00	69	60
16:00-17:00	61	58
17:00-18:00	65	66
18:00-19:00	68	69
19:00-20:00	67	58
20:00-21:00	63	64
21:00-22:00	50	78
Day L_{Aeq}	63	63
22:00-23:00	44	51
23:00-24:00	44	49
24:00-01:00	44	46
01:00-02:00	47	46
02:00-03:00	43	45
03:00-04:00	43	45
04:00-05:00	45	58
05:00-06:00	53	56
06:00-07:00	62	58
Night L_{Aeq}	47	51

1.4 Surface Water Quality

1.4.1 Survey Item

Parameters for water quality survey are determined so as to cover the parameters of existing environmental standards of Myanmar.

Table 1.4-1 Survey Parameters for Water Quality Survey

No.	Parameter	Unit	Myanmar Environmental Guideline Value
1	Temperature	^{o}C	-
2	pH	-	6 – 9
3	Dissolved Oxygen	mg/l	-
4	Electrical Conductivity (EC)	µS/cm	-
5	Total Dissolved Solid (TDS)	Ppm	-
6	Turbidity	FNU	-
7	BOD (5 days)	mg/l	50
8	COD	mg/l	250
9	Total Suspended Solids (TSS)	mg/l	50
10	Oil & Grease	mg/l	10
11	Total Coliform Bacteria	100 ml	400

Source: General Application; Wastewater, Storm water runoff, Effluent and sanitary discharges

(Myanmar National Environmental Guidelines (2015, Dec 29th))

1.4.2 Survey Locations

The coordinate locations of water samples and surveys are shown in Table 1.4-2.

Table 1.4-2 Sampling and survey points of surface water quality survey

Category	Sampling Point	Coordinates	Description of Sampling Points
Surface Water	SW 1	16°46'16.39"N 96° 7'26.42"E	Up stream of Gas Turbine, Yangon River, near about 0.25 kilometers West of Pipe line and south of project area.
Surface Water	SW 2	16° 46' 11.25"N 96° 7' 44.26"E	Upstream of Gas Turbine, Yangon River, near about 0.3 kilometers east of Pipe line.
Surface Water	SW 3	16° 45' 55.62"N 96° 7' 50.73"E	At mouth of Twantae Canal and about near the pipe line.
Surface Water	SW 4	16° 46' 3.46"N 96° 8' 2.27"E	Downstream of Twantae Canal, near near pipe line.
Surface Water	SW 5	16°43'44.85"N 96° 8'14.10"E	Downstream of Naung Ngok To Chaung, near the pipe line.
Surface Water	SW 6	16°43'46.82"N 96° 8'15.25"E	Upstream of Nyaung Ngok To Chaung, near the pipe line.
Surface Water	SW 7	16°40'57.67"N 96° 8'54.64"E	Downstream of Pyaw Bwe Chaung, near the pipe line (Pyaw Bwe Gyi village).
Surface Water	SW 8	16°40'58.36"N 96° 8'56.10"E	Upstream of Pyaw Bwe Chaung, near the pipe line (Pyaw Bwe Gyi village)
Surface Water	SW 9	16°40'14.17"N 96°10'19.41"E	Upstream of water location in Tha Nat Pin Chaung, near the pipe line (Tha Nat Pin bridge)
Surface Water	SW 10	16°40'14.04"N 96°10'18.72"E	Downstream of water location in Tha Nat Pin Chaung, near the pipe line (Tha Nat Pin bridge)
Surface Water	SW 11	16°39'39.81"N 96°11'9.78"E	Upstream of Ya Kaing Chaung, near the pipe line.
Surface Water	SW 12	16°39'40.99"N 96°11'10.60"E	Downstream of Ya Kaing Chaung, near about 0.02 kilometers noutheast of pipe line.
Surface Water	SW 13	16°39'42.26"N 96°13'49.15"E	Near FSRU Option 2 and near about 1.05 kilometers north of pipe line, in Yangon River.
Surface Water	SW 14	16°38'56.46"N 96°14'47.50"E	Near FSRU Option 2 and near about 1.59 kilometers of pipe line, in Yangon River.

SW1

SW1 was surveyed and collected at upstream of gas turbine in Yangon River, near about 0.25 kilometers west of pipe line and south of project area, Alone Township, Yangon. The Yangon River width of SW 1 is about 512.47 meters width (measured in Google Map). The turbidity is high. The flow rate of the river is generally about 0.069 m/s within high tide condition. The survey activities of SW 1 are shown in Figure 1.4-1.


Figure 1.4-1 Water quality survey at SW1

SW2

SW2 was measured Downstream of Gas Turbine, Yangon River and about 300 m east of pipe line, Alone Township, Yangon. SW 2 is near mouth of Twantae Canal and the turbidity is also high. The flow rate of the river is about 0.15 m/s within high tide. This river is mainly used for fishing and transportation. The survey activities of SW 2 are shown in Figure 1.4-2.


Figure 1.4-2 Water quality survey at SW2

SW3

SW3 was surveyed at mouth of Twantae Canal, near about 0.16 kilometers south of pipe line, Alone Township, Yangon. The canal width of SW 3 is about 387.95 meters width and the sampling point is located downstream of Thandwe Canal. The turbidity is high. The flow rate of the canal is about 0.057 m/s in high tide condition. The survey activities of SW 3 are shown in Figure 1.4-3.


Figure 1.4-3 Water quality survey at SW 3

SW4

SW4 was surveyed and collected at mouth of Twantae Canal and about 220 meters nearly northeast of pipe line, Da La Township, Yangon Region. The channel width of SW 4 is about 459.09 meters width and the sampling point is located downstream of Twantae Canal. The flow rate of the river is about 0.135 m/s. The survey activities of SW 4 are shown in Figure 1.4-4.


Figure 1.4-4 Water quality survey at SW4

SW5

SW 5 was surveyed in Nuaung Ngok To Chaung and about 0 kilometer east of pipe line nearly, Da La Township, Yangon Region. The canal width of SW 5 is about 5.36 meters width in dry season. The turbidity is moderate to high. The survey activities of SW 5 are shown in Figure 1.4-5.

Figure 1.4-5 Water quality survey at SW5

SW6

SW6 was surveyed in up stream of Nuaung Ngok To Chaung and about 0.03 kilometers east of pipe line, Da La Township, Yangon Region. The sampling point is located up stream of pipe line and beside the car road. There are a lot of waste disposal near the sampling point. The turbidity is moderate and transparency is low to medium. The survey activities of SW6 are shown in Figure 1.4-6.

Figure 1.4-6 Water quality survey at SW6

SW7

SW7 was collected at middle of Pyaw Bwe Chaung from bridge and it was located southwest of pipe line, near Pyaw Bwe village, Dala Township, Yangon Region. The channel width of SW7 is about 5.56 meters width and the sampling point is located near about 0.01 kilometer of pipe line. The medium transparency of water is found and turbidity is moderate. The survey activities of SW7 are shown in Figure 1.4-7.

Figure 1.4-7 Water quality survey at SW7

SW8

SW8 was surveyed at downstream of the project area in the Pyaw Bwe Chaung, in Pyaw Bwe Gyi village, Dala Township, Yangon Region. It is located near about 20 meter southeast of pipe line. SW 8 was sampling in the Pyaw Bwe Chaung where across from left to right bank distance is about 5.56 meters (measured in Google Map).The turbidity is moderate and the transparency of water is also medium. The survey activities of SW8 are shown in Figure 1.4-8.

Figure 1.4-8 Water quality survey at SW8

SW9

SW9 was collected in the Tha Nat Pin Chaung, in Pyaw Bwe Gyi village, Dala Township, Yangon Region. It is closely located southwest of pipe line. SW 9 was sampling in the upstream of Tha Nat Pin Chaung where across from left to right bank distance is about 5.56 meters (measured in Google Map), near Tha Net Pin bridge. The turbidity is moderate. The survey activities of SW8 are shown in Figure 1.4-9.

Figure 1.4-9 Water quality survey at SW9

SW10

SW10 was surveyed at downstream of Tha Nat Pin Chaung, Dala Township, Yangon Region. It is located near about 0.02 kilometers southwest of pipe line. SW 10 was sampling in the Pyaw Bwe Chaung near Tha Net Pin bridge.The turbidity is moderate and the transparency of water is medium. The survey activities of SW10 are shown in Figure 1.4-10.


Figure 1.4-10 Water quality survey at SW10

SW11

SW 11 was surveyed and collected at upstream of Ya Khaing Chaung, near about 20 meters southwest of pipe line, Dala Township, Yangon Region. The survey location is between Ya Khaing Gyaung village and Ton Tin Kan village. SW11 was sampled at the middle of the Ya Khaing Chaung from the Ya Khaing Chaung Bridge. The turbidity is moderate and transparency is medium. The survey activities of SW11 are shown in Figure 1.4-11.

Figure 1.4-11 Water quality survey at SW11

SW12

SW12 was surveyed and collected at downstream of Ya Khaing Chaung, , Dala Township, Yangon Region. It is located near about 0.02 kilometer northeast of pipe line. The Ya Khaing Chaung width of SW12 is about 45.87 meters width (measured in Google Map). The turbidity is high and transparency is low. The survey activities of SW12 are shown in Figure 1.4-12.

Figure 1.4-12 Water quality survey at SW12

SW 13

SW13 was surveyed and collected at upstream of FSRU option 2, Yangon River and it lies about 1.05 kilometers at northwest of pipe line and northwest of FSRU option 2, Dala Township, Yangon. The Yangon River width of SW 13 is about 2,171.77 meters width (measured in Google Map). The turbidity is high and the flow rate of the river is generally about 0.25 m/s within low tide. The survey activities of SW13 are shown in Figure 1.4-13.

Figure 1.4-13 Water quality survey at SW13

SW14

SW14 was surveyed at downstream of FSRU Option 2,Yangon River, near about 250 meters at southeast of pipe line and southwest of project area, Alone Township, Yangon. The width of Yangon River is 2,003.88 meters (measured in Google Map). The location of SW14 is located near Chaung Oo village and the southwest of proposed FSRU Option 2. The turbidity and transparency of water are high and low. The flow rate of the river is generally about 0.27 m/s within high tide. The survey activities of SW14 are shown in Figure 1.4-14.

Figure 1.4-14 Water quality survey at SW14

1.4.3 Survey Period

The sampling and measuring of the surface water were conducted on 3rd – 5th May, 2018.

1.4.4 Survey Method

Water samples were taken by Alpha horizontal water sampler and collected in plastic and sterilized glass sample containers. All sampling was in strict accordance with recognized standard procedures. The parameters as pH, temperature, dissolved oxygen (DO), electrical conductivity (EC), and total dissolved solid including the odor and color in visual analyzing were measured at each site concurrently with sample collection and. According to the Laboratory standard, some

samples were preserved using the chemicals. All samples were kept in iced boxes and were transported to the laboratory within 24 hours.

Moreover, the river survey; the flow rate, width and depth of river, was also measured using Vale port Flow Meter equipment and depth sounder.

Table 1.4-3 Field Equipment for surface water quality survey

No.	Equipment	Manufacturer	Originate Country	Model/Serial No.
1	SMART TROLL@ MP _Multi parameter for water	In_Situ Inc.	USA	SN - 346054
2	Multi Parameters for water quality	HANNA	USA	H17609823 (Turbidity Sensor)
3	Alpha Bottle (Water Sampler)m	Wildlife Supply Company®	Indonesia	Wildco P/N-1120-G45
4	Flow meter	GLOBAL WATER 800-876-1172	USA	FB211 Serial -1449006336
5	Depth Sounder	Japan	Japan	FP211/1136160536

Table 1.4-4 Analysis Method for Water Samples

No.	Item	Analysis Method
1	Temperature	SMART TROLL@MP _Multi parameter for water (pH sensor)
2	pH	SMART TROLL@MP _Multi parameter for water (DO sensor)
3	Dissolved Oxygen	SMART TROLL@MP _Multi parameter for water (EC/TDS sensor)
4	Electrical Conductivity (EC)	SMART TROLL@MP _Multi parameter for water (EC/TDS sensor)
5	Total Dissolved Solid (TDS)	SMART TROLL@MP _Multi parameter for water (EC/TDS sensor)
6	Turbidity	HANNA Multi Parameters (Turbidity sensor)

1.4.5 Survey Result

Laboratories

Water samples were sent to the STS Green Laboratory in Thailand. Water quality results are shown in following Table 1.4-5.

Table 1.4-5 In-Situ Measurement and laboratory analysis of Surface Water Quality

No.	Sample No./ Physical Parameter	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8
1	Location	Up stream of Yangon River	Downstream of Yangon River	At mouth of Twantae Canal (up)	At mouth of Twantae Canal (below)	Nuaung Ngok To Chaung (down)	Up stream of Nuaung Ngok To Chaung	Downstream of Pyaw Bwe Chaung	Up stream of Pyaw Bwe Gyi Chaung
2	Date/Time	4.5.2018 8:17	4.5.2018 9:30	3.5.2018 15:30	4.5.2018 10:17	5.5.2018 15:10	5.5.2018 15:20	5.5.2018 15:30	5.5.2018 15:35
3	Weather	Sunny	Sunny	Sunny	Sunny	Slightly Cloud	Slightly Rain	Sunny	Sunny
4	Transparency	Low	Low	Low	Low	Low to Medium	Low to Medium	Medium	Medium
5	Color	Buff	Buff	Buff	Buff	Yellowish Brown	Yellowish Brown	Light Green	Light Green
6	Water Depth (m)	10.5	3.5	11.5	5.5	-	-	-	-
7	Depth (of sample taken) (m)	1	1	1	1	-	-	-	-
-	Flow rate/velocity (m/s)	0.069	0.15	0.057	0.135	-	-	-	-
9	Tem (°C) (air & water)	30.7	30.9	31.8	31.0	34.7	35.4	34	34.2
10	pH	7.73	7.65	7.53	7.75	7.5	7.74	7.55	7.76
11	DO (mg/l)	5.2	5.19	4.02	5.01	3.38	5.18	8.02	8.05
12	EC (µs/m)	1061.3	1053.4	662.6	1087.3	11861.7	12502.4	23615.9	24067.1
13	TDS (ppm)	1229.3	1152.7	383.9	1078.8	6559.64	6864.89	13087.5	13240.85
14	Turbidity (FNU)	30.14	30.62	33.00	32.72	-	-	-	-
15	Remark	Sampling and Insitu test	Sampling and Insitu test	Sampling and Insitu test	Sampling and Insitu test	Sampled on 3/5/2018 14:45	Sampled on 3/5/2018 15:00	` Sampled on 3/5/2018 13:40	Sampled on 3/5/2018 14:00

No.	Sample No./ Physical Parameter	SW 9	SW 10	SW 11	SW 12	SW 13	SW 14
1	Location	Up stream of Tha Nat Pin Chaung	Downstream of Tha Nat Pin Chaung	Up stream of Ya Kaing Gyaung	Downstream of Ya Kaing Gyaung	Near FSRU Option 2, Yangon River	Near FSRU Option 2, Yangon River
2	Date/Time	5.5.2018 14:05	5.5.2018 14:18	5.5.2018 13:10	5.5.2018 13:30	3.5.2018 11:17	3.5.2018 12:00
3	Weather	Sunny	Sunny	Sunny	Sunny	Sunny	Slightly Cloud
4	Transparency	Medium	Medium	Medium	Medium	Low	Low
5	Color	Light Green	Light Green	Light Green	Light Green	Buff	Buff
6	Water Depth (m)	-	-	-	-	8.9	7.1
7	Depth (of sample taken) (m)	-	-	-	-	1	1
8	Flow rate/velocity (m/s)	-	-	-	-	0.25	0.27
9	Tem (°C) (air & water)	34.1	34.5	33.2	34.2	31.9	31.7
10	pH	8.14	8.13	7.83	7.65	7.5	7.4
11	DO (mg/l)	5.32	5.19	5.21	5.31	5.68	5.87
12	EC (µs/m)	22858.8	23091.6	22626.7	22885.5	2365	1373
13	TDS (ppm)	12702.8	12817.4	12724.7	12802.45	1370	1306
14	Turbidity (FNU)	-	-	-	-	38	36
15	Remark	Sampled on 3/5/2018 12:40	Sampled on 3/5/2018 12:20	Sampled on 3/5/2018 12:00	Sampled on 3/5/2018 12:10	Sampling and Insitu test	Sampling and Insitu test

1.5 Ground Water Quality

1.5.1 Survey Item

Parameters for water quality survey are determined so as to cover the parameters of existing environmental standards of Myanmar.

Table 1.5-1 Survey Parameters for Underground Water Quality Survey

No.	Parameter	Unit	Myanmar Environmental Guideline Value
1	Temperature	^{o}C	-
2	pH	-	6 – 9
3	Dissolved Oxygen	mg/l	-
4	Electrical Conductivity (EC)	µS/cm	-
5	Total Dissolved Solid (TDS)	Ppm	-
6	Turbidity	FNU	-
7	Total Suspended Solids (TSS)	mg/l	50

Source: General Application; Wastewater, Storm water runoff, Effluent and sanitary discharges (Myanmar National Environmental Guidelines (2015, Dec 29th))

1.5.2 Survey Locations

The locations of water samples and surveys are shown in Table 1.5-2. The detail of each sampling points are described as below.

Table 1.5-2 Sampling and survey points of underground water quality survey

Category	Sampling Point	Coordinates	Description of Sampling Point
Ground water	GW 1	16°40'59.81"N 96° 8'41.28"E	At well, Pyaw Bwe Gyi Village and about 90 meter at south of pipeline
Ground water	GW 2	16°45'0.67"N 96° 8'30.66"E	At well, beside the Botaza road, Dala,Township and about 40 meter at south of pipe line.
Ground water	GW 3	16°46'48.11"N 96° 8'11.26"E	At well, Tha Khin Mya park, Alone and about 1.01 meter at northeast of gas turbine.

GW1

GW1 was measured and collected at domestic well which is not fared from Dala main road and located about 90 meter from the proposed pipe line , Dala Township, Yangon Region. Although the survey location is surrounded by rice mills and houses; the well is used for domestic purposed especially for washing and not for drinking purpose. GW1 was surveyed and collected from the well at depth about 6 m. The transparency of water is high. The survey activities of GW1 are shown in Figure 1.5-1.

Figure 1.5-1 Groundwater quality survey at GW1

GW2

GW2 was located beside the Botaza Road, Dala Township, Yangon Region. The survey location is surrounded by many residential houses. This well is mainly used for domestic purposes and not for drinking. At first, water is colorless after a few minutes later it changes to yellowish colored. GW2 was surveyed and collected from the well at depth about 15 m. The survey activities of GW2 is shown in Figure 1.5-2

Figure 1.5-2 Groundwater quality survey at GW2

GW3

GW3 was surveyed and collected from the well situated in Tha Khin Mya Park, Alone Township, Yangon Region. GW 3 is located at the corner of Lower Kyeemyindaing Road and Aung Yadana Street. This well is mainly used for domestics for residents. GW3 was surveyed and collected from the well at depth about 13.7 m. The transparency of water is high. The survey activities of GW3 is shown in Figure 1.5-3


Figure 1.5-3 Groundwater quality survey at GW 3

1.5.3 Survey Period

The sampling and measuring of the surface water were conducted on 5th May, 2018.

1.5.4 Survey Method

Water samples were taken by Alpha horizontal water sampler for some wells and collected in plastic and sterilized glass sample containers. All sampling was in strict accordance with recognized standard procedures. The parameters as pH, temperature, dissolved oxygen (DO), electrical conductivity (EC), and total dissolved solid including the odor and color in visual analyzing were measured at each site concurrently with sample collection and. According to the Laboratory standard, some samples were preserved using the chemicals. All samples were kept in iced boxes and were transported to the laboratory within 24 hours.

Table 1.5-3 Field Equipment for Ground water quality survey

No.	Equipment	Manufacturer	Originate Country	Model/Serial No.
1	SMART TROLL@ MP _Multi parameter for water	In_Situ Inc.	USA	SN - 346054
2	Multi Parameters for water quality	HANNA	USA	H17609823 (Turbidity Sensor)
3	Alpha Bottle (Water Sampler)	Wildlife Supply Company®	Indonesia	Wildco P/N-1120-G45

The following table provides the test method for water quality.

Table 1.5-4 Analysis Method for Water Samples

No.	Item	Analysis Method
1	Temperature	SMART TROLL@MP _Multi parameter for water (pH sensor)
2	pH	SMART TROLL@MP _Multi parameter for water (DO sensor)
3	Dissolved Oxygen	SMART TROLL@MP _Multi parameter for water (EC/TDS sensor)
4	Electrical Conductivity (EC)	SMART TROLL@MP _Multi parameter for water (EC/TDS sensor)
5	Total Dissolved Solid (TDS)	SMART TROLL@MP _Multi parameter for water (EC/TDS sensor)
6	Turbidity	HANNA Multi Parameters (Turbidity sensor)

1.5.5 Survey Result

Laboratories

Water samples were sent to the STS Green Laboratory in Thailand. Water quality results are shown in following Table 1.5-5.

1.5-5 In-situ groundwater quality results

No.	Sample No./ Physical Parameter	GW-1	GW-2	GW-3
1	Location	Pyaw Bwe Gyi Village	Beside the Botaza Road , Dala	Tha Khin Mya Park
2	Date/Time	5.5.2018 14:45	5.5.2018 15:32	5.5.2018 17:10
3	Weather	Sunny	Slightly Cloud	Slightly Sunny
4	Transparency	High	Low to High	High
5	Color	Colorless	Slightly Yellow	Colorless
6	Water Depth (m)	6	15	34
7	Depth (of sample taken) (m)	-	-	-
8	Flow rate/velocity (m/s)	-	-	-
9	Tem (°C) (air & water)	30.4	28.4	25.1
10	pH	7.37	6.7	7.04
11	DO (mg/l)	1.25	1.15	2.32
12	EC (µs/m)	25986.5	5599.5	184
13	TDS (ppm)	15266.76	3367.46	111.41
14	Turbidity (FNU)	-	-	-
15	Remark	Sampled on 3/5/2018 14:15	Sampled on 3/5/2018 15:15	Sampled on 4/5/2018 14:30

1.6 Soil

1.6.1 Survey Item

Parameters for soil quality survey are determined so as to cover the parameters of existing available environmental standards. Soil sample was taken by the manual hand auger.

1.6.2 Survey Locations

The locations of soil samples and surveys are shown in Table 1.6-1. The detail of each sampling points are described as below.

Table 1.6-1 Sampling and survey points of soil quality survey

Category	Sampling Point	Coordinates	Description of Sampling Point
Soil	S0 1	16°46'29.86"N 96° 07'41.17"E	In the compound of Combined Cycle Power Plant Project (Ahlone), at project area, in Ahlone Township, Yangon Region
Soil	S0 2	16°46'7.14"N 96° 7'31.01"E	In the right bank (Conner of Yangon River) and Twan Te Canal, in Ahlone Township, Yangon Region
Soil	S0 3	16°45'59.11"N 96° 8'0.06"E	In the left bank of Twan Te Canal, Seikkyi Village, Dala Township, Yangon Region
Soil	S0 4	16°45'9.01"N 96° 7'55.77"E	Beside the street which located in Kyansitthar Ward, Ahlone Township, Yangon Region
Soil	S0 5	16°44'59.06"N 96° 8'30.30"E	Beside the road (near the paddy field), in Tapinshwehtee Ward, Ahlone Township, Yangon Region
Soil	S0 6	16°43'47.49"N 96° 8'15.41"E	In the paddy field which located in west of Gwa & Nuaung Ngok To Village, Dala Township, Yangon Region
Soil	S0 7	16°40'57.68"N 96° 8'55.93"E	In the paddy field (near Pyaw Bwe Gyi Village) which located in Dala Township, Yangon Region
Soil	S0 8	16°38'28.81"N 96°12'13.19"E	In the stream (the stream was run dry for now) which located in Shan Gan Village, Dala Township, Yangon Region
Soil	S0 9	16°39'4.89"N 96°14'20.95"E	In the paddy field (near FSRU Option 2), right bank of river, Chaung Oo Village, Dala Township, Yangon Region

S01

S01 was collected in the compound of Combine Cycle power plant Company Limited which located in project area, Ahlone Township, Yangon Region. Surveyed location is generally covered by shrub land and sparely mangrove forest. It situated in the left bank of Hlaing River. The soil sample was collected for top soil (30cm-50cm depth) and sub soil (80cm-100cm depth). The top soil and sub soil are mainly composed of organic materials and mud with dark grey color. Typical soil type is clayey soil. The location of S01 is shown in Figure 1.6-1.

Figure 1.6-1 Soil quality survey at S01

S02

S02 was surveyed in the right bank (corner of Yangon River) and Twan Te Canal located in Ahlone Township, Yangon Region. The survey location is approximately 0.06 kilometers south-east of gas pipeline which will construct later. The soil sample was collected for top soil (30cm-50cm depth) and sub soil (80cm-100cm depth). The top soil and sub soil color are light gray to reddish brown and mainly composed of residual organic materials. Physically soil type is siltly clay. The survey activity of S02 is shown in Figure 1.6-2.

Figure 1.6-2 Soil quality survey at S02

S03

S03 was collected in the left bank of Twan Te Canal which located in Seikkyi Village, Dala Township, and Yangon Region. It lies approximately 0.1 kilometers northeast of gas pipeline which will construct later. The top soil sample was taken from 30cm-50cm depth and sub soil sample was taken from 80cm-100cm depth. The top soil and sub soil are brownish grey color. Soil type is clay. The location of S03 is shown in Figure 1.6-3.

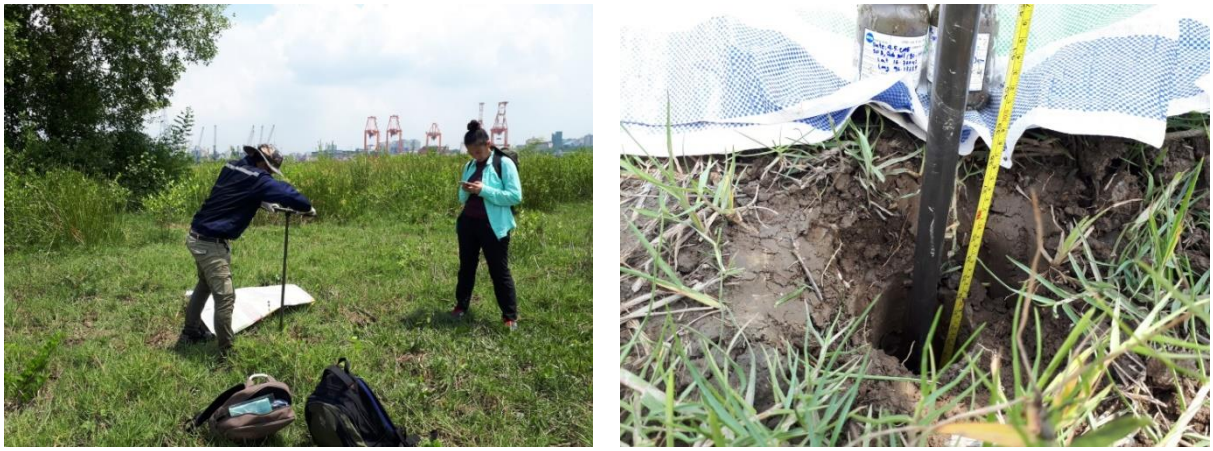


Figure 1.6-3 Soil quality survey at S03

S04

S04 was collected beside the street which located in Kyansitthar Ward, Dala Township, and Yangon Region. The survey location is approximately 0.03 kilometer west of gas pipeline which will construct later. The soil sample was collected for top soil (30cm-50cm depth) and sub soil (80cm-100cm depth). The top soil and sub soil are light brown color, siltly clay. The location of S04 is shown in Figure 1.6-4.

Figure 1.6-4 Soil quality survey at S04

S05

S05 was collected beside the road (near the paddy field) which located in Tapinshwehtee Ward, Dala Township, and Yangon Region. It lies approximately 0.02 kilometers southwest of gas pipeline which will construct later. The soil sample was collected for top soil (30cm-50cm depth) and sub soil (80cm-100cm depth) per location. The top soil and sub soil are greyish brown color clayey soil.

S06

S06 was collected in the paddy field which located in west of Gwa & Nuaung Ngok To Village, Dala Township, and Yangon Region. The survey location is approximately 0.03 kilometers east of gas pipeline which will construct later. S06 is generally covered by agricultural land. The soil sample was collected for top soil (30cm-50cm depth) and sub soil (80cm-100cm depth). The top soil and sub soil are light brown color silty clay.

S07

S07 was collected in the paddy field (near Pyaw Bwe Gyi Village) which located in Dala Township, and Yangon Region. It situated near the gas pipeline. S07 is generally flat terrain covering with agricultural land. The soil sample was collected for top soil (30cm-50cm depth) and sub soil (80cm-100cm depth) per location. The top soil and sub soil are light brown color silty clay.

S08

S08 was collected in the stream (dried in dry season) which located in Shan Gan Village, Dala Township, and Yangon Region. The survey location is approximately 0.01 kilometers south-west of gas pipeline which will construct later. S08 is generally flat terrain covering with agricultural land.

The soil sample was collected for top soil (30cm-50cm depth) and sub soil (80cm-100cm depth). The top soil and sub soil are dark brown color clayey soil. The survey location of S08 is shown in Figure 1.6-5.

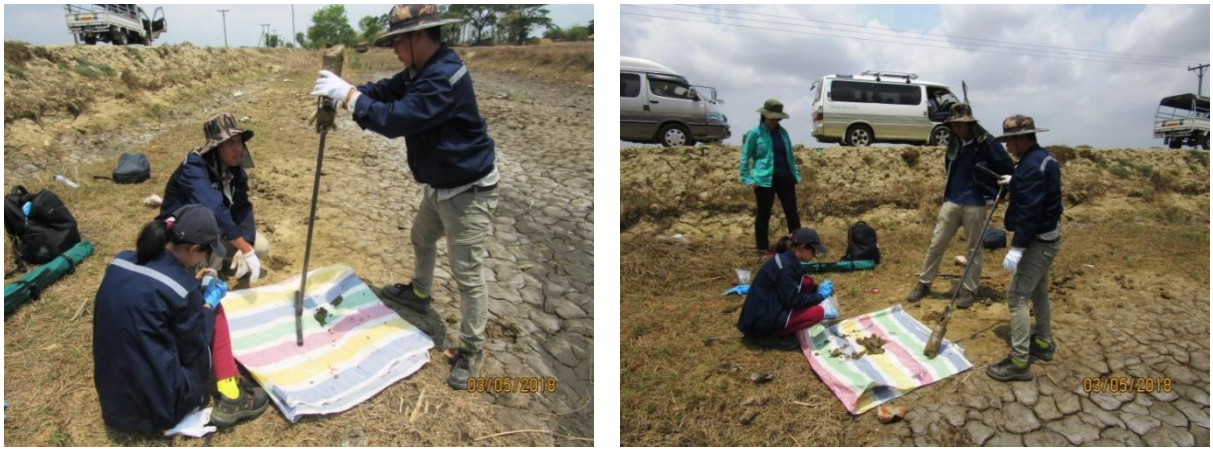


Figure 1.6-5 Soil quality survey at S08

S09

S09 was collected in the paddy field (right bank of river) which located in Chaung Oo Village, Dala Township, and Yangon Region. It lies approximately 0.73 kilometers south-east of gas pipeline which will construct later. S09 is generally flat terrain covering with agricultural land. The soil sample was collected for top soil (30cm-50cm depth) and sub soil (80cm-100cm depth). The top soil and sub soil color are light brown color silty clays. The survey location of S09 is shown in Figure 1.6-6.

Figure 1.6-6 Soil quality survey at S09

1.7 Sediment

1.7.1 Survey Item

Parameters for sediment survey are determined so as to cover the parameters of existing available environmental standards. Sediment sample was taken by the Grab Sampler.

1.7.2 Survey Locations

The locations of sediment samples and surveys are shown in Table 1.7-1. The detail of each sampling points are described as below.

Table 1.7-1 Sampling and survey points of sediment survey

Category	Sampling Point	Coordinates	Description of Sampling Point
Sediment	SE 1	16°46'16.68"N 96° 7'29.64"E	Near about 0.16 kilometers in the left bank of Yangon River (Upstream), Dala Township, Yangon Region
Sediment	SE 2	16°46'12.72"N 96° 7'41.88"E	Near about 0.22 kilometers in the left bank of Yangon River (Downstream), Dala Township, Yangon Region
Sediment	SE 3	16°45'56.19"N 96° 7'47.98"E	Near about 0.19 kilometers in the right bank of Twantae Canal, which located near the mouth of Twantae Canal, Dala Township, Yangon Region
Sediment	SE 4	16°39'40.66"N 96°13'34.87"E	Near about 0.05 kilometers in the left bank of Yangon River which located near That Kai Kwin Village, Dala Township, Yangon Region
Sediment	SE 5	16°39'21.60"N 96°14'21.48"E	Near about 0.09 kilometers in the left bank of Yangon River which located in Dala Township, Yangon Region
Sediment	SE 6	16°39'3.28"N 96°14'36.81"E	Near about 0.03 kilometers in the left bank of Yangon River which located near Chaung Oo Village, Dala Township, Yangon Region

SE1

SE1 was collected in the left of Yangon River (upstream) located about 0.16 kilometers of gas pipeline which will construct later, Dala Township, Yangon Region. It's located at south of project area and southwest of Asia Terminal port. The sample was collected from a boat using grab sampler set up. The survey activities of SE1 is shown in Figure 1.7-1.

Figure 1.7-1 Sediment survey at SE 1

SE 2

SE 2 was collected at downstream of Yangon River, about 0.22 kilometers of proposed gas pipeline, Dala Township, Yangon Region. It's situated south of project area and Asia Terminal port. Sediment was caught to a depth 1m. The survey activities of SE2 is shown in Figure 1.7-2.

Figure 1.7-2 Sediment survey at SE2

SE3

SE3 was collected at upstream of Twantae Canal, about 0.09 kilometers fared from canal bank and near about 0.17 kilometers of proposed gas pipeline Dala Township, Yangon Region. It's situated south of project area and Asia Terminal port. The sample will be taken from a boat using grab sampler set up. Sediment was caught to a depth 5m. The survey activities of SE3 is shown in Figure 1.7-3.

Figure 1.7-3 Sediment survey at SE3

SE4

SE4 was collected near about 0.05 kilometers in the left bank of Yangon River (upstream) which located near That Kai Kwin Village, Dala Township, and Yangon Region. It lies approximately 1.01 kilometers north-west of FSRU Option 2 which will construct later. The survey activities of SE4 is shown in Figure 1.7-4.

Figure 1.7-4 Sediment survey at SE4

SE5

SE5 was collected near about 0.09 kilometers in the left bank of Yangon River (upstream) in Dala Township, Yangon Region. It is lied approximately 0.17 kilometers of proposed FSRU Option 2. The survey activities of SE5 is shown in Figure 1.7-5.

Figure 1.7-5 Sediment survey at SE5

SE6

SE6 was collected near about 0.03 kilometers in the left bank of Yangon River (downstream) which located near Chaung Oo Village, Dala Township, and Yangon Region. It is located approximately 0.43 kilometers of proposed FSRU Option 2. The survey activities of SE6 is shown in Figure 1.7-6.

Figure 1.7-6 Sediment survey at SE6

1.7.3 Survey Period

The sampling and measuring of the sediment samples were conducted on 3rd-5th May, 2018.

1.7.4 Survey Method

Methodology

River sea bed sediments were collected by dive-based sampling method. Six stations were collected in this survey. At each station, sediment was collected in an amber glass bottle. Each benthic sample was then slowly sieved through a mesh size of 2.0, 1and 0.5mm. Firstly, benthic samples were sieved by 2.0 and 1.0mm mesh size. And then, it is continuously being sieved by 0.5mm size. Finally, the benthic samples were collected into the sieve of 1.0 and 0.5mm size. The specimens and coarse sediment that were retained in the sieve were collected in a plastic container and preserved in 10% formalin solution.

AQ1 (hourly wind speed and direction results)				AQ2 (hourly wind speed and direction results)			
Date	**Time**	**Wind Direction(Degree)**	**Wind Speed (kph)**	**Date**	**Time**	**Wind Direction(Degree)**	**Wind Speed (kph)**
2.5.2018	11:00-12:00	149	4.3	2/5/2018	13:00-14:00	52	5.28
2.5.2018	12:00-13:00	166	4.0	2/5/2018	14:00-15:00	54	5.64
2.5.2018	13:00-14:00	181	3.7	2/5/2018	15:00-16:00	51	7.24
2.5.2018	14:00-15:00	166	3.6	2/5/2018	16:00-17:00	47	6.95
2.5.2018	15:00-16:00	152	5.3	2/5/2018	17:00-18:00	49	6.81
2.5.2018	16:00-17:00	162	4	2/5/2018	18:00-19:00	62	4.00
2.5.2018	17:00-18:00	173	3.5	2/5/2018	19:00-20:00	59	3.75
2.5.2018	18:00-19:00	205	3.7	2/5/2018	20:00-21:00	76	2.77
2.5.2018	19:00-20:00	204	3.5	2/5/2018	21:00-22:00	53	2.60
2.5.2018	20:00-21:00	208	2.8	2/5/2018	22:00-23:00	67	1.28
3.5.2018	21:00-22:00	197	1.4	2/5/2018	23:00-00:00	52	1.89
3.5.2018	22:00-23:00	200	0.6	3/5/2018	00:00-01:00	59	1.09
3.5.2018	23:00-00:00	215	1.5	3/5/2018	01:00-02:00	63	1.27
3.5.2018	00:00-01:00	226	0.9	3/5/2018	02:00-03:00	45	3.17
3.5.2018	01:00-02:00	233	2.0	3/5/2018	03:00-04:00	44	3.68
3.5.2018	02:00-03:00	112	0.8	3/5/2018	04:00-05:00	51	4.16
3.5.2018	03:00-04:00	90	1.7	3/5/2018	05:00-06:00	46	4.34
3.5.2018	04:00-05:00	131	1.6	3/5/2018	06:00-07:00	41	4.51
3.5.2018	05:00-06:00	121	1.7	3/5/2018	07:00-08:00	43	4.80
3.5.2018	06:00-07:00	103	2.5	3/5/2018	08:00-09:00	46	4.53
3.5.2018	07:00-08:00	115	2.4	3/5/2018	09:00-10:00	49	3.56
3.5.2018	08:00-09:00	137	2.6	3/5/2018	10:00-11:00	47	4.56
3.5.2018	09:00-10:00	132	2.1	3/5/2018	11:00-12:00	43	4.48
3.5.2018	10:00-11:00	164	2.1	3/5/2018	12:00-13:00	63	4.33
3.5.2018	11:00-12:00	127	4.0	3/5/2018	13:00-14:00	53	4.66
3.5.2018	12:00-13:00	167	2.9	3/5/2018	14:00-15:00	139	3.18
3.5.2018	13:00-14:00	149	3.5	3/5/2018	15:00-16:00	131	2.14
3.5.2018	14:00-15:00	220	8.6	3/5/2018	16:00-17:00	130	2.59
3.5.2018	15:00-16:00	218	7.2	3/5/2018	17:00-18:00	194	2.83
3.5.2018	16:00-17:00	220	6.3	3/5/2018	18:00-19:00	195	3.08
3.5.2018	17:00-18:00	228	9.3	3/5/2018	19:00-20:00	133	1.40
3.5.2018	18:00-19:00	231	10.3	3/5/2018	20:00-21:00	201	0.63
3.5.2018	19:00-20:00	212	5.6	3/5/2018	21:00-22:00	221	1.87
3.5.2018	20:00-21:00	200	1.4	3/5/2018	22:00-23:00	223	2.31
3.5.2018	21:00-22:00	191	0.1	3/5/2018	23:00-00:00	224	2.94
3.5.2018	22:00-23:00	214	0.8	4/5/2018	00:00-01:00	226	3.65
3.5.2018	23:00-00:00	238	1.1	4/5/2018	01:00-02:00	223	3.13
4.5.2018	00:00-01:00	235	1.5	4/5/2018	02:00-03:00	218	2.64
4.5.2018	01:00-02:00	248	0.8	4/5/2018	03:00-04:00	220	1.20
4.5.2018	02:00-03:00	242	0.4	4/5/2018	04:00-05:00	219	1.09
4.5.2018	03:00-04:00	241	0.1	4/5/2018	05:00-06:00	217	0.97
4.5.2018	04:00-05:00	231	0.0	4/5/2018	06:00-07:00	214	0.70
4.5.2018	05:00-06:00	233	0.3	4/5/2018	07:00-08:00	213	1.74
4.5.2018	06:00-07:00	227	0.0	4/5/2018	08:00-09:00	221	1.04
4.5.2018	07:00-08:00	239	0.2	4/5/2018	09:00-10:00	220	1.21
4.5.2018	08:00-09:00	196	0.1	4/5/2018	10:00-11:00	69	2.93
4.5.2018	09:00-10:00	239	0.3	4/5/2018	11:00-12:00	59	4.72
4.5.2018	10:00-11:00	200	2.3	4/5/2018	12:00-13:00	65	4.91
4.5.2018	11:00-12:00	198	4.0	4/5/2018	13:00-14:00	214	3.26
4.5.2018	12:00-13:00	205	4.9	4/5/2018	14:00-15:00	145	3.28
4.5.2018	13:00-14:00	118	8.3	4/5/2018	15:00-16:00	48	3.98
4.5.2018	14:00-15:00	122	3.7	4/5/2018	16:00-17:00	55	3.20
4.5.2018	15:00-16:00	188	3.2	4/5/2018	17:00-18:00	51	1.85
4.5.2018	16:00-17:00	187	1.6	4/5/2018	18:00-19:00	194	1.56
4.5.2018	17:00-18:00	177	0.7	4/5/2018	19:00-20:00	215	2.73
4.5.2018	18:00-19:00	216	4.8	4/5/2018	20:00-21:00	219	0.53
4.5.2018	19:00-20:00	147	2.4	4/5/2018	21:00-22:00	215	0.48
4.5.2018	20:00-21:00	123	0.0	4/5/2018	22:00-23:00	217	0.44
4.5.2018	21:00-22:00	5	0.0	4/5/2018	23:00-00:00	224	0.51
4.5.2018	22:00-23:00	5	0.0	5/5/2018	00:00-01:00	227	0.12
4.5.2018	23:00-00:00	98	0.0	5/5/2018	01:00-02:00	222	0.38
5.5.2018	00:00-01:00	184	0.0	5/5/2018	02:00-03:00	230	0.46
5.5.2018	01:00-02:00	275	0.1	5/5/2018	03:00-04:00	226	0.09
5.5.2018	02:00-03:00	250	0.1	5/5/2018	04:00-05:00	228	0.01
5.5.2018	03:00-04:00	250	0.0	5/5/2018	05:00-06:00	224	0.00
5.5.2018	04:00-05:00	251	0.0	5/5/2018	06:00-07:00	203	0.01
5.5.2018	05:00-06:00	94	0.0	5/5/2018	07:00-08:00	199	0.94
5.5.2018	06:00-07:00	200	0.0	5/5/2018	08:00-09:00	204	1.25

5.5.2018	07:00-08:00	218	0.1	5/5/2018	09:00-10:00	218	1.78
5.5.2018	08:00-09:00	237	0.8	5/5/2018	10:00-11:00	186	2.20
5.5.2018	09:00-10:00	245	0.9	5/5/2018	11:00-12:00	149	2.64
5.5.2018	10:00-11:00	207	1.7	5/5/2018	12:00-13:00	152	2.95

AQ3 (hourly wind speed and direction results)				AQ4 (hourly wind speed and direction results)			
Date	**Time**	**Wind Direction (Degree)**	**Wind Speed (kph)**	**Date**	**Time**	**Wind Direction (Degree)**	**Wind Speed (kph**
2.5.2018	15:00-16:00	274.86	4.77	12.5.2018	16:00-17:00	320	0.00
2.5.2018	16:00-17:00	288.87	5.03	12.5.2018	17:00-18:00	320	0.00
2.5.2018	17:00-18:00	270.25	5.60	12.5.2018	18:00-19:00	263	0.00
2.5.2018	18:00-19:00	256.37	6.00	12.5.2018	19:00-20:00	169	0.00
2.5.2018	19:00-20:00	268.07	3.42	12.5.2018	20:00-21:00	169	0.00
2.5.2018	20:00-21:00	221.68	2.49	12.5.2018	21:00-22:00	169	0.00
2.5.2018	21:00-22:00	210.57	1.96	12.5.2018	22:00-23:00	169	0.00
2.5.2018	22:00-23:00	122.55	1.65	12.5.2018	23:00-00:00	169	0.00
2.5.2018	23:00-00:00	33.88	0.88	13.5.2018	00:00-01:00	169	0.00
3.5.2018	00:00-01:00	64.80	0.62	13.5.2018	01:00-02:00	169	0.00
3.5.2018	01:00-02:00	49.02	0.79	13.5.2018	02:00-03:00	169	0.00
3.5.2018	02:00-03:00	64.16	1.45	13.5.2018	03:00-04:00	169	0.00
3.5.2018	03:00-04:00	232.00	0.00	13.5.2018	04:00-05:00	169	0.00
3.5.2018	04:00-05:00	232.00	0.00	13.5.2018	05:00-06:00	169	0.00
3.5.2018	05:00-06:00	232.00	0.00	13.5.2018	06:00-07:00	272	0.00
3.5.2018	06:00-07:00	232.00	0.00	13.5.2018	07:00-08:00	310	0.00
3.5.2018	07:00-08:00	232.00	1.29	13.5.2018	08:00-09:00	310	0.00
3.5.2018	08:00-09:00	354.00	1.31	13.5.2018	09:00-10:00	218	0.03
3.5.2018	09:00-10:00	360.00	1.25	13.5.2018	10:00-11:00	229	0.00
3.5.2018	10:00-11:00	43.00	1.65	13.5.2018	11:00-12:00	216	0.02
3.5.2018	11:00-12:00	283.00	2.24	13.5.2018	12:00-13:00	249	0.06
3.5.2018	12:00-13:00	257.00	1.60	13.5.2018	13:00-14:00	218	0.10
3.5.2018	13:00-14:00	262.00	2.44	13.5.2018	14:00-15:00	248	0.06
3.5.2018	14:00-15:00	353.00	4.99	13.5.2018	15:00-16:00	242	0.07
3.5.2018	15:00-16:00	263.00	3.57	13.5.2018	16:00-17:00	293	0.10
3.5.2018	16:00-17:00	285.00	3.14	13.5.2018	17:00-18:00	317	0.08
3.5.2018	17:00-18:00	323.00	5.13	13.5.2018	18:00-19:00	289	0.01
3.5.2018	18:00-19:00	332.00	5.39	13.5.2018	19:00-20:00	215	0.01
3.5.2018	19:00-20:00	218.43	4.60	13.5.2018	20:00-21:00	200	0.02
3.5.2018	20:00-21:00	188.10	2.53	13.5.2018	21:00-22:00	236	0.01
3.5.2018	21:00-22:00	172.57	0.47	13.5.2018	22:00-23:00	237	0.00
3.5.2018	22:00-23:00	155.57	0.52	13.5.2018	23:00-00:00	237	0.00
3.5.2018	23:00-00:00	80.47	0.35	13.5.2018	00:00-01:00	237	0.00
4.5.2018	00:00-01:00	160.98	0.44	13.5.2018	01:00-02:00	237	0.00
4.5.2018	01:00-02:00	149.27	0.21	14.5.2018	02:00-03:00	232	0.00
4.5.2018	02:00-03:00	66.82	0.27	14.5.2018	03:00-04:00	232	0.00
4.5.2018	03:00-04:00	46.73	0.03	14.5.2018	04:00-05:00	232	0.00
4.5.2018	04:00-05:00	99.93	0.07	14.5.2018	05:00-06:00	232	0.00
4.5.2018	05:00-06:00	119.68	0.02	14.5.2018	06:00-07:00	231	0.00
4.5.2018	06:00-07:00	217.57	0.08	14.5.2018	07:00-08:00	231	0.00
4.5.2018	07:00-08:00	163.95	0.59	14.5.2018	08:00-09:00	197	0.02
4.5.2018	08:00-09:00	183.07	0.53	14.5.2018	09:00-10:00	151	0.05
4.5.2018	09:00-10:00	164.90	0.76	14.5.2018	10:00-11:00	224	0.02
4.5.2018	10:00-11:00	251.32	1.97	14.5.2018	11:00-12:00	152	0.02
4.5.2018	11:00-12:00	274.83	2.81	14.5.2018	12:00-13:00	187	0.09
4.5.2018	12:00-13:00	280.60	4.14	14.5.2018	13:00-14:00	171	0.01
4.5.2018	13:00-14:00	183.48	2.81	14.5.2018	14:00-15:00	185	0.00
4.5.2018	14:00-15:00	226.55	1.90	14.5.2018	15:00-16:00	218	0.04
4.5.2018	15:00-16:00	269.42	1.95	14.5.2018	16:00-17:00	233	0.18
4.5.2018	16:00-17:00	279.48	1.75	14.5.2018	17:00-18:00	314	0.10
4.5.2018	17:00-18:00	265.73	0.95	14.5.2018	18:00-19:00	235	0.60
4.5.2018	18:00-19:00	209.87	2.89	14.5.2018	19:00-20:00	181	0.07

4.5.2018	19:00-20:00	90.37	1.68	14.5.2018	20:00-21:00	144	0.00
4.5.2018	20:00-21:00	56.65	0.49	14.5.2018	21:00-22:00	144	0.00
4.5.2018	21:00-22:00	90.58	0.49	14.5.2018	22:00-23:00	144	0.00
4.5.2018	22:00-23:00	186.78	0.46	14.5.2018	23:00-00:00	144	0.00
4.5.2018	23:00-00:00	60.12	0.33	15.5.2018	00:00-01:00	144	0.00
5.5.2018	00:00-01:00	67.05	0.22	15.5.2018	01:00-02:00	144	0.00
5.5.2018	01:00-02:00	21.95	0.08	15.5.2018	02:00-03:00	144	0.00
5.5.2018	02:00-03:00	22.10	0.17	15.5.2018	03:00-04:00	144	0.00
5.5.2018	03:00-04:00	19.00	0.03	15.5.2018	04:00-05:00	144	0.00
5.5.2018	04:00-05:00	311.98	0.02	15.5.2018	05:00-06:00	144	0.00
5.5.2018	05:00-06:00	51.10	0.00	15.5.2018	06:00-07:00	144	0.00
5.5.2018	06:00-07:00	321.28	0.07	15.5.2018	07:00-08:00	154	0.00
5.5.2018	07:00-08:00	106.80	0.84	15.5.2018	08:00-09:00	173	0.00
5.5.2018	08:00-09:00	128.07	1.03	15.5.2018	09:00-10:00	130	0.03
5.5.2018	09:00-10:00	191.68	0.56	15.5.2018	10:00-11:00	119	0.04
5.5.2018	10:00-11:00	210.63	1.88	15.5.2018	11:00-12:00	176	0.04
5.5.2018	11:00-12:00	154.27	2.58	15.5.2018	12:00-13:00	159	0.07
5.5.2018	12:00-13:00	204.82	3.00	15.5.2018	13:00-14:00	137	0.13
5.5.2018	13:00-14:00	251.00	4.39	15.5.2018	14:00-15:00	198	0.09
5.5.2018	14:00-15:00	206.17	4.66	15.5.2018	15:00-16:00	273	0.40

AQ5 (hourly wind speed and direction results)				**AQ6 (hourly wind speed and direction results)**			
Date	**Time**	**Wind Direction (Degree)**	**Wind speed (kph)**	**Date**	**Time**	**Wind Direction (Degree)**	**Wind speed (kph)**
6.5.2018	11:00-12:00	140	5.82	6/5/2018	13:00-14:00	228	1.9
6.5.2018	12:00-13:00	245	4.22	6/5/2018	14:00-15:00	189	1.9
6.5.2018	13:00-14:00	248	3.21	6/5/2018	15:00-16:00	120	4.2
6.5.2018	14:00-15:00	209	3.24	6/5/2018	16:00-17:00	134	4.8
6.5.2018	15:00-16:00	167	6.11	6/5/2018	17:00-18:00	129	4.7
6.5.2018	16:00-17:00	172	5.10	6/5/2018	18:00-19:00	131	3
6.5.2018	17:00-18:00	171	3.07	6/5/2018	19:00-20:00	181	1.2
6.5.2018	18:00-19:00	175	1.54	6/5/2018	20:00-21:00	140	0.8
6.5.2018	19:00-20:00	206	1.72	6/5/2018	21:00-22:00	219	0.4
6.5.2018	20:00-21:00	196	0.56	6/5/2018	22:00-23:00	229	0.1
6.5.2018	21:00-22:00	229	1.01	6/5/2018	23:00-00:00	228	0.3
6.5.2018	22:00-23:00	228	0.31	7/5/2018	00:00-01:00	221	0.1
6.5.2018	23:00-00:00	230	0.43	7/5/2018	01:00-02:00	242	0.1
7.5.2018	00:00-01:00	234	0.76	7/5/2018	02:00-03:00	235	0.7
7.5.2018	01:00-02:00	235	1.01	7/5/2018	03:00-04:00	228	0.2
7.5.2018	02:00-03:00	246	2.87	7/5/2018	04:00-05:00	237	0.0
7.5.2018	03:00-04:00	245	3.23	7/5/2018	05:00-06:00	213	0.0
7.5.2018	04:00-05:00	254	1.16	7/5/2018	06:00-07:00	114	0.1
7.5.2018	05:00-06:00	264	0.68	7/5/2018	07:00-08:00	240	1.1
7.5.2018	06:00-07:00	193	0.26	7/5/2018	08:00-09:00	256	2.0
7.5.2018	07:00-08:00	242	1.79	7/5/2018	09:00-10:00	242	2.5
7.5.2018	08:00-09:00	264	5.65	7/5/2018	10:00-11:00	253	1.9
7.5.2018	09:00-10:00	272	5.89	7/5/2018	11:00-12:00	253	2.3
7.5.2018	10:00-11:00	254	5.17	7/5/2018	12:00-13:00	264	2.3
7.5.2018	11:00-12:00	239	5.72	7/5/2018	13:00-14:00	262	2.0
7.5.2018	12:00-13:00	256	5.74	7/5/2018	14:00-15:00	250	2.1
7.5.2018	13:00-14:00	256	5.43	7/5/2018	15:00-16:00	20	0.4
7.5.2018	14:00-15:00	250	4.92	7/5/2018	16:00-17:00	245	1.2
7.5.2018	15:00-16:00	261	3.70	7/5/2018	17:00-18:00	192	1.6
7.5.2018	16:00-17:00	259	3.19	7/5/2018	18:00-19:00	120	3.0
7.5.2018	17:00-18:00	233	4.06	7/5/2018	19:00-20:00	126	2
7.5.2018	18:00-19:00	190	1.51	7/5/2018	20:00-21:00	146	0.3
7.5.2018	19:00-20:00	181	1.23	7/5/2018	21:00-22:00	234	0.7
7.5.2018	20:00-21:00	211	0.57	7/5/2018	22:00-23:00	245	0.2

7.5.2018	21:00-22:00	238	1.92	7/5/2018	23:00-00:00	239	0.8
7.5.2018	22:00-23:00	243	0.97	8/5/2018	00:00-01:00	241	0.4
7.5.2018	23:00-00:00	236	1.62	8/5/2018	01:00-02:00	238	0.4
8.5.2018	00:00-01:00	234	1.54	8/5/2018	02:00-03:00	239	0.8
8.5.2018	01:00-02:00	228	0.38	8/5/2018	03:00-04:00	226	0.4
8.5.2018	02:00-03:00	232	1.83	8/5/2018	04:00-05:00	229	0.0
8.5.2018	03:00-04:00	232	0.93	8/5/2018	05:00-06:00	229	0.0
8.5.2018	04:00-05:00	231	0.39	8/5/2018	06:00-07:00	220	0.0
8.5.2018	05:00-06:00	191	0.08	8/5/2018	07:00-08:00	239	1.2
8.5.2018	06:00-07:00	209	0.15	8/5/2018	08:00-09:00	265	2.0
8.5.2018	07:00-08:00	256	3.89	8/5/2018	09:00-10:00	258	2.8
8.5.2018	08:00-09:00	278	5.88	8/5/2018	10:00-11:00	249	2.7
8.5.2018	09:00-10:00	276	6.55	8/5/2018	11:00-12:00	244	2.6
8.5.2018	10:00-11:00	268	5.98	8/5/2018	12:00-13:00	258	1.7
8.5.2018	11:00-12:00	253	4.98	8.5.2018	13:00-14:00	259	2.2
8.5.2018	12:00-13:00	246	4.22	8.5.2018	14:00-15:00	238	1.8
8.5.2018	13:00-14:00	254	5.39	8.5.2018	15:00-16:00	248	1.8
8.5.2018	14:00-15:00	250	4.16	8.5.2018	16:00-17:00	244	2.0
8.5.2018	15:00-16:00	248	5.59	8.5.2018	17:00-18:00	218	1.3
8.5.2018	16:00-17:00	251	4.78	8.5.2018	18:00-19:00	124	2.8
8.5.2018	17:00-18:00	238	3.42	8.5.2018	19:00-20:00	180	1
8.5.2018	18:00-19:00	187	1.17	8.5.2018	20:00-21:00	224	0.7
8.5.2018	19:00-20:00	211	0.73	8.5.2018	21:00-22:00	226	0.4
8.5.2018	20:00-21:00	222	0.90	8.5.2018	22:00-23:00	244	0.2
8.5.2018	21:00-22:00	233	0.31	8.5.2018	23:00-00:00	234	0.4
8.5.2018	22:00-23:00	256	1.25	9.5.2018	00:00-01:00	225	0.4
8.5.2018	23:00-00:00	255	2.14	9.5.2018	01:00-02:00	234	0.7
9.5.2018	00:00-01:00	252	1.50	9.5.2018	02:00-03:00	224	0.3
9.5.2018	01:00-02:00	241	1.58	9.5.2018	03:00-04:00	234	0.6
9.5.2018	02:00-03:00	227	0.90	9.5.2018	04:00-05:00	169	0.1
9.5.2018	03:00-04:00	231	1.23	9.5.2018	05:00-06:00	231	0.1
9.5.2018	04:00-05:00	227	0.18	9.5.2018	06:00-07:00	115	0.0
9.5.2018	05:00-06:00	238	0.06	9.5.2018	07:00-08:00	194	0.7
9.5.2018	06:00-07:00	218	0.01	9.5.2018	08:00-09:00	243	2.0
9.5.2018	07:00-08:00	235	0.98	9.5.2018	09:00-10:00	237	1.7
9.5.2018	08:00-09:00	275	4.33	9.5.2018	10:00-11:00	253	1.6
9.5.2018	09:00-10:00	263	3.88	9.5.2018	11:00-12:00	254	1.7
9.5.2018	10:00-11:00	246	4.33	9.5.2018	12:00-13:00	254	2.6

AQ7 (hourly wind speed and direction results)				**AQ8 (hourly wind speed and direction results)**			
Date	**Time**	**Wind Direction (Degree)**	**Wind speed (kph)**	**Date**	**Time**	**Wind Direction (Degree)**	**Wind speed (kph)**
6.5.2018	14:00-15:00	218	4.41	9.5.2018	16:00-17:00	188	3
6.5.2018	15:00-16:00	189	12.06	9.5.2018	17:00-18:00	181	2
6.5.2018	16:00-17:00	194	11.77	9.5.2018	18:00-19:00	190	2
6.5.2018	17:00-18:00	197	8.57	9.5.2018	19:00-20:00	190	2
6.5.2018	18:00-19:00	190	4.56	9.5.2018	20:00-21:00	193	1
6.5.2018	19:00-20:00	190	2.16	9.5.2018	21:00-22:00	196	0
6.5.2018	20:00-21:00	193	1.66	9.5.2018	22:00-23:00	193	0
6.5.2018	21:00-22:00	196	0.01	10.5.2018	23:00-00:00	192	0
6.5.2018	22:00-23:00	193	0.00	10.5.2018	00:00-01:00	215	0
6.5.2018	23:00-00:00	192	0.00	10.5.2018	01:00-02:00	221	0
7.5.2018	00:00-01:00	213	0.00	10.5.2018	02:00-03:00	226	1
7.5.2018	01:00-02:00	220	0.00	10.5.2018	03:00-04:00	233	1

7.5.2018	02:00-03:00	225	0.18	10.5.2018	04:00-05:00	229	1
7.5.2018	03:00-04:00	232	0.18	10.5.2018	05:00-06:00	205	0
7.5.2018	04:00-05:00	230	0.05	10.5.2018	06:00-07:00	206	0
7.5.2018	05:00-06:00	209	0.00	10.5.2018	07:00-08:00	245	0
7.5.2018	06:00-07:00	206	0.02	10.5.2018	08:00-09:00	229	0
7.5.2018	07:00-08:00	231	0.48	10.5.2018	09:00-10:00	180	0
7.5.2018	08:00-09:00	252	2.40	10.5.2018	10:00-11:00	267	1
7.5.2018	09:00-10:00	187	2.76	10.5.2018	11:00-12:00	110	3
7.5.2018	10:00-11:00	256	2.45	10.5.2018	12:00-13:00	150	1
7.5.2018	11:00-12:00	135	1.93	10.5.2018	13:00-14:00	130	2
7.5.2018	12:00-13:00	144	2.37	10.5.2018	14:00-15:00	139	1
7.5.2018	13:00-14:00	128	1.88	10.5.2018	15:00-16:00	155	1
7.5.2018	14:00-15:00	128	1.96	10.5.2018	16:00-17:00	165	4
7.5.2018	15:00-16:00	162	0.88	10.5.2018	17:00-18:00	174	4
7.5.2018	16:00-17:00	155	0.64	10.5.2018	18:00-19:00	178	3
7.5.2018	17:00-18:00	196	3.34	10.5.2018	19:00-20:00	180	2
7.5.2018	18:00-19:00	199	5.38	10.5.2018	20:00-21:00	145	6
7.5.2018	19:00-20:00	199	4.61	10.5.2018	21:00-22:00	218	1
7.5.2018	20:00-21:00	201	0.23	10.5.2018	22:00-23:00	115	0
7.5.2018	21:00-22:00	282	0.18	10.5.2018	23:00-00:00	211	0
7.5.2018	22:00-23:00	273	0.05	11.5.2018	00:00-01:00	229	0
7.5.2018	23:00-00:00	263	0.03	11.5.2018	01:00-02:00	229	0
8.5.2018	00:00-01:00	259	0.00	11.5.2018	02:00-03:00	188	0
8.5.2018	01:00-02:00	225	0.00	11.5.2018	03:00-04:00	184	0
8.5.2018	02:00-03:00	224	0.00	11.5.2018	04:00-05:00	147	0
8.5.2018	03:00-04:00	235	0.00	11.5.2018	05:00-06:00	39	4
8.5.2018	04:00-05:00	248	0.00	11.5.2018	06:00-07:00	67	4
8.5.2018	05:00-06:00	240	0.00	11.5.2018	07:00-08:00	93	6
8.5.2018	06:00-07:00	240	0.00	11.5.2018	08:00-09:00	96	8
8.5.2018	07:00-08:00	289	0.48	11.5.2018	09:00-10:00	97	8
8.5.2018	08:00-09:00	303	1.84	11.5.2018	10:00-11:00	115	8
8.5.2018	09:00-10:00	287	2.29	11.5.2018	11:00-12:00	123	6
8.5.2018	10:00-11:00	290	2.25	11.5.2018	12:00-13:00	129	3
8.5.2018	11:00-12:00	242	2.37	11.5.2018	13:00-14:00	119	2
8.5.2018	12:00-13:00	86	3.58	11.5.2018	14:00-15:00	121	1
8.5.2018	13:00-14:00	177	2.39	11.5.2018	15:00-16:00	108	2
8.5.2018	14:00-15:00	274	1.18	11.5.2018	16:00-17:00	171	2
8.5.2018	15:00-16:00	272	1.44	11.5.2018	17:00-18:00	182	2
8.5.2018	16:00-17:00	237	0.71	11.5.2018	18:00-19:00	181	1
8.5.2018	17:00-18:00	218	1.69	11.5.2018	19:00-20:00	176	1
8.5.2018	18:00-19:00	195	5.69	11.5.2018	20:00-21:00	171	0
8.5.2018	19:00-20:00	198	1.24	11.5.2018	21:00-22:00	156	0
8.5.2018	20:00-21:00	225	0.02	11.5.2018	22:00-23:00	179	0
8.5.2018	21:00-22:00	233	0.03	11.5.2018	23:00-00:00	208	1

8.5.2018	22:00-23:00	289	0.01	12.5.2018	00:00-01:00	168	0
8.5.2018	23:00-00:00	299	0.00	12.5.2018	01:00-02:00	171	0
9.5.2018	00:00-01:00	299	0.00	12.5.2018	02:00-03:00	171	0
9.5.2018	01:00-02:00	229	0.00	12.5.2018	03:00-04:00	171	0
9.5.2018	02:00-03:00	232	0.00	12.5.2018	04:00-05:00	171	0
9.5.2018	03:00-04:00	242	0.00	12.5.2018	05:00-06:00	171	0
9.5.2018	04:00-05:00	250	0.00	12.5.2018	06:00-07:00	169	0
9.5.2018	05:00-06:00	250	0.00	12.5.2018	07:00-08:00	91	0
9.5.2018	06:00-07:00	238	0.00	12.5.2018	08:00-09:00	134	0
9.5.2018	07:00-08:00	239	0.10	12.5.2018	09:00-10:00	130	0
9.5.2018	08:00-09:00	292	0.88	12.5.2018	10:00-11:00	184	1
9.5.2018	09:00-10:00	278	0.79	12.5.2018	11:00-12:00	108	4
9.5.2018	10:00-11:00	268	0.87	12.5.2018	12:00-13:00	116	2
9.5.2018	11:00-12:00	229	0.94	12.5.2018	13:00-14:00	235	1
9.5.2018	12:00-13:00	189	1.72	12.5.2018	14:00-15:00	231	0
9.5.2018	13:00-14:00	196	1.88	12.5.2018	15:00-16:00	231	0

AQ9 (hourly wind speed and direction results)				**AQ10 (hourly wind speed and direction results)**			
Date	**Time**	**Wind Direction (Degree)**	**Wind speed (kph)**	**Date**	**Time**	**Wind Direction (Degree)**	**Wind speed (kph)**
9.5.2018	14:00-15:00	217.56	16.32	9.5.2018	15:00-16:00	0	4.87
9.5.2018	15:00-16:00	246.93	14.31	9.5.2018	16:00-17:00	0	5.21
9.5.2018	16:00-17:00	261.92	9.78	9.5.2018	17:00-18:00	0	2.43
9.5.2018	17:00-18:00	245.15	11.81	9.5.2018	18:00-19:00	0	4.01
9.5.2018	18:00-19:00	251.87	10.70	9.5.2018	19:00-20:00	0	3.29
9.5.2018	19:00-20:00	264.03	7.30	9.5.2018	20:00-21:00	0	3.05
9.5.2018	20:00-21:00	268.22	6.99	9.5.2018	21:00-22:00	0	3.13
9.5.2018	21:00-22:00	276.23	4.98	9.5.2018	22:00-23:00	0	3.55
9.5.2018	22:00-23:00	270.02	5.20	9.5.2018	23:00-00:00	0	2.78
9.5.2018	23:00-00:00	277.52	4.29	9.5.2018	00:00-01:00	0	2.93
10.5.2018	00:00-01:00	281.85	2.62	10.5.2018	01:00-02:00	0	3.83
10.5.2018	01:00-02:00	284.37	1.89	10.5.2018	02:00-03:00	0	4.03
10.5.2018	02:00-03:00	288.62	1.15	10.5.2018	03:00-04:00	0	1.81
10.5.2018	03:00-04:00	262.70	7.59	10.5.2018	04:00-05:00	0	0.02
10.5.2018	04:00-05:00	285.13	1.03	10.5.2018	05:00-06:00	0	0.00
10.5.2018	05:00-06:00	77.68	3.63	10.5.2018	06:00-07:00	0	0.12
10.5.2018	06:00-07:00	95.22	4.46	10.5.2018	07:00-08:00	0	0.06
10.5.2018	07:00-08:00	133.12	6.74	10.5.2018	08:00-09:00	0	0.14
10.5.2018	08:00-09:00	143.75	9.50	10.5.2018	09:00-10:00	0	0.19
10.5.2018	09:00-10:00	143.50	9.41	10.5.2018	10:00-11:00	0	0.01
10.5.2018	10:00-11:00	139.15	5.09	10.5.2018	11:00-12:00	0	0.25
10.5.2018	11:00-12:00	120.85	2.55	10.5.2018	12:00-13:00	0	1.12
10.5.2018	12:00-13:00	182.42	5.05	10.5.2018	13:00-14:00	0	1.39

10.5.2018	13:00-14:00	205.15	9.60	10.5.2018	14:00-15:00	153	1.65
10.5.2018	14:00-15:00	208.08	12.00	10.5.2018	15:00-16:00	161	2.30
10.5.2018	15:00-16:00	210.08	16.32	10.5.2018	16:00-17:00	173	2.12
10.5.2018	16:00-17:00	232.40	16.75	10.5.2018	17:00-18:00	182	2.12
10.5.2018	17:00-18:00	235.55	15.94	10.5.2018	18:00-19:00	188	1.85
10.5.2018	18:00-19:00	238.88	14.88	10.5.2018	19:00-20:00	203	1.67
10.5.2018	19:00-20:00	241.42	12.46	10.5.2018	20:00-21:00	238	6.82
10.5.2018	20:00-21:00	193.50	6.09	10.5.2018	21:00-22:00	296	6.78
10.5.2018	21:00-22:00	191.43	3.37	10.5.2018	22:00-23:00	255	1.60
10.5.2018	22:00-23:00	210.88	2.30	10.5.2018	23:00-00:00	288	3.10
10.5.2018	23:00-00:00	291.98	0.32	10.5.2018	00:00-01:00	256	1.19
11.5.2018	00:00-01:00	302.98	0.10	11.5.2018	01:00-02:00	248	0.39
11.5.2018	01:00-02:00	305.30	1.46	11.5.2018	02:00-03:00	209	0.29
11.5.2018	02:00-03:00	262.78	1.03	11.5.2018	03:00-04:00	212	0.13
11.5.2018	03:00-04:00	263.17	0.51	11.5.2018	04:00-05:00	206	0.05
11.5.2018	04:00-05:00	197.15	0.31	11.5.2018	05:00-06:00	67	3.22
11.5.2018	05:00-06:00	77.68	3.63	11.5.2018	06:00-07:00	117	0.72
11.5.2018	06:00-07:00	95.22	4.46	11.5.2018	07:00-08:00	152	0.62
11.5.2018	07:00-08:00	133.12	6.74	11.5.2018	08:00-09:00	138	1.15
11.5.2018	08:00-09:00	143.75	9.50	11.5.2018	09:00-10:00	130	1.54
11.5.2018	09:00-10:00	146.60	9.54	11.5.2018	10:00-11:00	131	1.44
11.5.2018	10:00-11:00	159.03	10.61	11.5.2018	11:00-12:00	143	0.55
11.5.2018	11:00-12:00	178.50	10.28	11.5.2018	12:00-13:00	167	0.18
11.5.2018	12:00-13:00	193.40	8.79	11.5.2018	13:00-14:00	188	0.41
11.5.2018	13:00-14:00	199.10	6.99	11.5.2018	14:00-15:00	181	0.97
11.5.2018	14:00-15:00	214.12	8.14	11.5.2018	15:00-16:00	157	0.88
11.5.2018	15:00-16:00	195.03	9.32	11.5.2018	16:00-17:00	167	1.02
11.5.2018	16:00-17:00	204.23	11.64	11.5.2018	17:00-18:00	178	1.15
11.5.2018	17:00-18:00	232.70	12.75	11.5.2018	18:00-19:00	183	0.56
11.5.2018	18:00-19:00	233.10	9.10	11.5.2018	19:00-20:00	186	0.64
11.5.2018	19:00-20:00	234.85	8.34	11.5.2018	20:00-21:00	184	0.60
11.5.2018	20:00-21:00	232.33	7.40	11.5.2018	21:00-22:00	187	0.40
11.5.2018	21:00-22:00	238.12	7.34	11.5.2018	22:00-23:00	176	0.76
11.5.2018	22:00-23:00	236.40	7.97	11.5.2018	23:00-00:00	252	2.70
11.5.2018	23:00-00:00	295.00	3.84	11.5.2018	00:00-01:00	303	0.13
12.5.2018	00:00-01:00	277.93	0.34	12.5.2018	01:00-02:00	216	0.06
12.5.2018	01:00-02:00	254.72	0.98	12.5.2018	02:00-03:00	215	0.05
12.5.2018	02:00-03:00	241.93	0.74	12.5.2018	03:00-04:00	219	0.60
12.5.2018	03:00-04:00	262.70	0.74	12.5.2018	04:00-05:00	218	0.53
12.5.2018	04:00-05:00	285.13	0.97	12.5.2018	05:00-06:00	212	0.70
12.5.2018	05:00-06:00	259.25	0.70	12.5.2018	06:00-07:00	189	0.09
12.5.2018	06:00-07:00	222.47	1.35	12.5.2018	07:00-08:00	130	0.04
12.5.2018	07:00-08:00	177.08	2.45	12.5.2018	08:00-09:00	169	0.06
12.5.2018	08:00-09:00	199.52	4.82	12.5.2018	09:00-10:00	160	0.05

12.5.2018	09:00-10:00	203.27	6.46	12.5.2018	10:00-11:00	181	1.17
12.5.2018	10:00-11:00	157.15	5.02	12.5.2018	11:00-12:00	155	1.88
12.5.2018	11:00-12:00	125.00	7.82	12.5.2018	12:00-13:00	200	0.18
12.5.2018	12:00-13:00	182.42	5.05	12.5.2018	13:00-14:00	245	1.61
12.5.2018	13:00-14:00	205.15	9.60	12.5.2018	14:00-15:00	145	1.77

Hourly air quality results

AQ1 (first day)

Date	**Time**	**CO**	**NO2**	**NO**	**PM2.5**	**PM10**	**RH**	**SO2**	**TmpC**
D.M.Y	**H.M.S**	**µg/m3**	**µg/m3**	**µg/m3**	**µg/m3**	**µg/m3**	**%**	**µg/m3**	**Deg. C**
2.5.2018	11:00-12:00	47.61	4.25	0.01	2.00	1.00	66.11	0.00	32.43
2.5.2018	12:00-13:00	62.22	3.89	0.00	3.10	15.62	66.20	0.00	33.77
2.5.2018	13:00-14:00	16.61	114.45	0.00	4.30	2.47	66.53	0.00	33.57
2.5.2018	14:00-15:00	25.48	48.16	0.00	9.00	2.57	66.93	0.00	33.63
2.5.2018	15:00-16:00	27.29	15.30	0.00	8.70	2.95	67.05	0.00	33.93
2.5.2018	16:00-17:00	38.36	9.19	0.00	2.92	8.52	67.50	0.00	34.35
2.5.2018	17:00-18:00	65.09	47.41	0.00	33.80	95.02	72.93	31.23	30.63
2.5.2018	18:00-19:00	107.27	68.36	0.00	15.12	40.25	80.85	130.10	27.32
2.5.2018	19:00-20:00	111.56	26.09	0.00	28.33	9.95	83.92	130.66	26.05
2.5.2018	20:00-21:00	97.91	12.76	0.00	20.80	30.58	86.80	0.00	25.28
3.5.2018	21:00-22:00	71.00	11.57	0.00	15.47	1.28	86.33	0.00	25.23
3.5.2018	22:00-23:00	54.21	16.47	0.00	13.57	3.20	86.55	0.00	24.92
3.5.2018	23:00-00:00	74.44	16.52	0.00	5.42	16.85	87.73	0.00	24.70
3.5.2018	00:00-01:00	49.63	9.97	0.00	7.47	3.47	88.40	0.00	24.62
3.5.2018	01:00-02:00	59.26	12.32	0.00	9.93	16.88	89.52	0.00	24.83
3.5.2018	02:00-03:00	40.37	9.72	0.00	9.28	3.70	89.67	0.00	24.30
3.5.2018	03:00-04:00	50.29	10.91	0.00	18.77	30.60	91.80	0.00	23.93
3.5.2018	04:00-05:00	67.66	17.00	0.00	20.13	11.33	93.70	0.00	23.65
3.5.2018	05:00-06:00	65.56	19.75	0.00	14.25	21.17	93.85	0.00	23.63
3.5.2018	06:00-07:00	90.37	12.98	0.01	8.23	8.20	88.38	0.00	24.37
3.5.2018	07:00-08:00	104.69	3.76	0.04	2.93	96.57	77.53	0.00	28.07
3.5.2018	08:00-09:00	35.02	3.76	0.08	2.67	1.00	71.07	0.28	32.05
3.5.2018	09:00-10:00	49.24	4.17	0.06	8.62	1.60	68.28	0.00	34.22
3.5.2018	10:00-11:00	56.69	3.76	0.04	17.93	5.18	65.13	0.00	36.90

AQ1 (second day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
3.5.2018	11:00-12:00	12.03	3.86	0.02	20.31	8.92	63.78	0.00	37.10
3.5.2018	12:00-13:00	46.57	7.84	0.00	16.90	6.07	62.42	0.00	37.42
3.5.2018	13:00-14:00	54.68	5.58	0.00	17.77	1.13	61.72	0.00	38.08
3.5.2018	14:00-15:00	93.24	35.85	0.04	44.67	77.95	72.10	0.00	35.45

3.5.2018	15:00-16:00	70.05	56.38	0.00	19.25	67.63	72.55	0.41	34.12
3.5.2018	16:00-17:00	73.96	12.45	0.02	29.00	9.30	72.10	0.00	34.45
3.5.2018	17:00-18:00	67.47	60.24	0.00	40.73	48.68	76.52	11.88	30.97
3.5.2018	18:00-19:00	69.19	60.27	0.00	26.27	191.55	83.67	72.09	28.12
3.5.2018	19:00-20:00	93.24	41.92	0.00	24.52	65.55	87.05	18.88	27.12
3.5.2018	20:00-21:00	93.81	34.49	0.00	26.78	26.45	88.67	1.32	26.80
3.5.2018	21:00-22:00	76.82	35.59	0.00	26.57	24.47	89.92	0.00	26.33
3.5.2018	22:00-23:00	85.13	40.45	0.00	30.88	42.37	91.30	0.00	26.05
3.5.2018	23:00-00:00	61.46	30.57	0.00	38.27	47.93	94.92	0.00	25.42
4.5.2018	00:00-01:00	56.02	37.13	0.00	46.35	66.77	95.13	0.00	25.48
4.5.2018	01:00-02:00	48.58	40.10	0.00	44.92	50.97	97.17	0.00	25.05
4.5.2018	02:00-03:00	34.26	43.15	0.00	41.68	40.83	97.68	0.00	24.95
4.5.2018	03:00-04:00	48.38	39.54	0.00	34.58	26.90	98.15	0.00	24.62
4.5.2018	04:00-05:00	144.68	29.88	0.00	41.47	43.75	99.68	0.00	24.48
4.5.2018	05:00-06:00	33.69	31.64	0.00	48.33	84.27	98.35	0.00	24.52
4.5.2018	06:00-07:00	39.32	11.58	0.00	35.68	30.18	94.43	0.00	24.90
4.5.2018	07:00-08:00	49.63	13.08	0.03	37.12	21.77	91.55	0.00	25.38
4.5.2018	08:00-09:00	29.49	6.71	0.04	10.88	1.78	81.42	0.50	28.45
4.5.2018	09:00-10:00	36.17	3.95	0.05	5.95	6.48	70.78	3.32	34.87
4.5.2018	10:00-11:00	28.34	3.76	0.09	11.98	1.75	64.72	0.00	39.27

AQ1 (third day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
4.5.2018	11:00-12:00	21.28	4.64	0.05	26.18	4.75	63.55	0.00	38.90
4.5.2018	12:00-13:00	67.95	16.52	0.01	35.08	54.42	64.15	0.00	38.10
4.5.2018	13:00-14:00	160.23	198.99	0.00	68.25	137.73	86.02	81.93	27.75
4.5.2018	14:00-15:00	132.37	43.08	0.01	24.87	1.85	78.68	48.19	28.12
4.5.2018	15:00-16:00	35.50	3.76	0.01	5.70	2.12	69.42	0.00	31.52
4.5.2018	16:00-17:00	34.07	4.17	0.06	20.70	43.65	65.12	2.57	35.13
4.5.2018	17:00-18:00	88.94	68.48	0.02	44.63	63.27	75.70	3.79	31.03
4.5.2018	18:00-19:00	85.13	31.73	0.00	48.37	64.68	80.05	24.99	29.40
4.5.2018	19:00-20:00	90.47	22.01	0.00	46.28	39.92	84.20	42.08	27.48
4.5.2018	20:00-21:00	176.74	27.28	0.00	43.82	37.73	86.80	12.79	25.98
4.5.2018	21:00-22:00	56.50	26.09	0.00	44.40	36.88	87.95	4.80	25.90
4.5.2018	22:00-23:00	59.45	17.59	0.00	38.65	30.72	89.92	0.00	25.48
4.5.2018	23:00-00:00	50.39	25.34	0.00	40.67	43.82	92.17	0.00	25.30
5.5.2018	00:00-01:00	62.13	20.04	0.00	46.73	49.85	95.57	0.00	24.73
5.5.2018	01:00-02:00	62.70	24.49	0.00	62.92	67.98	96.88	0.00	24.53
5.5.2018	02:00-03:00	73.87	15.52	0.00	72.87	68.82	97.03	0.00	24.35
5.5.2018	03:00-04:00	72.15	18.85	0.00	84.68	85.05	98.68	0.00	24.20
5.5.2018	04:00-05:00	119.77	22.23	0.00	75.35	76.10	99.42	0.00	23.93
5.5.2018	05:00-06:00	234.86	5.74	0.00	163.22	156.75	100.00	0.00	23.92
5.5.2018	06:00-07:00	870.35	6.30	0.00	74.47	74.73	92.43	0.00	25.38
5.5.2018	07:00-08:00	41.61	3.76	0.05	27.32	23.95	80.77	5.96	30.17

5.5.2018	08:00-09:00	22.04	3.76	0.04	17.63	7.28	68.97	1.47	35.05
5.5.2018	09:00-10:00	11.64	3.76	0.04	21.58	4.12	65.00	0.00	36.72
5.5.2018	10:00-11:00	25.67	4.89	0.02	4.15	3.23	59.43	0.00	40.02

AQ2 (first day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
2/5/2018	13:00-14:00	8.97	114.45	3.34	2.00	1.00	58.10	0.00	32.88
2/5/2018	14:00-15:00	21.28	47.10	7.23	3.60	2.23	57.73	1.60	33.85
2/5/2018	15:00-16:00	25.58	15.43	10.25	3.70	2.42	56.47	8.75	35.00
2/5/2018	16:00-17:00	37.70	9.16	9.62	11.82	8.73	56.65	10.79	34.43
2/5/2018	17:00-18:00	62.41	48.85	0.70	35.40	39.38	61.87	0.06	30.60
2/5/2018	18:00-19:00	104.59	67.86	1.79	22.05	23.55	67.12	0.00	28.00
2/5/2018	19:00-20:00	110.70	26.75	0.84	15.55	13.48	69.42	3.10	27.00
2/5/2018	20:00-21:00	96.96	12.95	4.32	6.08	4.47	71.95	0.85	26.62
2/5/2018	21:00-22:00	69.19	11.45	2.83	4.15	2.58	72.45	0.19	26.17
2/5/2018	22:00-23:00	52.77	16.93	1.27	3.82	2.32	73.05	0.60	26.00
2/5/2018	23:00-00:00	73.96	16.49	8.70	2.15	1.07	72.87	0.53	26.00
3/5/2018	00:00-01:00	48.67	9.75	3.42	2.10	1.03	73.90	0.53	26.27
3/5/2018	01:00-02:00	58.69	12.32	20.20	4.53	2.83	74.73	0.16	26.00
3/5/2018	02:00-03:00	39.80	9.06	0.91	6.15	16.33	75.68	2.63	26.00
3/5/2018	03:00-04:00	50.20	10.97	0.58	11.50	32.57	77.95	3.70	25.52
3/5/2018	04:00-05:00	67.85	16.81	0.59	12.37	29.57	80.78	0.00	25.00
3/5/2018	05:00-06:00	63.75	19.79	1.11	8.10	5.43	81.57	0.00	25.00
3/5/2018	06:00-07:00	89.42	12.92	12.68	9.65	1.97	77.75	1.07	25.47
3/5/2018	07:00-08:00	103.54	3.76	48.90	4.42	1.20	71.22	23.33	27.28
3/5/2018	08:00-09:00	33.97	3.76	50.17	2.03	1.03	66.32	24.11	29.45
3/5/2018	09:00-10:00	49.63	4.11	54.83	4.32	3.50	62.83	29.63	31.27
3/5/2018	10:00-11:00	55.73	3.76	45.81	8.17	9.43	59.68	17.59	32.97
3/5/2018	11:00-12:00	58.69	4.01	41.90	12.67	9.95	57.62	9.22	33.92
3/5/2018	12:00-13:00	59.65	3.89	35.62	4.88	3.72	56.05	4.55	34.98

AQ2 (second day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
3/5/2018	13:00-14:00	53.92	4.99	28.78	4.42	4.20	54.15	4.48	36.48
3/5/2018	14:00-15:00	92.57	38.51	11.31	44.15	49.72	60.77	0.00	33.27
3/5/2018	15:00-16:00	71.29	55.63	3.25	25.97	18.25	60.97	0.13	34.00
3/5/2018	16:00-17:00	79.02	12.39	26.02	41.37	42.95	60.40	2.32	33.52
3/5/2018	17:00-18:00	66.80	60.08	0.58	40.68	39.05	64.53	0.00	30.30
3/5/2018	18:00-19:00	68.71	59.95	0.65	22.92	29.07	70.78	0.00	28.38
3/5/2018	19:00-20:00	93.81	41.99	0.94	17.92	28.35	73.07	0.00	28.00
3/5/2018	20:00-21:00	96.48	31.23	3.35	14.60	12.73	75.15	0.00	27.08

3/5/2018	21:00-22:00	76.63	35.21	0.80	20.05	33.67	78.27	0.25	26.65
3/5/2018	22:00-23:00	84.65	40.48	0.72	25.83	46.02	79.98	0.00	26.17
3/5/2018	23:00-00:00	60.79	31.76	0.57	32.82	63.10	84.03	0.09	26.00
4/5/2018	00:00-01:00	54.97	37.75	0.57	31.48	51.72	85.68	0.00	26.00
4/5/2018	01:00-02:00	48.48	39.82	0.57	27.00	40.90	87.70	0.00	25.63
4/5/2018	02:00-03:00	33.40	40.95	0.58	22.93	28.47	88.40	0.00	25.73
4/5/2018	03:00-04:00	49.63	38.82	0.70	22.82	28.33	89.60	0.16	25.82
4/5/2018	04:00-05:00	144.96	29.57	1.63	33.97	44.08	89.95	9.47	25.82
4/5/2018	05:00-06:00	27.96	30.98	0.92	34.62	48.02	89.13	1.10	26.00
4/5/2018	06:00-07:00	27.48	12.10	5.35	29.53	16.97	85.07	0.09	26.13
4/5/2018	07:00-08:00	45.33	12.86	8.44	32.18	25.83	83.07	1.25	26.77
4/5/2018	08:00-09:00	27.39	5.30	18.71	16.75	3.47	76.03	8.56	27.80
4/5/2018	09:00-10:00	36.26	3.76	40.73	9.53	12.70	70.00	23.89	29.90
4/5/2018	10:00-11:00	29.11	3.76	86.20	9.73	11.00	59.80	39.82	34.55
4/5/2018	11:00-12:00	6.11	3.86	68.31	26.05	17.55	56.32	14.39	36.27
4/5/2018	12:00-13:00	48.77	8.34	24.71	31.62	27.37	56.07	1.76	35.95

AQ2 (third day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
4/5/2018	13:00-14:00	160.14	198.93	0.88	48.70	50.17	82.12	1.13	26.70
4/5/2018	14:00-15:00	133.80	42.36	35.11	10.55	1.02	66.65	0.82	28.43
4/5/2018	15:00-16:00	19.18	3.76	57.57	2.30	1.27	59.28	14.02	31.88
4/5/2018	16:00-17:00	35.60	4.04	55.75	14.93	16.33	56.07	20.88	34.48
4/5/2018	17:00-18:00	89.99	68.58	3.51	46.38	51.25	64.90	0.31	30.30
4/5/2018	18:00-19:00	86.18	34.62	0.73	41.80	50.30	68.58	0.85	28.55
4/5/2018	19:00-20:00	91.52	21.82	0.70	42.47	52.32	72.02	0.75	27.22
4/5/2018	20:00-21:00	177.41	27.56	0.59	40.52	52.37	73.83	6.27	26.27
4/5/2018	21:00-22:00	57.16	22.45	0.57	35.45	47.45	75.13	0.00	26.00
4/5/2018	22:00-23:00	60.60	16.90	0.60	36.98	56.08	77.98	0.00	26.00
4/5/2018	23:00-00:00	49.53	25.02	0.74	29.63	40.35	79.65	0.00	26.00
5/5/2018	00:00-01:00	62.70	19.91	0.57	40.68	54.40	84.02	0.00	25.23
5/5/2018	01:00-02:00	64.42	24.43	0.57	48.17	71.00	85.33	0.03	25.00
5/5/2018	02:00-03:00	73.48	15.55	0.60	57.63	81.88	86.32	0.03	25.00
5/5/2018	03:00-04:00	72.72	18.69	0.57	60.50	91.08	89.62	0.25	25.00
5/5/2018	04:00-05:00	118.24	22.73	0.64	70.50	95.62	90.43	9.34	25.00
5/5/2018	05:00-06:00	243.64	5.17	0.98	74.93	99.13	90.75	5.61	25.00
5/5/2018	06:00-07:00	159.18	5.80	12.68	59.05	55.22	89.25	8.31	25.72
5/5/2018	07:00-08:00	38.36	3.76	36.11	31.32	12.22	76.87	9.22	27.80
5/5/2018	08:00-09:00	18.13	4.33	63.77	4.72	2.78	67.80	50.42	30.38
5/5/2018	09:00-10:00	2.67	3.76	68.99	4.63	3.27	62.02	40.29	32.40
5/5/2018	10:00-11:00	24.34	4.99	48.35	8.28	6.45	57.13	13.67	35.07
5/5/2018	11:00-12:00	19.56	4.17	51.26	16.23	11.52	55.35	23.61	36.22
5/5/2018	12:00-13:00	68.23	16.09	7.14	31.77	19.60	55.72	2.01	36.73

AQ3 (first day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
2.5.2018	15:00-16:00	311.04	11.78	0.01	2.37	3.56	53.75	20.10	35.35
2.5.2018	16:00-17:00	246.23	33.08	0.00	1.47	4.32	55.10	2.95	34.80
2.5.2018	17:00-18:00	298.72	70.99	0.00	2.00	3.78	67.90	16.78	29.17
2.5.2018	18:00-19:00	272.57	87.42	0.00	5.80	8.13	74.37	13.89	27.50
2.5.2018	19:00-20:00	306.94	86.39	0.01	6.45	9.33	78.72	10.88	27.00
2.5.2018	20:00-21:00	308.10	76.07	0.01	2.62	4.33	81.92	7.21	26.82
2.5.2018	21:00-22:00	259.32	68.48	0.01	2.02	4.95	83.13	11.19	26.02
2.5.2018	22:00-23:00	263.64	69.39	0.00	2.03	4.00	85.92	10.88	26.00
2.5.2018	23:00-00:00	227.76	60.64	0.02	2.00	8.37	87.52	11.73	25.97
3.5.2018	00:00-01:00	214.00	56.10	0.03	2.00	4.52	88.10	12.23	25.87
3.5.2018	01:00-02:00	237.66	72.21	0.01	1.88	12.30	90.93	20.85	25.15
3.5.2018	02:00-03:00	218.16	75.93	0.00	3.08	6.80	92.04	15.47	25.00
3.5.2018	03:00-04:00	210.68	63.56	0.00	2.00	8.10	92.27	27.81	24.45
3.5.2018	04:00-05:00	158.03	87.05	0.00	2.03	11.90	91.83	1.98	24.00
3.5.2018	05:00-06:00	146.16	79.02	0.00	2.00	4.95	89.57	2.13	24.00
3.5.2018	06:00-07:00	149.06	65.75	0.00	2.00	3.60	84.63	9.12	24.00
3.5.2018	07:00-08:00	50.29	44.17	0.00	1.79	8.83	77.67	1.88	26.43
3.5.2018	08:00-09:00	252.32	156.28	0.01	2.12	9.57	71.10	4.52	28.37
3.5.2018	09:00-10:00	260.37	103.29	0.00	2.35	4.88	64.42	8.59	30.35
3.5.2018	10:00-11:00	178.64	83.85	0.00	1.40	3.92	57.55	21.35	32.47
3.5.2018	11:00-12:00	227.24	77.70	0.00	1.68	3.65	54.43	23.80	33.58
3.5.2018	12:00-13:00	196.62	54.62	0.00	2.97	4.75	49.53	23.52	35.48
3.5.2018	13:00-14:00	218.81	33.65	0.00	2.58	5.08	46.40	11.85	37.15
3.5.2018	14:00-15:00	315.75	96.55	0.00	1.27	9.88	61.80	10.25	31.92

AQ3 (second day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
3.5.2018	15:00-16:00	350.66	74.41	0.01	2.78	8.13	62.98	4.11	32.17
3.5.2018	16:00-17:00	374.96	46.31	0.00	1.67	5.13	63.02	3.67	31.60
3.5.2018	17:00-18:00	331.24	89.77	0.00	1.83	6.90	69.58	2.85	28.87
3.5.2018	18:00-19:00	288.52	108.05	0.00	2.55	8.58	78.87	2.73	27.20
3.5.2018	19:00-20:00	290.90	100.72	0.01	2.48	9.18	82.97	3.10	26.02
3.5.2018	20:00-21:00	317.30	83.88	0.01	2.05	9.82	84.75	3.20	26.00
3.5.2018	21:00-22:00	344.18	79.90	0.02	2.47	8.65	84.97	12.42	26.00
3.5.2018	22:00-23:00	351.78	62.24	0.04	2.00	10.17	87.02	34.12	25.88
3.5.2018	23:00-00:00	217.73	67.79	0.01	2.00	3.87	90.18	5.68	25.02
4.5.2018	00:00-01:00	224.85	66.38	0.00	2.13	11.37	91.22	22.17	25.00
4.5.2018	01:00-02:00	208.72	76.89	0.02	2.00	5.63	92.80	13.01	25.00
4.5.2018	02:00-03:00	171.48	71.02	0.00	2.00	8.53	94.03	7.87	25.00

4.5.2018	03:00-04:00	181.46	73.69	0.00	2.02	10.02	94.70	3.54	25.00
4.5.2018	04:00-05:00	209.93	68.76	0.00	2.32	5.48	94.87	9.47	25.00
4.5.2018	05:00-06:00	318.93	73.15	0.03	2.00	3.70	94.22	20.76	25.00
4.5.2018	06:00-07:00	336.30	65.66	0.04	2.33	5.57	91.78	19.79	25.28
4.5.2018	07:00-08:00	395.88	59.67	0.05	2.02	5.75	90.95	35.81	25.92
4.5.2018	08:00-09:00	348.12	13.83	0.11	2.53	4.87	79.45	24.02	27.27
4.5.2018	09:00-10:00	405.94	5.14	0.14	2.38	13.38	74.52	48.48	28.53
4.5.2018	10:00-11:00	271.57	3.79	0.15	2.20	7.05	62.52	48.70	31.52
4.5.2018	11:00-12:00	164.78	3.76	0.28	2.67	3.45	53.37	65.85	34.60
4.5.2018	12:00-13:00	256.82	4.39	0.19	1.52	6.57	53.28	33.43	34.47
4.5.2018	13:00-14:00	385.31	173.09	0.00	4.90	7.00	90.68	45.53	25.53
4.5.2018	14:00-15:00	243.00	38.69	0.01	1.12	5.83	68.70	6.77	28.40

AQ3 (third day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
4.5.2018	15:00-16:00	246.70	5.61	0.04	2.10	7.45	56.53	16.12	31.55
4.5.2018	16:00-17:00	304.33	16.71	0.17	2.17	4.43	52.47	23.64	33.55
4.5.2018	17:00-18:00	562.66	84.57	0.05	1.42	4.07	69.08	28.10	29.30
4.5.2018	18:00-19:00	283.08	72.06	0.00	3.72	8.37	73.28	11.88	27.78
4.5.2018	19:00-20:00	491.05	79.21	0.01	2.65	8.73	77.23	20.66	26.88
4.5.2018	20:00-21:00	395.59	72.18	0.00	2.02	4.70	77.87	22.17	26.00
4.5.2018	21:00-22:00	316.23	64.22	0.02	2.50	5.50	80.12	20.32	26.00
4.5.2018	22:00-23:00	296.29	66.13	0.04	2.00	3.62	82.32	15.90	26.00
4.5.2018	23:00-00:00	294.32	52.99	0.01	2.28	4.60	84.75	23.86	25.45
5.5.2018	00:00-01:00	256.28	56.38	0.00	2.02	6.42	87.45	11.35	25.00
5.5.2018	01:00-02:00	281.91	66.35	0.01	2.02	3.85	90.20	21.95	25.00
5.5.2018	02:00-03:00	254.00	61.43	0.00	2.00	4.30	90.58	17.53	24.87
5.5.2018	03:00-04:00	268.28	65.16	0.00	2.00	8.62	91.58	24.33	24.62
5.5.2018	04:00-05:00	302.22	64.97	0.02	2.02	6.27	92.73	25.18	24.15
5.5.2018	05:00-06:00	430.13	55.19	0.03	2.13	4.77	91.27	49.20	24.98
5.5.2018	06:00-07:00	763.41	59.77	0.06	2.03	8.75	91.30	71.18	25.02
5.5.2018	07:00-08:00	279.43	25.46	0.05	2.00	7.52	83.83	18.34	26.42
5.5.2018	08:00-09:00	230.81	3.76	0.15	2.18	8.98	71.13	42.17	28.83
5.5.2018	09:00-10:00	59.79	3.76	0.20	2.13	10.83	57.55	33.18	31.40
5.5.2018	10:00-11:00	173.12	3.76	0.31	3.93	15.18	54.38	61.65	32.32
5.5.2018	11:00-12:00	259.08	4.04	0.22	2.63	15.37	51.47	85.26	33.90
5.5.2018	12:00-13:00	237.96	12.26	0.00	1.50	7.23	50.00	13.83	34.77
5.5.2018	13:00-14:00	271.06	20.51	0.00	1.87	15.83	51.57	6.84	35.30
5.5.2018	14:00-15:00	260.49	26.78	0.00	1.57	9.18	54.03	8.03	34.10

AQ4 (first day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
12.5.2018	16:00-17:00	177.39	76.76	0.00	2.00	4.73	92.67	1.88	23.93
12.5.2018	17:00-18:00	107.51	46.41	0.00	2.02	6.50	94.48	2.16	23.70
12.5.2018	18:00-19:00	174.08	44.24	0.00	1.85	8.05	89.55	4.26	23.70
12.5.2018	19:00-20:00	358.38	70.65	0.00	1.95	3.03	93.67	6.58	23.12
12.5.2018	20:00-21:00	466.72	73.41	0.00	2.00	4.35	92.07	38.73	23.62
12.5.2018	21:00-22:00	292.59	51.33	0.00	2.00	5.32	90.13	18.25	24.00
12.5.2018	22:00-23:00	422.03	57.29	0.00	2.00	6.27	94.27	103.48	23.15
12.5.2018	23:00-00:00	455.15	77.11	0.00	2.00	7.58	96.52	97.36	23.00
13.5.2018	00:00-01:00	275.30	68.45	0.00	2.00	10.82	100.00	18.34	22.87
13.5.2018	01:00-02:00	484.02	57.88	0.00	2.02	7.88	99.95	48.35	22.90
13.5.2018	02:00-03:00	271.15	57.60	0.00	2.03	4.53	99.62	10.57	22.42
13.5.2018	03:00-04:00	407.22	55.85	0.00	2.02	7.13	100.00	31.29	22.00
13.5.2018	04:00-05:00	935.46	56.16	0.00	2.02	11.28	100.00	25.37	22.00
13.5.2018	05:00-06:00	483.65	53.31	0.00	2.00	10.53	100.00	61.96	22.00
13.5.2018	06:00-07:00	697.81	55.63	0.00	2.13	7.33	97.18	84.47	22.85
13.5.2018	07:00-08:00	461.50	67.13	0.00	4.03	6.40	89.53	14.17	24.73
13.5.2018	08:00-09:00	391.54	40.64	0.06	6.00	12.20	82.80	1.88	26.00
13.5.2018	09:00-10:00	183.50	17.76	0.00	1.00	2.88	68.53	20.22	28.34
13.5.2018	10:00-11:00	245.79	5.30	0.00	1.50	6.72	61.87	28.41	31.27
13.5.2018	11:00-12:00	139.63	6.02	0.00	1.60	10.50	58.37	11.57	32.33
13.5.2018	12:00-13:00	340.80	7.68	0.00	4.53	5.02	53.73	26.68	33.07
13.5.2018	13:00-14:00	147.46	18.06	0.00	2.55	7.77	51.57	2.63	33.43
13.5.2018	14:00-15:00	172.78	36.94	0.00	1.22	7.98	51.82	3.10	32.63
13.5.2018	15:00-16:00	174.55	40.79	0.00	1.30	8.17	58.73	2.67	31.52

AQ4 (second day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
13.5.2018	16:00-17:00	270.16	48.23	0.00	1.40	6.82	63.63	7.15	30.60
13.5.2018	17:00-18:00	288.55	61.93	0.00	1.45	11.62	67.33	27.28	29.27
13.5.2018	18:00-19:00	299.67	82.53	0.00	3.13	14.83	74.62	11.60	28.22
13.5.2018	19:00-20:00	238.75	78.58	0.00	8.43	9.37	78.92	2.19	27.18
13.5.2018	20:00-21:00	219.07	70.55	0.00	2.00	10.98	79.75	2.01	26.67
13.5.2018	21:00-22:00	206.09	66.32	0.00	2.00	4.57	80.65	4.52	26.02
13.5.2018	22:00-23:00	237.67	78.55	0.00	2.05	13.73	84.20	5.02	25.45
13.5.2018	23:00-00:00	233.81	47.35	0.00	2.00	8.43	78.75	18.69	25.03
13.5.2018	00:00-01:00	171.49	47.25	0.00	1.85	11.65	76.85	3.54	25.55
13.5.2018	01:00-02:00	166.60	50.04	0.00	2.55	7.86	79.05	16.48	25.14
14.5.2018	02:00-03:00	152.92	68.39	0.00	2.22	3.37	93.78	17.59	24.00
14.5.2018	03:00-04:00	161.62	64.37	0.00	2.03	4.90	95.72	14.77	24.00

14.5.2018	04:00-05:00	194.07	58.79	0.00	2.47	3.67	96.07	20.82	24.12
14.5.2018	05:00-06:00	200.70	46.09	0.00	4.00	4.17	94.33	31.04	24.33
14.5.2018	06:00-07:00	194.86	63.56	0.00	2.72	7.45	91.35	19.75	25.00
14.5.2018	07:00-08:00	145.04	58.61	0.00	2.02	12.57	81.90	2.60	24.67
14.5.2018	08:00-09:00	117.72	128.35	0.00	2.19	7.15	73.15	2.51	28.04
14.5.2018	09:00-10:00	115.28	42.27	0.00	2.02	4.98	70.75	2.07	28.48
14.5.2018	10:00-11:00	126.76	10.66	0.00	2.95	5.67	59.95	6.05	32.30
14.5.2018	11:00-12:00	78.81	3.92	0.00	3.20	11.57	49.30	9.56	36.23
14.5.2018	12:00-13:00	50.34	6.27	0.00	1.45	14.03	47.70	14.14	36.25
14.5.2018	13:00-14:00	145.75	51.42	0.00	1.07	10.10	55.12	5.30	33.70
14.5.2018	14:00-15:00	185.46	64.44	0.00	1.43	11.60	58.23	1.88	32.17
14.5.2018	15:00-16:00	206.41	68.42	0.00	2.07	4.62	59.78	1.94	31.60

AQ4 (third day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
14.5.2018	16:00-17:00	299.71	72.65	0.00	2.02	11.38	61.70	1.91	29.92
14.5.2018	17:00-18:00	248.94	87.83	0.00	2.03	12.67	65.02	1.98	29.00
14.5.2018	18:00-19:00	228.40	79.39	0.00	1.65	3.62	69.73	2.67	27.08
14.5.2018	19:00-20:00	282.57	121.10	0.00	2.78	14.38	100.00	1.94	21.37
14.5.2018	20:00-21:00	457.15	97.86	0.01	3.02	8.87	100.00	1.91	22.00
14.5.2018	21:00-22:00	483.44	81.50	0.01	2.02	8.27	100.00	2.76	22.00
14.5.2018	22:00-23:00	325.94	70.61	0.05	2.45	9.90	100.00	2.48	22.17
14.5.2018	23:00-00:00	204.76	64.41	0.01	2.00	3.28	99.87	2.73	23.00
15.5.2018	00:00-01:00	209.31	54.65	0.01	2.00	3.50	99.67	17.69	23.00
15.5.2018	01:00-02:00	200.91	69.42	0.02	2.00	3.47	99.97	2.19	23.00
15.5.2018	02:00-03:00	174.38	60.08	0.01	2.00	3.85	99.30	6.30	23.00
15.5.2018	03:00-04:00	176.07	63.50	0.01	2.02	8.62	100.00	25.09	23.00
15.5.2018	04:00-05:00	246.69	55.66	0.00	2.00	11.05	100.00	16.31	23.02
15.5.2018	05:00-06:00	368.24	59.20	0.00	2.00	8.90	100.00	21.35	23.08
15.5.2018	06:00-07:00	395.20	66.57	0.01	2.07	7.62	100.00	28.19	24.03
15.5.2018	07:00-08:00	168.41	49.83	0.03	2.95	9.63	92.97	14.24	25.82
15.5.2018	08:00-09:00	158.88	21.82	0.07	2.43	4.67	83.17	34.40	27.62
15.5.2018	09:00-10:00	129.55	17.15	0.07	1.23	5.75	76.65	7.78	28.35
15.5.2018	10:00-11:00	189.85	147.69	0.08	2.48	8.15	64.33	31.14	31.30
15.5.2018	11:00-12:00	41.58	3.76	0.14	3.47	4.73	49.75	57.98	36.15
15.5.2018	12:00-13:00	47.97	5.14	0.24	2.15	6.53	48.05	57.51	35.73
15.5.2018	13:00-14:00	70.56	25.09	0.08	1.37	6.23	49.92	13.99	34.88
15.5.2018	14:00-15:00	132.57	27.66	0.00	1.20	8.67	53.43	2.95	33.15
15.5.2018	15:00-16:00	156.75	41.89	0.00	1.47	7.90	61.12	1.88	30.67

AQ5 (first day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
6.5.2018	11:00-12:00	0.00	3.76	0.00	1.00	11.89	43.67	19.65	38.44
6.5.2018	12:00-13:00	6.16	3.76	0.00	1.43	8.17	45.73	26.43	36.67
6.5.2018	13:00-14:00	21.18	3.76	0.00	2.57	7.95	40.92	12.20	38.22
6.5.2018	14:00-15:00	63.97	3.76	0.00	1.65	5.10	43.57	8.25	38.25
6.5.2018	15:00-16:00	143.39	33.87	0.00	1.97	6.30	63.70	20.32	32.55
6.5.2018	16:00-17:00	165.98	43.59	0.00	1.93	4.28	64.68	8.43	31.67
6.5.2018	17:00-18:00	179.58	58.26	0.00	1.92	8.22	67.30	6.74	30.18
6.5.2018	18:00-19:00	264.03	82.53	0.00	2.83	3.53	74.22	3.01	28.22
6.5.2018	19:00-20:00	219.36	86.95	0.00	2.83	10.28	76.13	1.94	27.37
6.5.2018	20:00-21:00	208.36	73.03	0.00	2.28	6.37	78.32	4.14	26.60
6.5.2018	21:00-22:00	155.28	81.24	0.00	2.27	4.15	80.48	9.53	26.00
6.5.2018	22:00-23:00	125.85	77.23	0.00	2.47	4.45	83.72	6.08	25.48
6.5.2018	23:00-00:00	127.52	75.82	0.00	2.03	3.88	87.07	2.73	25.00
7.5.2018	00:00-01:00	135.09	79.74	0.00	2.33	6.07	90.38	2.88	25.00
7.5.2018	01:00-02:00	119.28	82.75	0.00	2.03	11.10	92.75	4.20	25.00
7.5.2018	02:00-03:00	111.06	83.94	0.00	2.18	12.02	93.53	3.76	25.00
7.5.2018	03:00-04:00	97.69	88.99	0.00	2.00	9.05	93.48	1.94	25.00
7.5.2018	04:00-05:00	112.14	79.96	0.02	2.00	11.13	95.40	4.39	24.58
7.5.2018	05:00-06:00	143.57	78.05	0.00	2.00	4.93	96.35	2.23	24.05
7.5.2018	06:00-07:00	227.55	63.43	0.01	2.00	8.87	94.13	4.80	25.03
7.5.2018	07:00-08:00	132.64	16.68	0.08	2.63	6.85	78.62	13.80	28.82
7.5.2018	08:00-09:00	51.06	3.76	0.15	2.48	3.52	63.13	9.47	32.48
7.5.2018	09:00-10:00	40.66	3.89	0.08	1.60	4.95	55.32	16.59	34.33
7.5.2018	10:00-11:00	69.98	5.36	0.08	3.13	7.28	52.63	16.84	35.32

AQ5 (second day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
7.5.2018	11:00-12:00	59.72	15.74	0.05	2.28	5.68	47.15	9.25	35.90
7.5.2018	12:00-13:00	92.70	9.88	0.04	3.45	9.82	46.35	8.28	37.08
7.5.2018	13:00-14:00	81.62	9.91	0.10	3.20	7.90	42.98	4.01	38.07
7.5.2018	14:00-15:00	101.40	12.35	0.09	1.70	4.43	42.47	2.70	38.12
7.5.2018	15:00-16:00	112.15	27.84	0.01	1.32	12.13	43.25	1.88	37.12
7.5.2018	16:00-17:00	136.13	28.28	0.01	1.33	11.43	43.23	1.88	36.98
7.5.2018	17:00-18:00	234.88	91.69	0.00	1.77	9.02	53.05	4.08	33.78
7.5.2018	18:00-19:00	280.46	127.93	0.00	2.53	11.87	72.73	10.07	29.65
7.5.2018	19:00-20:00	214.54	120.13	0.00	6.30	10.28	80.52	2.73	28.05
7.5.2018	20:00-21:00	229.05	99.34	0.00	2.67	11.80	83.95	3.42	27.03
7.5.2018	21:00-22:00	202.32	62.78	0.00	2.08	12.87	78.25	2.98	27.00
7.5.2018	22:00-23:00	174.88	64.31	0.00	2.00	11.98	77.40	3.61	26.58

7.5.2018	23:00-00:00	177.93	79.49	0.00	2.00	11.08	82.18	4.33	26.00
8.5.2018	00:00-01:00	134.41	106.17	0.01	2.47	14.38	87.43	1.91	25.47
8.5.2018	01:00-02:00	123.63	84.00	0.02	2.10	14.40	93.13	5.58	25.00
8.5.2018	02:00-03:00	112.66	87.80	0.00	2.02	12.35	94.38	1.91	25.00
8.5.2018	03:00-04:00	112.74	83.97	0.00	2.00	10.82	96.60	5.39	24.53
8.5.2018	04:00-05:00	123.83	88.61	0.00	2.02	5.32	98.63	3.14	24.00
8.5.2018	05:00-06:00	210.04	86.32	0.00	2.00	3.80	99.92	14.05	24.00
8.5.2018	06:00-07:00	218.90	80.81	0.00	2.00	4.10	97.30	18.37	24.53
8.5.2018	07:00-08:00	134.67	25.84	0.06	2.23	10.10	79.63	14.27	28.58
8.5.2018	08:00-09:00	55.93	3.76	0.07	2.73	6.07	66.52	2.98	31.80
8.5.2018	09:00-10:00	55.92	4.26	0.08	1.97	7.18	59.70	4.83	33.52
8.5.2018	10:00-11:00	63.82	4.64	0.06	2.97	8.05	54.85	10.94	34.88

AQ5 (third day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
8.5.2018	11:00-12:00	103.79	20.60	0.00	2.02	7.88	53.85	6.27	34.68
8.5.2018	12:00-13:00	90.13	5.86	0.05	3.50	5.05	47.77	5.71	36.62
8.5.2018	13:00-14:00	84.49	10.35	0.16	2.78	3.15	45.48	2.10	37.90
8.5.2018	14:00-15:00	107.55	32.01	0.03	1.72	4.00	47.90	1.88	36.72
8.5.2018	15:00-16:00	110.56	15.90	0.04	1.83	9.68	44.65	1.88	37.53
8.5.2018	16:00-17:00	139.77	38.29	0.02	1.23	5.78	46.65	1.88	36.25
8.5.2018	17:00-18:00	221.20	86.51	0.00	1.52	7.83	54.07	4.61	33.10
8.5.2018	18:00-19:00	256.07	123.54	0.00	2.02	8.75	71.62	7.62	29.75
8.5.2018	19:00-20:00	255.09	97.27	0.00	9.07	10.65	78.27	4.55	28.43
8.5.2018	20:00-21:00	239.46	88.55	0.00	2.53	8.22	80.45	5.39	27.93
8.5.2018	21:00-22:00	228.91	82.59	0.00	2.07	4.82	78.37	3.01	27.07
8.5.2018	22:00-23:00	176.25	77.70	0.00	2.05	8.45	78.90	2.38	27.00
8.5.2018	23:00-00:00	129.65	80.55	0.03	2.28	12.58	80.37	4.39	26.93
9.5.2018	00:00-01:00	124.70	88.33	0.01	2.00	10.57	83.25	9.34	26.58
9.5.2018	01:00-02:00	114.47	94.35	0.00	2.02	11.80	87.63	7.06	26.00
9.5.2018	02:00-03:00	113.63	83.35	0.00	2.05	9.50	91.30	2.73	25.23
9.5.2018	03:00-04:00	114.15	82.03	0.00	2.03	8.10	93.93	3.07	25.00
9.5.2018	04:00-05:00	132.73	98.52	0.00	2.00	12.37	97.20	7.81	24.03
9.5.2018	05:00-06:00	180.29	93.47	0.00	2.00	4.77	99.48	14.46	24.00
9.5.2018	06:00-07:00	274.82	80.40	0.01	2.07	3.07	97.52	19.69	24.50
9.5.2018	07:00-08:00	158.26	35.62	0.04	2.25	4.28	83.13	9.97	28.02
9.5.2018	08:00-09:00	54.87	4.26	0.11	2.15	7.98	65.95	3.01	32.22
9.5.2018	09:00-10:00	57.98	3.76	0.04	2.47	4.85	57.28	11.82	34.70
9.5.2018	10:00-11:00	59.71	4.83	0.09	2.93	9.53	51.38	15.46	35.88

AQ6 (First day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
6/5/2018	13:00-14:00	0.92	4.89	82.56	2.00	1.00	50.62	16.33	39.28
6/5/2018	14:00-15:00	2.67	44.84	82.36	11.43	18.72	52.78	33.96	38.85
6/5/2018	15:00-16:00	53.06	82.09	1.77	46.75	44.70	61.42	0.31	34.18
6/5/2018	16:00-17:00	77.78	37.31	1.40	49.68	43.50	62.53	0.53	32.57
6/5/2018	17:00-18:00	92.28	55.72	1.28	49.10	47.67	63.67	0.09	31.13
6/5/2018	18:00-19:00	164.34	54.97	1.05	55.58	60.13	67.07	2.19	29.33
6/5/2018	19:00-20:00	116.62	18.88	0.90	39.32	46.82	68.07	0.00	28.42
6/5/2018	20:00-21:00	85.32	9.63	1.36	20.20	17.58	69.57	0.00	27.88
6/5/2018	21:00-22:00	58.40	8.87	0.64	12.72	10.75	70.80	0.00	28.00
6/5/2018	22:00-23:00	57.45	5.08	4.67	12.50	14.18	73.85	0.00	27.03
6/5/2018	23:00-00:00	51.92	15.58	0.63	14.65	17.15	75.92	0.00	27.00
7/5/2018	00:00-01:00	57.36	18.16	0.91	12.95	21.27	79.62	0.09	26.05
7/5/2018	01:00-02:00	50.01	19.22	0.68	10.18	22.20	83.48	0.31	26.00
7/5/2018	02:00-03:00	40.18	21.51	1.01	8.77	24.63	85.63	0.00	26.00
7/5/2018	03:00-04:00	34.36	8.94	1.77	6.88	3.98	86.13	0.00	26.00
7/5/2018	04:00-05:00	103.45	15.80	1.69	24.00	24.38	91.48	36.12	25.23
7/5/2018	05:00-06:00	198.60	12.42	4.07	65.82	91.92	97.98	48.19	25.00
7/5/2018	06:00-07:00	6.87	21.57	3.25	8.32	5.45	93.32	0.19	25.58
7/5/2018	07:00-08:00	43.90	4.23	35.63	3.97	1.37	72.77	16.49	29.65
7/5/2018	08:00-09:00	13.46	3.76	71.54	2.02	1.00	62.48	44.40	33.68
7/5/2018	09:00-10:00	17.94	3.76	100.08	2.00	1.00	58.10	65.66	35.82
7/5/2018	10:00-11:00	33.69	3.76	55.19	5.00	3.28	56.12	24.46	37.08
7/5/2018	11:00-12:00	11.45	3.76	45.66	14.00	2.48	52.45	12.76	38.37
7/5/2018	12:00-13:00	42.18	3.86	30.96	16.33	4.30	52.67	5.58	39.12

AQ6 (second day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
7/5/2018	13:00-14:00	29.21	3.76	45.03	4.51	2.41	50.95	3.32	39.98
7/5/2018	14:00-15:00	37.60	3.76	75.35	8.20	7.23	49.80	22.61	40.75
7/5/2018	15:00-16:00	11.31	0.91	15.81	18.87	21.94	0.60	8.82	0.78
7/5/2018	16:00-17:00	83.03	14.83	0.93	55.42	48.08	50.27	0.00	38.50
7/5/2018	17:00-18:00	151.55	75.76	1.45	57.87	61.57	55.95	0.56	35.07
7/5/2018	18:00-19:00	165.00	115.49	1.08	49.28	48.40	66.40	0.22	30.97
7/5/2018	19:00-20:00	106.41	81.09	0.61	28.50	35.13	71.43	0.00	29.17
7/5/2018	20:00-21:00	150.21	46.72	1.57	18.18	20.82	73.95	1.38	28.95
7/5/2018	21:00-22:00	80.16	10.76	4.00	32.25	33.38	69.32	0.00	28.90
7/5/2018	22:00-23:00	100.01	8.75	4.19	27.28	32.60	69.75	0.69	27.87
7/5/2018	23:00-00:00	76.35	26.40	0.57	27.77	29.83	72.57	1.10	27.00
8/5/2018	00:00-01:00	63.46	32.20	0.57	23.27	27.80	76.48	2.10	26.77

8/5/2018	01:00-02:00	46.67	45.75	0.57	9.95	19.33	81.38	0.00	26.00
8/5/2018	02:00-03:00	43.52	38.66	0.59	7.20	18.43	82.82	0.00	26.00
8/5/2018	03:00-04:00	51.06	26.75	0.64	11.25	14.43	87.00	1.98	26.00
8/5/2018	04:00-05:00	88.85	29.10	0.67	24.85	35.32	91.15	7.53	25.95
8/5/2018	05:00-06:00	131.60	31.23	1.37	40.33	54.35	98.28	25.27	25.00
8/5/2018	06:00-07:00	39.51	28.44	3.60	17.48	8.40	95.15	1.25	25.53
8/5/2018	07:00-08:00	317.60	5.49	29.10	4.00	1.82	73.03	20.51	29.63
8/5/2018	08:00-09:00	31.02	3.76	64.88	2.15	1.12	63.53	44.12	33.12
8/5/2018	09:00-10:00	13.27	3.76	83.77	2.00	1.05	58.52	52.21	35.87
8/5/2018	10:00-11:00	28.63	3.76	77.99	8.07	5.20	55.82	44.21	37.37
8/5/2018	11:00-12:00	43.90	4.39	37.39	23.87	12.68	54.47	15.68	38.28
8/5/2018	12:00-13:00	47.81	3.76	69.09	2.77	1.62	51.57	19.16	40.43

AQ6 (third day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
8.5.2018	13:00-14:00	57.07	8.31	67.80	19.12	18.20	52.28	26.59	39.48
8.5.2018	14:00-15:00	80.64	4.92	3.27	24.22	17.73	52.12	0.00	39.25
8.5.2018	15:00-16:00	70.14	3.76	65.30	25.02	24.58	50.60	10.57	39.90
8.5.2018	16:00-17:00	138.28	26.15	8.03	65.20	62.78	51.45	16.62	38.60
8.5.2018	17:00-18:00	136.85	67.57	0.74	74.30	77.22	55.88	0.00	34.72
8.5.2018	18:00-19:00	171.11	109.09	0.67	55.27	56.48	65.48	0.56	31.08
8.5.2018	19:00-20:00	138.85	74.25	0.57	32.70	35.57	69.47	0.00	29.83
8.5.2018	20:00-21:00	128.93	31.51	0.81	42.78	48.07	70.15	1.98	29.00
8.5.2018	21:00-22:00	101.06	12.51	0.80	38.85	45.92	68.47	0.03	28.75
8.5.2018	22:00-23:00	142.40	27.82	0.75	43.54	52.39	70.05	1.05	28.00
8.5.2018	23:00-00:00	51.15	23.41	0.63	14.97	15.12	71.32	0.03	28.00
9.5.2018	00:00-01:00	53.06	26.40	0.92	12.20	10.27	72.62	0.00	28.00
9.5.2018	01:00-02:00	41.42	36.15	0.57	20.85	21.78	76.53	0.00	27.38
9.5.2018	02:00-03:00	55.45	38.35	0.57	19.33	29.80	81.08	0.03	26.52
9.5.2018	03:00-04:00	54.30	37.57	0.57	16.40	27.65	83.92	0.03	26.00
9.5.2018	04:00-05:00	90.09	33.21	0.60	26.78	39.30	89.48	0.41	26.00
9.5.2018	05:00-06:00	106.31	28.79	1.18	26.22	35.17	94.15	5.80	25.95
9.5.2018	06:00-07:00	73.67	26.03	2.06	13.30	10.38	97.17	0.78	25.82
9.5.2018	07:00-08:00	49.72	5.36	22.83	2.65	1.57	75.92	8.65	29.08
9.5.2018	08:00-09:00	26.43	3.76	64.87	2.10	1.13	63.77	30.51	33.42
9.5.2018	09:00-10:00	6.97	3.76	88.38	2.00	1.00	58.53	44.46	36.15
9.5.2018	10:00-11:00	21.19	3.76	93.72	2.43	1.32	55.20	44.21	38.00
9.5.2018	11:00-12:00	20.33	3.86	52.13	11.80	7.07	54.87	18.44	38.13
9.5.2018	12:00-13:00	47.31	3.76	1.84	9.95	1.16	52.95	0.00	39.79

AQ7 (first day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
6.5.2018	14:00-15:00	134.27	19.76	0.01	32.71	13.63	60.41	0.00	38.90
6.5.2018	15:00-16:00	175.72	25.05	0.00	44.75	18.02	66.65	0.00	36.28
6.5.2018	16:00-17:00	76.02	25.77	0.00	29.83	14.80	68.25	0.00	34.52
6.5.2018	17:00-18:00	70.04	21.87	0.00	36.61	79.44	69.66	0.14	33.46
6.5.2018	18:00-19:00	110.42	25.55	0.00	44.75	3.15	75.12	29.79	30.23
6.5.2018	19:00-20:00	124.21	21.43	0.03	32.17	29.20	77.92	3.14	28.77
6.5.2018	20:00-21:00	165.19	20.93	0.01	25.17	84.45	78.28	4.39	27.77
6.5.2018	21:00-22:00	142.84	25.41	0.00	19.62	43.65	80.78	7.40	27.27
6.5.2018	22:00-23:00	141.45	23.87	0.00	26.50	10.33	84.37	9.38	26.17
6.5.2018	23:00-00:00	136.13	24.54	0.00	26.55	14.60	87.97	10.38	25.68
7.5.2018	00:00-01:00	119.02	21.97	0.00	24.17	13.40	90.90	0.00	25.43
7.5.2018	01:00-02:00	95.00	20.66	0.00	30.95	11.83	94.85	0.00	24.93
7.5.2018	02:00-03:00	88.22	22.45	0.00	20.55	108.85	94.25	0.00	25.08
7.5.2018	03:00-04:00	95.36	22.14	0.00	12.17	38.83	93.93	0.00	25.28
7.5.2018	04:00-05:00	182.73	25.70	0.00	12.47	73.35	94.50	0.00	25.23
7.5.2018	05:00-06:00	148.75	19.36	0.00	22.93	43.30	97.87	0.00	24.42
7.5.2018	06:00-07:00	113.46	9.67	0.00	41.83	37.08	95.78	0.00	25.03
7.5.2018	07:00-08:00	59.10	1.44	0.04	2.22	2.65	75.37	1.98	33.03
7.5.2018	08:00-09:00	60.09	1.17	0.06	2.27	1.00	64.27	0.00	38.90
7.5.2018	09:00-10:00	75.53	2.05	0.02	5.77	28.00	58.52	0.00	41.77
7.5.2018	10:00-11:00	73.35	3.87	0.01	13.30	13.18	54.97	0.00	43.72
7.5.2018	11:00-12:00	93.78	8.46	0.00	39.70	9.38	56.28	0.00	43.35
7.5.2018	12:00-13:00	125.67	13.99	0.00	25.33	2.23	52.77	0.00	43.57
7.5.2018	13:00-14:00	153.06	22.78	0.04	12.30	7.43	50.30	0.00	44.68

AQ7 (second day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
7.5.2018	14:00-15:00	150.64	21.75	0.00	62.65	32.85	49.33	0.00	45.30
7.5.2018	15:00-16:00	124.96	17.02	0.00	114.90	42.88	50.88	0.00	43.83
7.5.2018	16:00-17:00	159.10	28.13	0.00	70.88	42.97	52.25	0.00	42.02
7.5.2018	17:00-18:00	147.25	34.30	0.00	40.85	64.67	64.30	6.68	37.68
7.5.2018	18:00-19:00	127.92	31.33	0.00	53.07	38.93	74.30	6.15	33.18
7.5.2018	19:00-20:00	141.22	14.73	0.00	20.95	30.57	80.93	1.91	30.40
7.5.2018	20:00-21:00	141.13	21.57	0.00	7.87	30.02	82.83	1.25	29.68
7.5.2018	21:00-22:00	134.46	22.17	0.00	16.22	25.92	76.65	22.51	29.50
7.5.2018	22:00-23:00	115.61	18.97	0.00	2.37	28.82	79.30	29.13	28.17
7.5.2018	23:00-00:00	126.04	20.23	0.00	9.35	30.13	83.07	40.07	27.42
8.5.2018	00:00-01:00	110.52	19.56	0.00	36.95	30.98	88.35	14.20	26.50
8.5.2018	01:00-02:00	162.06	20.68	0.00	21.57	17.37	92.23	0.00	26.17

8.5.2018	02:00-03:00	232.23	19.25	0.00	21.90	17.93	95.07	0.00	25.78
8.5.2018	03:00-04:00	121.89	17.22	0.00	24.30	17.85	97.00	0.00	25.52
8.5.2018	04:00-05:00	108.36	15.96	0.00	10.62	16.17	97.10	0.00	25.22
8.5.2018	05:00-06:00	198.24	18.39	0.00	3.47	18.48	99.53	0.00	24.37
8.5.2018	06:00-07:00	143.74	10.33	0.00	2.08	18.82	95.45	0.00	25.22
8.5.2018	07:00-08:00	108.49	6.55	0.03	1.02	2.05	77.73	0.00	32.02
8.5.2018	08:00-09:00	99.05	19.20	0.05	1.00	2.02	66.48	0.00	38.25
8.5.2018	09:00-10:00	161.92	34.25	0.04	1.08	21.45	61.28	0.00	40.97
8.5.2018	10:00-11:00	70.43	1.15	0.00	9.97	19.67	57.78	0.00	42.45
8.5.2018	11:00-12:00	60.67	7.10	6.01	16.20	16.45	55.65	1.51	39.08
8.5.2018	12:00-13:00	66.80	7.52	5.15	27.55	26.80	54.80	0.00	37.53
8.5.2018	13:00-14:00	96.30	9.54	2.37	3.58	3.62	53.97	0.16	39.75

AQ7 (third day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
8.5.2018	14:00-15:00	98.81	9.76	0.04	4.00	38.28	53.53	0.00	45.02
8.5.2018	15:00-16:00	128.99	18.23	0.01	13.27	34.57	52.50	0.00	44.35
8.5.2018	16:00-17:00	138.20	24.79	0.00	18.41	40.66	53.52	0.00	42.52
8.5.2018	17:00-18:00	160.11	31.85	0.02	50.55	71.05	62.60	0.00	37.52
8.5.2018	18:00-19:00	163.28	31.17	0.00	22.23	40.68	74.00	7.78	32.90
8.5.2018	19:00-20:00	129.34	31.10	0.00	42.42	40.32	79.37	82.94	30.23
8.5.2018	20:00-21:00	131.96	25.82	0.00	32.85	40.00	80.53	71.27	29.28
8.5.2018	21:00-22:00	99.21	26.21	0.00	24.65	34.90	78.82	2.63	28.33
8.5.2018	22:00-23:00	96.93	33.73	0.00	37.90	42.73	79.98	4.23	28.20
8.5.2018	23:00-00:00	114.90	19.25	0.00	53.67	61.27	83.82	7.56	27.23
9.5.2018	00:00-01:00	109.68	19.01	0.00	12.82	29.40	86.82	0.50	26.45
9.5.2018	01:00-02:00	93.06	19.02	0.00	21.90	24.05	89.88	0.00	25.90
9.5.2018	02:00-03:00	108.56	20.21	0.00	19.63	22.12	92.45	0.00	25.62
9.5.2018	03:00-04:00	97.34	18.49	0.00	21.13	21.95	94.13	0.00	25.13
9.5.2018	04:00-05:00	241.07	20.48	0.00	24.18	30.25	95.95	0.00	24.92
9.5.2018	05:00-06:00	237.16	19.12	0.00	23.02	38.52	97.73	0.00	23.93
9.5.2018	06:00-07:00	149.35	13.33	0.00	74.38	16.48	96.48	0.00	24.85
9.5.2018	07:00-08:00	167.02	33.77	0.02	1.00	2.78	82.27	0.00	29.83
9.5.2018	08:00-09:00	144.28	9.55	0.06	3.13	3.08	67.55	2.60	37.30
9.5.2018	09:00-10:00	84.35	7.31	0.03	1.00	2.10	61.32	0.00	41.62
9.5.2018	10:00-11:00	114.82	24.72	0.04	7.47	8.40	57.15	0.00	43.85
9.5.2018	11:00-12:00	135.37	19.33	0.01	2.35	15.47	52.85	0.00	44.38
9.5.2018	12:00-13:00	213.30	35.87	0.01	3.82	26.87	52.63	0.00	44.25
9.5.2018	13:00-14:00	319.10	30.52	0.04	5.70	12.32	50.30	0.00	44.68

AQ8 (first day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
9.5.2018	16:00-17:00	1.93	101.02	0.00	1.00	8.73	70.29	1.88	27.88
9.5.2018	17:00-18:00	82.41	129.31	0.00	1.88	5.40	83.68	2.04	27.33
9.5.2018	18:00-19:00	71.70	93.35	0.00	2.05	3.75	82.92	1.88	27.00
9.5.2018	19:00-20:00	78.09	71.74	0.00	2.02	6.98	76.27	1.88	26.95
9.5.2018	20:00-21:00	114.12	85.20	0.00	2.40	9.12	81.80	2.10	26.18
9.5.2018	21:00-22:00	136.52	67.82	0.00	2.25	5.03	82.60	4.23	26.00
9.5.2018	22:00-23:00	157.12	72.43	0.00	2.05	10.15	82.97	5.86	26.00
10.5.2018	23:00-00:00	141.38	85.79	0.00	2.00	12.55	84.83	3.98	25.93
10.5.2018	00:00-01:00	138.93	73.81	0.00	2.00	10.57	87.32	3.51	25.00
10.5.2018	01:00-02:00	135.83	83.69	0.00	2.03	10.98	91.27	2.19	25.00
10.5.2018	02:00-03:00	108.91	64.28	0.00	2.05	12.00	93.47	2.16	25.00
10.5.2018	03:00-04:00	93.77	73.75	0.00	2.00	10.22	93.87	4.36	25.00
10.5.2018	04:00-05:00	86.21	71.62	0.00	2.00	12.32	94.32	3.67	25.00
10.5.2018	05:00-06:00	142.51	78.36	0.00	2.00	12.55	95.27	27.94	25.00
10.5.2018	06:00-07:00	178.74	78.99	0.00	2.25	9.72	94.97	43.93	25.35
10.5.2018	07:00-08:00	178.95	52.24	0.01	2.63	11.32	89.75	27.28	26.57
10.5.2018	08:00-09:00	72.50	16.05	0.10	3.50	10.62	80.18	3.32	28.48
10.5.2018	09:00-10:00	53.81	4.33	0.21	2.33	6.22	70.28	3.23	30.65
10.5.2018	10:00-11:00	69.41	3.95	0.07	2.25	4.18	61.40	3.76	33.32
10.5.2018	11:00-12:00	74.17	6.71	0.08	1.92	5.73	56.95	2.07	35.17
10.5.2018	12:00-13:00	85.93	28.28	0.00	1.95	11.60	59.47	1.98	34.35
10.5.2018	13:00-14:00	104.78	27.59	0.01	3.12	7.08	57.07	1.91	35.38
10.5.2018	14:00-15:00	137.27	63.47	0.00	1.13	4.92	63.32	1.98	33.37
10.5.2018	15:00-16:00	175.72	79.21	0.00	1.97	5.35	66.35	1.91	32.78

AQ8 (second day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
10.5.2018	16:00-17:00	119.68	56.76	0.00	2.92	5.32	66.82	1.88	33.38
10.5.2018	17:00-18:00	152.50	70.77	0.00	2.40	11.75	75.03	1.91	30.62
10.5.2018	18:00-19:00	152.76	109.81	0.00	3.22	8.58	84.73	2.07	28.37
10.5.2018	19:00-20:00	129.23	110.50	0.00	3.70	4.87	87.60	2.73	28.00
10.5.2018	20:00-21:00	134.89	60.83	0.00	2.78	8.43	96.32	3.01	24.65
10.5.2018	21:00-22:00	149.62	68.48	0.00	2.55	12.03	100.00	1.88	21.37
10.5.2018	22:00-23:00	146.33	74.02	0.00	4.07	8.98	100.00	1.88	21.61
10.5.2018	23:00-00:00	119.00	67.70	0.00	1.23	3.27	100.00	1.88	21.68
11.5.2018	00:00-01:00	122.95	62.18	0.00	2.13	4.08	99.30	2.82	21.78
11.5.2018	01:00-02:00	113.37	65.03	0.00	2.08	10.20	98.17	2.07	22.00
11.5.2018	02:00-03:00	138.10	64.97	0.00	2.00	13.27	94.98	2.01	22.32
11.5.2018	03:00-04:00	180.98	65.57	0.00	2.02	8.27	95.73	18.22	22.80

11.5.2018	04:00-05:00	205.87	65.63	0.00	2.03	4.75	98.32	36.44	22.95
11.5.2018	05:00-06:00	105.00	58.29	0.00	2.02	4.35	95.78	1.88	23.00
11.5.2018	06:00-07:00	168.95	59.64	0.00	2.02	3.68	95.18	6.55	23.02
11.5.2018	07:00-08:00	155.14	48.76	0.00	2.83	3.18	89.53	3.01	24.10
11.5.2018	08:00-09:00	120.64	21.60	0.06	2.47	5.33	80.70	2.57	25.48
11.5.2018	09:00-10:00	93.45	26.21	0.00	2.02	7.58	78.95	1.88	26.02
11.5.2018	10:00-11:00	159.14	170.74	0.05	2.55	8.28	72.50	9.19	27.72
11.5.2018	11:00-12:00	121.97	13.95	0.11	1.58	3.75	68.53	9.34	29.62
11.5.2018	12:00-13:00	63.42	7.06	0.00	1.55	4.52	68.63	13.23	30.00
11.5.2018	13:00-14:00	61.09	25.74	0.00	2.00	8.82	67.00	2.01	30.80
11.5.2018	14:00-15:00	87.07	37.03	0.00	1.85	11.15	67.23	1.94	31.22
11.5.2018	15:00-16:00	91.85	27.34	0.00	2.28	11.47	63.13	1.88	33.23

AQ8 (third day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
11.5.2018	16:00-17:00	122.29	46.16	0.00	1.18	14.05	67.55	1.88	30.45
11.5.2018	17:00-18:00	125.57	75.63	0.00	1.43	14.22	71.22	1.88	28.58
11.5.2018	18:00-19:00	162.27	104.04	0.00	8.28	5.90	80.00	1.88	26.80
11.5.2018	19:00-20:00	165.04	99.40	0.00	2.63	12.02	86.53	3.89	26.00
11.5.2018	20:00-21:00	130.27	102.85	0.00	2.02	11.43	89.28	1.88	26.00
11.5.2018	21:00-22:00	132.41	85.13	0.00	2.67	8.80	90.53	1.91	25.92
11.5.2018	22:00-23:00	99.43	86.14	0.00	2.25	7.07	94.45	2.48	25.23
11.5.2018	23:00-00:00	95.03	111.16	0.00	2.03	6.72	100.00	1.88	21.97
12.5.2018	00:00-01:00	114.65	63.25	0.00	2.70	6.75	100.00	1.88	21.98
12.5.2018	01:00-02:00	108.94	62.56	0.00	2.68	4.92	99.98	1.88	22.08
12.5.2018	02:00-03:00	94.05	62.34	0.01	2.02	3.57	100.00	1.88	22.70
12.5.2018	03:00-04:00	110.75	66.76	0.03	2.00	4.15	99.48	2.01	23.00
12.5.2018	04:00-05:00	94.18	59.58	0.00	2.00	4.60	100.00	1.98	23.00
12.5.2018	05:00-06:00	265.00	66.07	0.00	2.07	5.47	99.47	31.92	23.00
12.5.2018	06:00-07:00	231.19	61.40	0.02	2.45	3.50	96.50	22.39	23.88
12.5.2018	07:00-08:00	134.26	40.01	0.04	2.67	10.95	89.35	6.49	25.57
12.5.2018	08:00-09:00	181.23	141.14	0.16	2.08	8.32	83.03	13.04	27.27
12.5.2018	09:00-10:00	133.84	19.91	0.08	1.53	8.87	87.28	12.70	26.72
12.5.2018	10:00-11:00	81.58	35.59	0.00	2.08	11.12	96.10	19.41	24.10
12.5.2018	11:00-12:00	121.47	79.24	0.00	5.33	14.32	86.52	1.88	24.20
12.5.2018	12:00-13:00	110.99	71.65	0.00	7.58	9.33	80.42	1.88	26.08
12.5.2018	13:00-14:00	176.85	87.14	0.00	1.97	11.20	71.55	5.30	26.55
12.5.2018	14:00-15:00	232.83	121.32	0.00	5.42	8.85	90.78	2.45	24.15
12.5.2018	15:00-16:00	434.06	83.28	0.00	3.38	8.18	85.17	9.53	24.88

AQ9 (first day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
9.5.2018	14:00-15:00	61.82	128.44	0.17	21.85	98.76	65.66	0.83	39.76
9.5.2018	15:00-16:00	22.14	79.58	0.02	46.90	71.52	64.88	3.36	34.45
9.5.2018	16:00-17:00	60.60	106.42	0.00	49.62	59.95	69.00	91.22	31.85
9.5.2018	17:00-18:00	48.77	99.46	0.00	21.52	13.58	80.35	107.18	31.65
9.5.2018	18:00-19:00	31.78	41.52	0.00	15.78	8.25	79.62	10.76	31.25
9.5.2018	19:00-20:00	53.25	57.51	0.00	19.02	10.68	76.80	0.00	30.38
9.5.2018	20:00-21:00	86.08	76.79	0.00	30.08	21.83	82.85	0.00	29.57
9.5.2018	21:00-22:00	29.49	15.90	0.00	27.23	6.22	85.98	4.80	29.27
9.5.2018	22:00-23:00	38.27	26.06	0.00	30.02	3.47	82.48	0.00	28.75
9.5.2018	23:00-00:00	58.60	36.34	0.00	26.03	32.52	83.37	0.00	28.12
10.5.2018	00:00-01:00	57.74	35.12	0.00	27.53	37.52	85.68	0.00	27.33
10.5.2018	01:00-02:00	54.30	45.09	0.00	41.05	37.80	87.92	0.00	26.53
10.5.2018	02:00-03:00	40.46	37.97	0.00	15.67	17.32	89.82	0.00	26.82
10.5.2018	03:00-04:00	35.21	27.03	0.00	6.62	5.33	87.40	0.00	28.80
10.5.2018	04:00-05:00	35.98	29.85	0.01	2.17	1.68	66.98	0.00	39.40
10.5.2018	05:00-06:00	129.31	22.58	0.01	8.07	1.60	63.43	0.00	42.08
10.5.2018	06:00-07:00	182.75	10.38	0.00	7.48	27.75	60.95	0.00	44.53
10.5.2018	07:00-08:00	172.83	6.11	0.00	22.52	44.97	60.40	0.00	45.15
10.5.2018	08:00-09:00	14.70	0.88	0.05	10.10	14.20	63.23	0.00	40.12
10.5.2018	09:00-10:00	21.95	16.34	0.02	5.40	2.15	64.18	0.00	39.98
10.5.2018	10:00-11:00	33.50	25.62	0.01	3.37	1.60	64.40	0.00	41.08
10.5.2018	11:00-12:00	151.55	20.70	0.00	7.58	1.63	62.78	0.00	42.82
10.5.2018	12:00-13:00	165.77	5.58	0.00	9.72	41.38	59.80	0.00	45.40
10.5.2018	13:00-14:00	69.37	11.20	0.00	39.83	60.71	61.48	0.00	44.71

AQ9 (second day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
10.5.2018	14:00-15:00	38.94	9.00	0.00	41.40	47.57	64.28	0.00	42.92
10.5.2018	15:00-16:00	1139.23	1.93	0.00	38.42	58.62	69.38	0.00	40.22
10.5.2018	16:00-17:00	108.70	17.57	0.00	40.85	66.77	72.43	0.00	37.90
10.5.2018	17:00-18:00	70.62	29.41	0.00	32.20	37.25	76.52	14.58	34.77
10.5.2018	18:00-19:00	75.04	73.79	0.00	31.65	15.48	83.47	126.84	32.12
10.5.2018	19:00-20:00	62.03	67.46	0.00	26.63	16.83	86.00	70.65	31.00
10.5.2018	20:00-21:00	109.18	45.68	0.00	36.35	17.92	82.30	18.12	29.18
10.5.2018	21:00-22:00	84.80	208.80	0.00	71.43	134.28	88.90	29.63	23.72
10.5.2018	22:00-23:00	66.90	10.24	0.00	57.35	252.72	84.93	16.43	22.63
10.5.2018	23:00-00:00	50.20	8.51	0.00	29.45	161.85	97.20	0.00	22.67
11.5.2018	00:00-01:00	38.94	16.15	0.00	26.93	73.22	100.00	0.00	22.38
11.5.2018	01:00-02:00	272.75	25.74	0.00	18.10	36.92	97.97	0.00	22.90

11.5.2018	02:00-03:00	49.05	5.83	0.00	13.95	3.27	94.47	0.00	23.67
11.5.2018	03:00-04:00	45.62	5.08	0.00	21.23	3.25	95.60	0.00	23.62
11.5.2018	04:00-05:00	67.76	3.29	0.00	33.27	12.25	99.02	0.00	24.08
11.5.2018	05:00-06:00	45.62	3.76	0.00	25.68	10.08	98.12	0.00	23.93
11.5.2018	06:00-07:00	126.88	3.76	0.00	32.12	24.07	97.70	0.00	23.87
11.5.2018	07:00-08:00	92.57	3.76	0.00	4.97	1.00	88.82	0.00	25.18
11.5.2018	08:00-09:00	21.57	3.76	0.03	2.10	1.00	82.10	0.00	27.33
11.5.2018	09:00-10:00	11.64	3.76	0.01	3.77	1.00	79.93	0.00	28.47
11.5.2018	10:00-11:00	52.77	3.76	0.03	2.57	1.00	73.40	0.00	31.10
11.5.2018	11:00-12:00	13.65	3.76	0.04	8.22	1.10	71.12	0.00	34.25
11.5.2018	12:00-13:00	27.20	4.95	0.03	16.83	1.62	71.25	0.00	35.17
11.5.2018	13:00-14:00	11.26	8.72	0.00	4.32	2.20	68.23	0.00	37.02

AQ9 (third day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
11.5.2018	14:00-15:00	37.41	9.00	0.03		20.75	69.40	0.00	36.63
11.5.2018	15:00-16:00	61.08	12.26	0.00	15.67	18.90	71.50	0.00	37.12
11.5.2018	16:00-17:00	91.21	3.83	0.00	38.30	26.13	74.38	0.00	34.53
11.5.2018	17:00-18:00	33.07	32.64	0.00	41.18	30.02	75.27	0.88	31.85
11.5.2018	18:00-19:00	60.03	96.26	0.00	42.25	29.95	83.13	13.36	29.18
11.5.2018	19:00-20:00	62.03	86.45	0.00	38.42	26.85	89.42	25.43	27.68
11.5.2018	20:00-21:00	40.56	77.26	0.00	25.43	15.10	91.85	0.00	27.12
11.5.2018	21:00-22:00	29.78	71.37	0.00	8.65	16.30	93.22	0.00	27.32
11.5.2018	22:00-23:00	26.05	75.63	0.00	7.02	20.45	95.50	0.00	27.83
11.5.2018	23:00-00:00	17.85	32.49	0.00	2.73	29.57	90.97	0.00	26.93
12.5.2018	00:00-01:00	28.34	77.33	0.00	44.58	44.43	93.82	0.72	25.42
12.5.2018	01:00-02:00	38.17	54.84	0.00	26.42	28.72	94.78	1.54	25.28
12.5.2018	02:00-03:00	26.05	45.44	0.00	13.72	26.67	95.72	0.00	25.18
12.5.2018	03:00-04:00	23.29	50.70	0.00	12.77	27.50	95.15	0.00	25.43
12.5.2018	04:00-05:00	33.05	47.44	0.00	15.68	30.87	95.03	0.00	25.13
12.5.2018	05:00-06:00	22.14	36.69	0.00	32.58	37.13	97.30	0.00	25.27
12.5.2018	06:00-07:00	421.62	18.22	0.00	25.67	33.62	94.80	0.00	25.38
12.5.2018	07:00-08:00	31.40	10.38	0.01	6.23	15.83	88.48	2.41	27.85
12.5.2018	08:00-09:00	74.80	14.77	0.05	2.58	18.85	87.17	0.00	29.07
12.5.2018	09:00-10:00	54.49	11.57	0.00	12.83	20.72	86.12	0.00	29.33
12.5.2018	10:00-11:00	19.56	22.67	0.00	17.52	30.67	88.13	0.00	28.60
12.5.2018	11:00-12:00	20.80	93.35	0.00	23.07	25.92	91.72	37.85	25.20
12.5.2018	12:00-13:00	170.13	8.23	0.00	33.83	8.32	60.42	0.00	44.85
12.5.2018	13:00-14:00	180.51	6.26	0.00	29.75	50.74	60.75	0.00	45.05

AQ10 (first day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
9.5.2018	15:00-16:00	41.20	99.51	2.32	97.70	107.89	62.07	2.25	30.57
9.5.2018	16:00-17:00	63.56	113.60	0.84	40.60	50.93	62.67	0.19	29.68
9.5.2018	17:00-18:00	57.83	97.83	0.63	6.83	7.67	70.60	0.00	30.00
9.5.2018	18:00-19:00	31.87	33.99	0.88	18.23	21.07	70.15	0.00	29.32
9.5.2018	19:00-20:00	28.92	39.07	0.66	23.63	26.70	67.55	0.00	29.00
9.5.2018	20:00-21:00	84.36	81.90	0.57	9.83	7.87	73.72	19.35	28.12
9.5.2018	21:00-22:00	48.58	35.62	1.77	14.27	10.98	74.12	1.82	28.00
9.5.2018	22:00-23:00	23.29	21.04	4.67	32.00	26.90	69.67	0.00	28.00
9.5.2018	23:00-00:00	58.69	36.53	0.79	25.73	32.68	71.92	0.00	27.02
9.5.2018	00:00-01:00	57.16	36.03	0.57	28.75	31.68	74.82	0.00	27.00
10.5.2018	01:00-02:00	54.97	46.44	0.57	30.32	44.07	78.87	0.00	26.18
10.5.2018	02:00-03:00	45.71	46.28	0.57	21.78	36.52	82.43	0.13	26.00
10.5.2018	03:00-04:00	41.42	32.30	2.73	12.75	29.12	86.42	0.00	26.00
10.5.2018	04:00-05:00	33.97	27.28	2.01	6.53	3.03	87.25	0.03	26.00
10.5.2018	05:00-06:00	150.31	20.19	12.94	33.87	34.45	88.40	66.07	26.00
10.5.2018	06:00-07:00	178.94	10.50	14.57	67.42	67.83	85.28	47.57	26.65
10.5.2018	07:00-08:00	99.35	8.18	18.04	18.12	5.80	80.98	21.20	27.62
10.5.2018	08:00-09:00	77.30	3.76	26.85	6.28	3.35	74.42	21.86	29.33
10.5.2018	09:00-10:00	72.82	3.76	41.35	8.57	8.10	68.72	42.61	31.67
10.5.2018	10:00-11:00	55.73	3.76	83.84	3.28	2.13	60.18	69.42	36.40
10.5.2018	11:00-12:00	30.16	3.76	121.62	3.15	1.92	57.48	66.85	38.72
10.5.2018	12:00-13:00	14.98	8.00	30.74	36.80	9.23	55.42	10.03	40.28
10.5.2018	13:00-14:00	61.94	6.43	7.36	33.73	28.68	56.27	6.05	40.20
10.5.2018	14:00-15:00	48.48	52.99	1.15	94.20	56.90	57.90	0.00	38.98

AQ10 (second day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
10.5.2018	15:00-16:00	48.53	3.76	0.57	3.98	2.27	60.03	1.02	37.29
10.5.2018	16:00-17:00	111.56	18.28	6.98	35.20	49.50	63.40	17.21	35.02
10.5.2018	17:00-18:00	68.90	29.51	0.59	31.95	16.42	64.07	2.23	34.32
10.5.2018	18:00-19:00	61.17	76.48	0.57	28.30	35.33	72.68	0.25	30.60
10.5.2018	19:00-20:00	64.99	67.45	0.60	17.90	19.97	75.35	0.00	29.93
10.5.2018	20:00-21:00	50.77	46.28	5.14	46.65	59.72	77.02	0.00	27.57
10.5.2018	21:00-22:00	86.56	212.35	0.57	38.57	137.12	89.92	0.00	23.13
10.5.2018	22:00-23:00	62.13	10.32	0.57	7.35	36.68	89.15	0.00	23.02
10.5.2018	23:00-00:00	51.25	8.59	2.72	9.72	2.62	98.20	0.00	23.28
10.5.2018	00:00-01:00	40.46	16.15	0.57	10.20	3.62	93.55	0.00	23.15
11.5.2018	01:00-02:00	44.95	26.18	0.63	13.07	1.85	87.43	0.00	24.00
11.5.2018	02:00-03:00	49.34	5.55	0.96	13.85	7.78	80.65	0.00	24.00

11.5.2018	03:00-04:00	45.62	5.08	1.12	16.93	24.60	82.67	0.00	24.00
11.5.2018	04:00-05:00	71.29	3.76	2.96	19.43	43.32	84.75	4.20	24.57
11.5.2018	05:00-06:00	46.95	3.76	20.44	29.25	24.48	82.53	14.33	24.83
11.5.2018	06:00-07:00	118.15	3.76	13.62	70.62	97.43	84.33	34.84	24.90
11.5.2018	07:00-08:00	9.54	3.76	20.22	28.27	11.63	76.78	0.03	25.85
11.5.2018	08:00-09:00	9.83	3.76	31.99	21.62	16.38	71.53	1.32	27.22
11.5.2018	09:00-10:00	2.29	3.76	20.89	4.10	2.73	69.98	0.00	27.97
11.5.2018	10:00-11:00	54.40	4.33	25.87	5.13	2.67	66.05	19.47	29.65
11.5.2018	11:00-12:00	6.30	3.76	58.54	2.10	1.12	62.17	9.16	33.30
11.5.2018	12:00-13:00	10.88	5.02	55.98	4.77	3.37	61.63	7.27	34.05
11.5.2018	13:00-14:00	4.58	9.38	30.50	3.33	1.88	59.57	1.19	35.42
11.5.2018	14:00-15:00	38.11	8.91	14.18	38.33	36.67	59.92	5.92	34.92

AQ10 (third day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
11.5.2018	15:00-16:00	68.91	12.88	2.48	48.34	33.25	60.59	2.46	34.98
11.5.2018	16:00-17:00	91.16	3.97	26.47	11.99	7.68	59.90	10.54	35.02
11.5.2018	17:00-18:00	28.25	32.30	1.73	51.02	47.47	61.72	1.91	32.35
11.5.2018	18:00-19:00	76.06	97.55	0.67	31.87	39.97	69.40	5.39	28.72
11.5.2018	19:00-20:00	72.72	87.01	0.70	23.35	56.77	74.78	0.00	28.00
11.5.2018	20:00-21:00	46.48	78.11	0.57	10.30	8.63	76.72	0.00	28.00
11.5.2018	21:00-22:00	31.21	71.93	0.60	13.13	33.67	79.63	0.00	27.97
11.5.2018	22:00-23:00	27.87	76.42	0.58	8.02	9.18	80.42	0.00	27.57
11.5.2018	23:00-00:00	20.52	33.18	5.12	32.52	18.88	79.57	0.00	26.27
11.5.2018	00:00-01:00	33.40	79.18	0.57	24.15	39.33	83.43	0.00	24.72
12.5.2018	01:00-02:00	43.33	55.91	0.67	12.05	14.17	81.03	0.00	25.00
12.5.2018	02:00-03:00	31.40	46.31	0.60	13.95	29.22	84.87	0.00	25.00
12.5.2018	03:00-04:00	25.29	50.48	0.61	20.50	48.93	87.37	0.00	25.00
12.5.2018	04:00-05:00	34.55	49.04	0.93	25.15	43.90	84.60	0.03	25.00
12.5.2018	05:00-06:00	28.34	37.03	1.57	22.65	27.37	84.18	0.00	25.00
12.5.2018	06:00-07:00	417.42	19.38	10.42	117.68	127.12	82.33	119.19	25.68
12.5.2018	07:00-08:00	27.87	10.57	23.68	51.55	34.37	78.60	10.88	27.23
12.5.2018	08:00-09:00	80.35	14.74	15.45	31.95	25.20	76.30	17.78	27.57
12.5.2018	09:00-10:00	53.54	11.32	15.70	21.83	22.95	73.50	18.88	28.03
12.5.2018	10:00-11:00	8.97	23.05	9.72	18.47	22.40	73.78	0.00	27.40
12.5.2018	11:00-12:00	17.27	93.03	1.38	25.70	48.50	76.58	0.00	25.57
12.5.2018	12:00-13:00	32.15	26.68	13.73	2.13	1.10	65.87	0.68	28.56
12.5.2018	13:00-14:00	2.69	4.46	76.43	2.07	1.10	50.20	17.19	39.73
12.5.2018	14:00-15:00	0.00	37.35	103.83	8.07	19.19	53.52	47.03	38.11

APPENDIX L PHYSICAL BASELINE DATA ANALYSIS FOR DRY SEASON FROM STS GREEN

Surface Water Analysis Result

Project Name: Ahlone Expansion Combined Cycle Power Plant and FSRU Project to supply power to the Republic of the Union of Myanmar

Sampling by: ERM-Siam Co., Ltd.

Parameter	Unit	Method Analysis	LOQ	Results														Laboratory
				SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	SW10	SW11	SW12	SW13	SW14	
Sampling Date				4/5/2018	4/5/2018	3/5/2018	4/5/2018	3/5/2018	3/5/2018	3/5/2018	3/5/2018	3/5/2018	3/5/2018	3/5/2018	3/5/2018	3/5/2018	3/5/2018	
Alkalinity	mg/L as $CaCO_3$	Titration Method	1.0	110	114	110	117	146	149	86.0	82.1	111	110	112	132	113	94.0	STS Green Co., Ltd.
Biochemical Oxygen Demand (BOD)	mg/L	5-Day BOD Test, Azide Modification Method	-	0.2	0.2	0.4	0.4	1.4	2.0	2.7	3.0	0.8	0.8	0.9	0.6	0.4	0.8	STS Green Co., Ltd.
Total Suspended Solids (TSS)	mg/L	Dried at 103-105 °C Method	10.0	1,169	461	843	1,211	37.2	21.3	26.8	33.3	55.9	48.2	16.1	<10.0	362	543	STS Green Co., Ltd.
Total Dissolved Solids (TDS)	mg/L	Dried at 180 °C Method	50.0	12,470	10,490	4,052	10,065	5,600	6,156	11,800	11,870	12,160	11,680	11,620	12,400	12,105	12,760	STS Green Co., Ltd.
Turbidity	NTU	Nephelometric Method	0.02	393	437	485	646	21.0	4.32	12.1	41.4	64.7	47.2	7.05	4.74	281	430	STS Green Co., Ltd.
Hardness as $CaCO_3$	mg/L as $CaCO_3$	EDTA Titrimetric Method	5.0	1,945	1,838	703	1,821	814	828	1,440	1,531	1,683	1,636	1,400	1,602	1,826	1,844	STS Green Co., Ltd.
Cyanide (CN)	mg/L	APHA (2012), 4500-CN (C),(E)	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	ALS Laboratory Group (Thailand)
Fluoride (F)	mg/L	APHA (2012), 4110B	0.1	<0.1	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ALS Laboratory Group (Thailand)
Sulfide	mg/L	Iodometric Method	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	STS Green Co., Ltd.
Total Organic Carbon	mg/L	Based on APHA (2012), 5310 B	0.05	6.86	3.06	3.54	5.30	4.84	6.34	4.78	4.94	1.63	1.67	2.33	2.47	3.08	3.32	ALS Laboratory Group (Thailand)
Ammonium-Nitrogen	mg/L	Phenate Method	0.010	0.499	0.146	0.082	0.116	0.179	0.169	0.157	0.103	0.035	0.255	0.257	0.304	0.246	0.229	STS Green Co., Ltd.
Sulfate (SO_4)	mg/L	Turbidimetric Method	1.0	534	485	117	523	118	105	404	307	579	513	456	531	531	501	STS Green Co., Ltd.
Nitrate (NO_3)	mg/L	Cadmium Reduction Method	0.005	2.38	1.99	1.70	1.90	0.140	<0.040	<0.040	<0.040	1.41	1.62	0.333	0.201	2.05	2.06	STS Green Co., Ltd.
Chromium (Cr)	mg/L	Electrothermal AAS Method	0.0005	0.0249	0.0252	0.0291	0.0391	0.0034	0.0025	0.0024	0.0027	0.0032	0.0029	0.0022	0.0007	0.0071	0.0380	STS Green Co., Ltd.
Calcium (Ca)	mg/L	Direct Nitrous Oxide-Acetylene Flame Method	0.02	185.98	119.94	59.90	105.26	76.85	86.31	133.72	135.04	138.98	133.16	140.44	135.92	131.21	164.70	STS Green Co., Ltd.
Magnesium (Mg)	mg/L	Direct Air-Acetylene Flame Method	0.003	386.15	320.30	92.04	292.68	162.40	138.72	328.50	307.25	322.00	356.70	317.25	347.25	352.92	358.85	STS Green Co., Ltd.
Sodium (Na)	mg/L	Direct Air-Acetylene Flame Method	0.01	2,158	2,160	903.20	2,258	836.20	1,399	2,988	2,557	2,636	1,820	2,585	2,307	2,651	2,476	STS Green Co., Ltd.
Potassium (K)	mg/L	Direct Air-Acetylene Flame Method	0.01	116.81	96.68	37.89	95.61	53.05	53.01	108.81	102.24	121.05	119.77	108.32	112.72	121.06	123.68	STS Green Co., Ltd.
Mercury (Hg)	mg/L	Cold-Vapor AAS Method	0.0003	0.0005	0.0003	0.0003	0.0006	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	0.0005	0.0003	STS Green Co., Ltd.
Lead (Pb)	mg/L	Electrothermal AAS Method	0.0020	0.0028	0.0028	0.0078	0.0079	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0071	STS Green Co., Ltd.
Cadmium (Cd)	mg/L	Electrothermal AAS Method	0.00005	0.00005	<0.00005	0.00009	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00014	<0.00005	<0.00005	STS Green Co., Ltd.
Copper (Cu)	mg/L	Direct Air-Acetylene Flame Method	0.05	0.05	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	STS Green Co., Ltd.
Iron (Fe)	mg/L	Direct Air-Acetylene Flame Method	0.10	64.71	19.77	26.21	75.29	2.49	1.93	1.18	1.51	1.77	1.68	0.47	0.36	43.45	1.32	STS Green Co., Ltd.
Tin (Sn)	mg/L	Based on APHA (2012), 3125	0.0001	0.0007	0.001	0.001	0.001	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	0.0007	0.001	ALS Laboratory Group (Thailand)
Manganese (Mn)	mg/L	Direct Air-Acetylene Flame Method	0.04	1.04	0.41	0.52	1.40	0.22	0.30	0.64	0.61	0.05	0.05	0.25	0.23	0.91	0.87	STS Green Co., Ltd.
Total Nitrogen	mg/L	Based on APHA (2012), Calculated	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	ALS Laboratory Group (Thailand)
Total Phosphorous	mg/L	Acid Digestion/Ascobic Acid Method	0.005	0.331	0.113	0.238	0.015	0.163	0.023	0.052	0.050	0.045	0.054	0.008	0.045	0.005	0.347	STS Green Co., Ltd.
Zinc (Zn)	mg/L	Direct Air-Acetylene Flame Method	0.02	0.17	0.05	0.07	0.13	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.10	0.08	STS Green Co., Ltd.
Nickel (Ni)	mg/L	Electrothermal AAS Method	0.0005	0.0194	0.0196	0.0275	0.0263	0.0042	0.0047	0.0039	0.0045	0.0035	0.0032	0.0019	0.0014	0.0087	0.0275	STS Green Co., Ltd.
Chloride (Cl)	mg/L	Mercuric Nitrate Method	1.0	5,998	5,455	2,094	6,164	2,788	3,014	6,017	6,193	6,321	6,203	6,056	5,998	6,091	6,511	STS Green Co., Ltd.
Oil and Grease	mg/L	Liquid-Liquid, Partition-Gravimetric Metod	2.0	5.8	6.3	3.9	5.2	4.2	5.1	4.9	4.0	6.2	5.4	5.7	5.9	6.1	7.0	STS Green Co., Ltd.
Chemical Oxygen Demand (COD)	mg/L	Open Reflux Method	5.0	61.0	25.0	13.0	29.5	50.0	60.0	71.0	66.0	31.0	24.0	17.0	42.0	61.5	81.0	STS Green Co., Ltd.

Groundwater Analysis Result

Project Name: Ahlone Expansion Combined Cycle Power Plant and FSRU Project to supply power to the Republic of the Union of Myanmar

Sampling by: ERM-Siam Co., Ltd.

Parameter	Unit	Method Analysis	LOQ	Results			Laboratory
				GW1	GW2	GW3	
Sampling Date				3/5/2018	3/5/2018	4/5/2018	
Alkalinity	mg/L as $CaCO_3$	Titration Method	1.0	650	152	17.1	STS Green Co., Ltd.
Biochemical Oxygen Demand (BOD)	mg/L	5-Day BOD Test, Azide Modification Method	-	0.2	0.4	0.2	STS Green Co., Ltd.
Total Suspended Solids (TSS)	mg/L	Dried at 103-105 °C Method	10.0	48.6	<10.0	<10.0	STS Green Co., Ltd.
Total Dissolved Solids (TDS)	mg/L	Dried at 180 °C Method	50.0	14,170	3,242	291	STS Green Co., Ltd.
Turbidity	NTU	Nephelometric Method	0.02	94.5	47.2	1.01	STS Green Co., Ltd.
Total Hardness as $CaCO_3$	mg/L as $CaCO_3$	EDTA Titrimetric Method	5.0	2,117	511	80.4	STS Green Co., Ltd.
Cyanide (CN)	mg/L	APHA (2012), 4500-CN (C),(E)	0.005	<0.005	<0.005	<0.005	ALS Laboratory Group (Thailand)
Fluoride (F)	mg/L	APHA (2012), 4110B	0.1	<0.1	<0.1	<0.1	ALS Laboratory Group (Thailand)
Sulfide	mg/L	Iodometric Method	1.0	<1.0	<1.0	<1.0	STS Green Co., Ltd.
Total Organic Carbon	mg/L	Based on APHA (2012), 5310 B	0.05	4.65	0.55	0.09	ALS Laboratory Group (Thailand)
Ammonium-Nitrogen	mg/L	Phenate Method	0.010	2.85	2.32	0.151	STS Green Co., Ltd.
Sulfate (SO_4)	mg/L	Turbidimetric Method	1.0	320	15.0	8.7	STS Green Co., Ltd.
Nitrate (NO_3)	mg/L	Cadmium Reduction Method	0.005	0.293	0.222	18.61	STS Green Co., Ltd.
Chromium (Cr)	mg/L	Electrothermal AAS Method	0.0005	<0.0005	<0.0005	0.0042	STS Green Co., Ltd.
Calcium (Ca)	mg/L	Direct Nitrous Oxide-Acetylene Flame Method	0.02	206.05	18.35	11.14	STS Green Co., Ltd.
Magnesium (Mg)	mg/L	Direct Air-Acetylene Flame Method	0.003	153.65	74.94	12.46	STS Green Co., Ltd.
Sodium (Na)	mg/L	Direct Air-Acetylene Flame Method	0.01	3,198	644.80	17.90	STS Green Co., Ltd.
Potassium (K)	mg/L	Direct Air-Acetylene Flame Method	0.01	177.57	59.95	3.69	STS Green Co., Ltd.
Mercury (Hg)	mg/L	Cold-Vapor AAS Method	0.0003	<0.0003	<0.0003	<0.0003	STS Green Co., Ltd.
Lead (Pb)	mg/L	Electrothermal AAS Method	0.0020	<0.0020	<0.0020	<0.0020	STS Green Co., Ltd.
Cadmium (Cd)	mg/L	Electrothermal AAS Method	0.00005	<0.00005	0.00010	0.00005	STS Green Co., Ltd.
Copper (Cu)	mg/L	Direct Air-Acetylene Flame Method	0.05	<0.05	<0.05	<0.05	STS Green Co., Ltd.

Parameter	Unit	Method Analysis	LOQ	Results			Laboratory
				GW1	GW2	GW3	
Iron (Fe)	mg/L	Direct Air-Acetylene Flame Method	0.10	9.68	3.86	<0.10	STS Green Co., Ltd.
Tin (Sn)	mg/L	Based on APHA (2012), 3125	0.0001	<0.0001	<0.0001	<0.0001	ALS Laboratory Group (Thailand)
Manganese (Mn)	mg/L	Direct Air-Acetylene Flame Method	0.04	0.40	2.94	<0.04	STS Green Co., Ltd.
Total Nitrogen	mg/L	Based on APHA (2012), Calculated	1.0	12.7	1.3	5.1	ALS Laboratory Group (Thailand)
Total Phosphorous	mg/L	Acid Digestion/Ascobic Acid Method	0.005	0.405	0.051	0.030	STS Green Co., Ltd.
Zinc (Zn)	mg/L	Direct Air-Acetylene Flame Method	0.02	0.02	0.07	<0.02	STS Green Co., Ltd.
Nickel (Ni)	mg/L	Electrothermal AAS Method	0.0005	<0.0005	0.0079	0.0141	STS Green Co., Ltd.
Chloride (Cl)	mg/L	Mercuric Nitrate Method	1.0	7,103	1,438	16.0	STS Green Co., Ltd.

Soil Analysis Result

Project Name: Ahlone Expansion Combined Cycle Power Plant and FSRU Project to supply power to the Republic of the Union of Myanmar

Sampling by: ERM-Siam Co., Ltd.

Parameter	Unit	Method Analysis	LOQ	Results																		Laboratory
				S01		S02		S03		S04		S05		S06		S07		S08		S09		
				Top Soil	Sub Soil	Top Soil	Sub Soil	Top Soil	Sub Soil	Top Soil	Sub Soil	Top Soil	Sub Soil	Top Soil	Sub Soil	Top Soil	Sub Soil	Top Soil	Sub Soil	Top Soil	Sub Soil	
pH	-	Electrometric Method	-	7.3	7.2	7.7	7.3	7.6	7.2	8.0	7.8	7.4	7.4	6.8	8.1	6.7	7.5	7.6	7.8	7.8	7.5	STS Green Co., Ltd.
Arsenic (As)	mg/kg	Hydride Generation AAS Method	0.04	0.30	<0.04	<0.04	<0.04	<0.04	<0.04	3.80	5.90	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	STS Green Co., Ltd.
Cadmium (Cd)	mg/kg	Direct Air-Acetylene Flame Method	1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<0.10	<1.00	<1.00	<1.00	<1.00	<1.00	STS Green Co., Ltd.
Chromium (Cr)	mg/kg	Direct Air-Acetylene Flame Method	2.50	47.54	36.82	74.99	73.34	63.39	71.71	66.66	70.60	56.20	56.87	64.97	68.02	60.84	64.10	63.83	64.62	72.61	74.00	STS Green Co., Ltd.
Copper (Cu)	mg/kg	Direct Air-Acetylene Flame Method	1.50	25.13	9.03	38.29	27.29	36.07	34.78	35.12	37.44	27.74	23.70	29.34	31.95	30.01	29.04	<1.50	29.26	33.64	31.93	STS Green Co., Ltd.
Iron (Fe)	mg/kg	Direct Air-Acetylene Flame Method	2.50	35,912	25,382	67,059	62,391	62,995	57,391	7,449	6,942	8,684	6,068	11,140	9,738	5,703	9,995	59,965	53,394	54,513	55,400	STS Green Co., Ltd.
Lead (Pb)	mg/kg	Direct Air-Acetylene Flame Method	5.00	31.59	8.53	25.51	26.92	26.04	25.62	26.84	33.20	28.74	<5.00	24.56	22.94	23.81	24.05	16.43	21.16	32.49	26.95	STS Green Co., Ltd.
Manganese (Mn)	mg/kg	Direct Air-Acetylene Flame Method	1.00	461.10	229.01	894.26	873.51	1,209	1,448	1,039	536.19	947.18	737.08	1,196	1,662	651.12	829.18	783.22	628.56	641.31	566.36	STS Green Co., Ltd.
Mercury (Hg)	mg/kg	Cold-Vapor Atomic Absorption Spectrometric Method	0.10	<0.10	<0.10	1.04	0.12	0.13	0.15	0.10	0.10	<0.10	0.10	0.12	<0.10	<0.10	0.12	0.10	0.10	0.12	<0.10	STS Green Co., Ltd.
Zinc (Zn)	mg/kg	Direct Air-Acetylene Flame Method	0.50	70.30	39.10	103.96	107.18	105.59	101.36	101.81	100.64	84.50	70.81	87.05	93.86	83.44	84.73	79.25	86.06	96.16	89.28	STS Green Co., Ltd.

Sediment Analysis Result

Project Name: Ahlone Expansion Combined Cycle Power Plant and FSRU Project to supply power to the Republic of the Union of Myanmar

Sampling by: ERM-Siam Co., Ltd.

Parameter	Unit	Method Analysis	LOQ	Results						Laboratory
				SE1	SE2	SE3	SE4	SE5	SE6	
Particle Size Distribution										
- Sand	%	Hydrometer Analysis	-	43.7	48.2	1.2	2.3	5.3	7.1	STS Instrument Co., Ltd.
- Silt	%	Hydrometer Analysis	-	32.1	27.6	61.8	44.5	42.6	39.9	STS Instrument Co., Ltd.
- Clay	%	Hydrometer Analysis	-	24.2	24.2	37.0	53.2	52.1	53.0	STS Instrument Co., Ltd.
Total Organic Carbon (TOC)	%	Based on US EPA, Method 9060	0.01	0.16	<0.10	0.25	0.20	0.27	0.47	ALS Laboratory Group (Thailand)
TPH (C10 – C36)										ALS Laboratory Group (Thailand)
- C10-C14	mg/kg	Based on US EPA, Method 3570 and	5	<5	<5	<5	<5	<5	<5	
- C15-C28	mg/kg	8015B	10	<10	<10	<10	<10	<10	<10	
- C29-C36	mg/kg		10	<10	<10	<10	<10	<10	<10	
Total Oil	mg/kg	Soxhlet Extraction Method	20.0	508	358	105	443	419	132	STS Green Co., Ltd.
Arsenic	mg/kg	Hydride Generation AAS Method	0.04	<0.04	<0.04	<0.04	0.10	<0.04	<0.04	STS Green Co., Ltd.
Barium	mg/kg	Direct Nitrous Oxide-Acetylene Flame Method	5.00	23.17	35.09	39.70	51.17	38.05	49.10	STS Green Co., Ltd.
Cadmium	mg/kg	Direct Air-Acetylene Flame Method	1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	STS Green Co., Ltd.
Chromium	mg/kg	Direct Air-Acetylene Flame Method	2.50	34.44	48.33	53.98	75.67	64.86	67.65	STS Green Co., Ltd.
Copper	mg/kg	Direct Air-Acetylene Flame Method	1.50	15.28	22.68	23.55	31.14	30.24	31.47	STS Green Co., Ltd.
Lead	mg/kg	Direct Air-Acetylene Flame Method	5.00	<5.00	7.17	<5.00	7.23	12.70	15.58	STS Green Co., Ltd.
Mercury	mg/kg	Cold-Vapor AAS Method	0.10	0.12	0.14	0.18	0.14	0.16	0.16	STS Green Co., Ltd.
Nickel	mg/kg	Direct Air-Acetylene Flame Method	2.00	68.12	85.75	101.11	131.96	114.52	127.78	STS Green Co., Ltd.

Benthos Analysis Result

Project Name: Ahlone Expansion Combined Cycle Power Plant and FSRU Project to supply power to the Republic of the Union of Myanmar

Sampling by: ERM-Siam Co., Ltd.

Phylum/Species	Stations		
	SE1	SE2	SE3
PHYLUM ANNELIDA			
Class Polychaeta (ไส้เดือนทะเล)			
Order Sabellida			
Family Oweniidae	72	48	6
Class Sipunculidea			
Order Sipunculiformes			
Family Sipunculidae (หนอนถั่ว)	6		
PHYLUM NEMERTEA			
Class Enopla			
Order Heteronemertea (ริบบิ้น)		12	
PHYLUM ARTHROPODA			
Class Malacostraca			
Order Decapoda			
Family Alpheidae			
Alpheus sp.	42	6	
Family Dorippidae			
Dorippe sp.		6	
PHYLUM MOLLUSCA			
Class Gastropoda (หอยฝาเดียว)			
Order Neogastropoda			
Family Buccinidae	6	6	
Class Bivalvia (หอยสองฝา)			
Order Adapedontada			
Order Adapedontada			
Family Pharidae			
Cultellus sp.	6	6	
Total (Orgs/m^2)	**132**	**84**	**6**
Number of Species	**5**	**6**	**1**
Diversity Index	**1.12**	**1.35**	**-**
Richness Index	**0.82**	**1.13**	**-**
Evenness Index	**0.69**	**0.75**	**-**

APPENDIX M PHYSICAL IN-SITU SAMPLING DURING WET SEASON FROM SEM

Physical Baseline Studies Report (Wet Season)

For

The Extension of Power Generation Activities (TTCL)

In Ahlone and Dala Townships

TABLE OF CONTACTS

List of Table

List of the Figure

PHYSICAL ENVIRONMENT BASELINE
For Wet Season

1.1 Outline

The actual physical baseline survey for environmental impact assessment was surveyed at/near gas turbine power plant, Ahlone and Dala Townships, Yangon Region. Ten air qualities, three locations of groundwater quality, fourteen locations of surface water quality, and six locations of sediment survey were measured and collected. The summary of physical environmental survey is shown in Table 1.1-1, and sampling points for environmental survey are shown in Figure 1.1-1.

Table 1.1-1 Summary of Physical Environmental Survey for Wet Season

Air Quality & Meteorology	Parameter	1) Nitrogen Dioxide, 2) Nitric Oxide, 3) Sulphur Dioxide, 4) Particulate Matter PM10, 5) Particulate Matter PM 2.5, 6) Carbon Monoxide, 7) Relative Humidity, 8) Temperature, 9) Wind Speed, and 10) Wind Direction
	Period	10 points for one time within three continuous days
	Location	Residential and rural areas
Surface Water Quality	Parameter	1)Water Depth, 2) Flow rate, 3) Water temperature, 4) pH, 5) Salinity, 6) Electrical Conductivity, 7) Dissolved Oxygen, 8) Total Dissolved Solid, 9) Turbidity, and 10) Color
	Period	One time at 14 locations
	Location	River and Stream
Ground Water Quality	Parameter	1)Tube well Depth, 2) Water temperature, 3) pH, 4) Salinity,5) Electrical Conductivity, 6) Dissolved Oxygen, 7) Total Dissolved Solid, and 8) Color
	Period	One time at 3 locations
	Location	Wells
Sediment	Parameter	In-situ
	Period	One time at 6 locations
	Location	River

Source: Field Survey, June – July, 2018

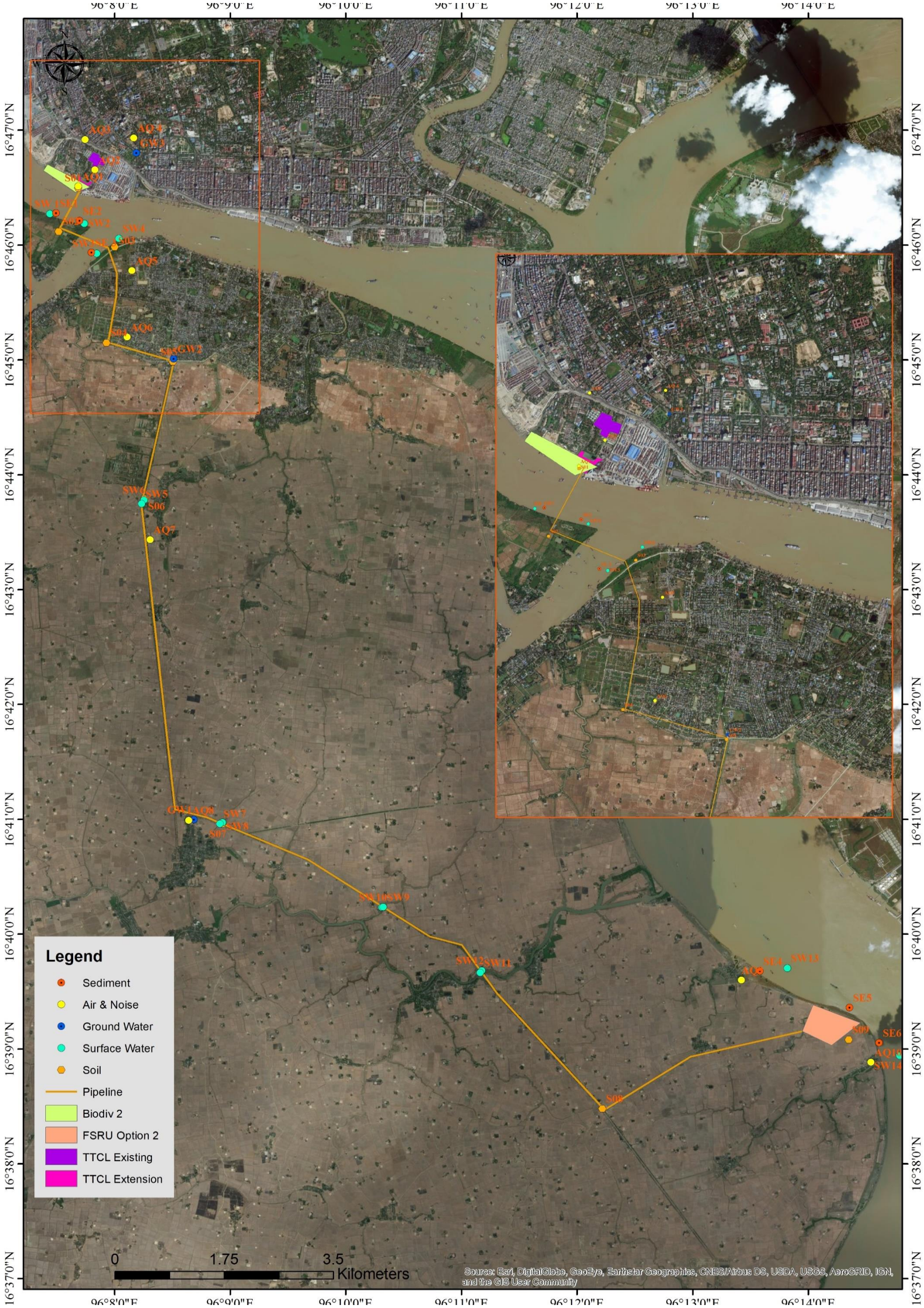


Figure 1.1-1 Location map of river sediment, water and air quality survey

1.2 Air Quality

1.2.1 Survey Item

Myanmar National Environmental Quality (Emission) Guidelines were announced on 29th December, 2015 and guideline values for air pollution level are shown in Table 1.2-1.

Table 1.2-1 Myanmar National Environmental Quality Guideline values for survey parameters of air quality

No	Parameter	Averaging Period	Guideline Value	Units
1.	Nitric oxide	-	-	µg/m3
2.	Nitrogen dioxide	1-hour	200	µg/m3
3.	Sulphur dioxide	24-hour	20	µg/m3
4.	Particulate matter PM_{10} [a]	24-hours	50	µg/m3
5.	Particulate matter $PM_{2.5}$ [b]	24-hours	25	µg/m3
6.	Carbon Monoxide	-	-	-
7.	Relative Humidity	-	-	%
8.	Temperature	-	-	℃
9.	Wind Speed	-	-	-
10.	Wind Direction	-	-	-

1.2.2 Survey Location

The coordinate location of air quality monitoring survey in detail are shown in Table 1.2-2.

Table 1.2-2 Sampling location for air quality survey

Sampling Points	Coordination	Description of Sampling Point
AQ1	16°46'30.69"N 96° 7'41.11"E	In the compound of Combined Cycle Power Plant (at project area) located in Ahlone Township, Yangon Region
AQ2	16°46'39.33"N 96° 7'49.79"E	Same as the AQ1
AQ3	16°46'55.17"N 96° 7'44.70"E	In the compound of Aung Mingalar Monastery (near the Kannar Road) located in Ahlone Township, Yangon Region
AQ4	16°46'56.00"N 96° 8'10.00"E	In the compound of Church (near the Thakhinmya Park) which located in Ahlone Township, Yangon Region
AQ5	16°45'46.67"N 96° 8'8.97"E	In the compound of No. (22) Basic Education Primary School which located in Dala Township, Yangon Region
AQ6	16°45'11.99"N 96° 8'6.46"E	In the compound of Yadanarayeyeikthar Monastery located in Kyansitthar Ward, Dala Township, Yangon Region
AQ7	16°43'26.10"N 96° 8'18.40"E	In the Nuaung Ngok To Village, in Dala Township, Yangon Region

AQ8	16°40'59.48"N 96° 8'38.41"E	In the compound of Pyasu Monastery which located in Pyaw Bwe Gyi Village, Dala Township, and Yangon Region
AQ9	16°39'36.00"N 96°13'25.32"E	In the compound of Aung Mingalar Monastery which located in That Kai Kwin Village, Dala Township, and Yangon Region
AQ10	16°38'53.04"N 96°14'32.48"E	In the Chaung Oo Village which located in Dala Township, Yangon Region

AQ1

AQ1 was measured in the compound of Combined Cycle Power Plant Project (Ahlone) which located in Ahlone Township, Yangon, and the project area. It is also situated in the left bank of Hlaing River and behind the Ahlone gas turbine power plant. The shrub land and Mangrove Forest encircled are occurred at the location. The possible pollution source might be emitted from gas turbine power plant funnel. The activities of AQ1 are shown in Figure 1.2-1.

Figure 1.2-1 Air quality monitoring survey at AQ1

AQ2

AQ2 was observed in the compound of Combined Cycle Power Plant Project (Ahlone) which located in Ahlone Township, Yangon, and the project area. The area is flat terrain with bushes and near power plant generator. The possible air pollution source may be come from gas turbine power plant funnel. The activities of AQ2 are shown in Figure 1.2-2.

Figure 1.2-2 Air quality monitoring survey at AQ2

AQ3

AQ3 was surveyed in the compound of Aung Mingalar Monastery (near the Kannar Street) and about monitoring point is set up at upstairs of monastery with 6 feet in height. There is a generator room behind the monastery and it generally works two times per day. The location is encircled by residential houses. It is possible that pollution source emitted from the human activities. The activities of AQ3 are shown in Figure 1.2-3.


Figure 1.2-3 Air quality monitoring survey at AQ3

AQ4

AQ4 was surveyed in the compound of Church (near the Thakhinmya Park) which located in Ahlone Township, Yangon Region and lies about 1.03 kilometers at northeast of power plant. It is possible that pollution source emitted from the human activities. The activities of AQ4 are shown in Figure 1.2-4.


Figure 1.2-4 Air quality monitoring survey at AQ4

AQ5

AQ5 was measured in the compound of No. (22) Basic Education Primary School which located in Dala Township, Yangon Region. It situated 0.22 kilometers away from proposed gas pipeline. The location is encircled by many residential houses. It is possible that pollution source emitted from

the human activities. The activities of AQ5 are shown in Figure 1.2-5.

Figure 1.2-5 Air quality monitoring survey at AQ5

AQ6

AQ6 was monitored in the compound of Yadanarayeyeikthar Monastery which located in Kyansitthar Ward, Dala Township, and Yangon Region and fared about 0.17 kilometers at north of gas pipeline. The location is surrounded by residential houses. The possible pollution source may be emitted from residences activities. The activities of AQ6 are shown in Figure 1.2-6.

Figure 1.2-6 Air quality monitoring survey at AQ6

AQ7

AQ7 was observed in the Nuaung Ngok To Village, Dala Township, Yangon Region and situated about 0.07 kilometers away from proposed gas pipeline. The location is at flat terrain and encircled with residential houses. It is possible that pollution source emitted from the human activities. The activities of AQ7 are shown in Figure 1.2-7.

Figure 1.2-7 Air quality monitoring survey at AQ7

AQ8

AQ8 was surveyed in the compound of Pyasu Monastery in Pyaw Bwe Gyi Village, Dala Township. It lies about 0.11 kilometers away from proposed gas pipeline. There is a grain mill in front of monastery and it works in the day time. The location is surrounded by many residential houses. It is possible that pollution source emitted from crematorium and the human activities. The activities of AQ8 are shown in Figure 1.2-8.

Figure 1.2-8 Air quality monitoring survey at AQ8

AQ9

AQ9 was measured in the compound of Aung Mingalar Monastery, That Kel Kyin Village, Dala Township, and Yangon Region. It lies about 1.02 kilometers away from proposed gas pipeline. The measured point is situated near bushes, trees, and paddy field. The location is surrounded by residential houses. It is possible that pollution source emitted from the residents' activities. The activities of AQ9 are shown in Figure 1.2-9.

Figure 1.2-9 Air quality monitoring survey at AQ9

AQ10

AQ10 was monitored in the Chaung Oo Village, Dala Township, Yangon Region and sited about 0.59 kilometers at southeast of proposed FSRU Option 2. It situated near paddy field and by the right band of Yangon River. The location is encircled by many residential houses. It is possible that pollution source emitted from the human activities. The field activities of AQ10 are shown in Figure 1.2-10.

Figure 1.2-10 Air quality monitoring survey at AQ10

1.2.3 Survey Period

Air quality survey was conducted from June 27 th – July 9 th, 2018 for baseline studies. Each sampling duration is described in Table 1.2-3.

Table 1.2-3 Sampling Duration for Air Quality Survey

Point	Period
AQ1 **AQ2** **AQ3**	June 27th – 30th, 2018 (72 hours)

AQ5 **AQ6** **AQ7**	June 30th – July 3rd, 2018 (72 hours)
AQ8 **AQ9** **AQ10**	July 3rd – 6th, 2018 (72 hours)
AQ4	July 6th – 9th, 2018 (72 hours)

1.2.4 Survey Method

Methodology

Sampling and analysis of ambient air pollutants were conducted by referring to the recommendation of United States Environmental Protection Agency (U.S. EPA). The Haz-Scanner EPAS Wireless Environmental Perimeter Air Station was used to collect Ambient Air Monitoring data.

Table 1.2-4 Sampling and Analysis Method for Air Quality

No.	Parameter	Analysis Method
1	Nitric oxide (NO_x)	On site reading
2	Nitrogen dioxide (NO2)	On site reading
3	Sulphur dioxide (SO2)	On site reading
4	Particulate matter 10 (PM10)	On site reading
5	Particulate matter 2.5 (PM2.5)	On site reading
6	Carbon Monoxide	On site reading
7	Relative Humidity	On site reading
8	Temperature	On site reading
9	Wind Speed	On site reading
10	Wind Direction	On site reading

1.2.5 Survey Result

AQ1

Average values of ambient gaseous levels at AQ1 are shown in Table 1.2-5. CO and NO values are not specified in Myanmar emission guideline. NO_2 emission standard per 24 hours is not specified in

the Myanmar Emission Guideline. That's why NO_2 emission per 1 hour which is mentioned in guideline is just assessed. NO_2, PM2.5, PM10 and SO_2 concentrations are within the standard. Hourly results of AQ1 described in appendix.

Table 1.2-5 Daily Ambient air quality results at AQ1

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	hours	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
27-28 June, 2018	24	107.81	111.79	0.02	5.38	14.42	85.07	8.37	25.26
28-29 June, 2018	24	106.83	50.56	0.03	10.65	11.53	72.40	1.83	28.21
29-30 June, 2018	24	37.30	26.99	0.01	24.94	16.61	79.44	6.84	27.78
Myanmar emission guideline value (24 hours)		-	200 (1 hour)	-	25	50	-	20	-

AQ2

Average values of ambient gaseous levels at AQ2 are shown in Table 1.2-6. NO_2, PM10 and SO_2 concentrations are within the standard expect PM2.5 for last day of survey period. Generally, it can say the area is lower than the standard except one day period for PM2.5 at the area. Hourly results of AQ2 described in appendix.

Table 1.2-6 Daily Ambient air quality results at AQ2

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	hours	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
27-28 June, 2018	24	42.1565	8.0725	11.8569	24.3583	29.2413	81.2436	4.6447	25.7313
28-29 June, 2018	24	56.0151	10.6284	12.9272	15.3417	19.5396	73.9896	8.6740	28.3660
29-30 June, 2018	24	51.1769	6.3459	28.8233	15.9552	24.6849	76.1600	28.7850	26.8812
Myanmar emission guideline value (24 hours)		-	200 (1 hour)	-	25	50	-	20	-

AQ3

Average values of ambient gaseous levels at AQ3 are shown in Table 1.2-7. CO and NO values are not specified in Myanmar emission guideline. NO_2 emission standard per 24 hours is not specified in the Myanmar Emission Guideline. That's why NO_2 emission per 1 hour which is mentioned in guideline is just assessed. NO_2, PM10 and SO_2 concentrations are within the standard while PM2.5 concentrations occur fairly higher than the standard for two days in 72 hours continuous monitoring.

So, it generally means the area had a few particulates emission source at the area. Hourly results of AQ3 described in appendix.

Table 1.2-7 Daily Ambient air quality results at AQ3

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	**hours**	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	**%**	µg/m3	**Deg. C**
27-28 June, 2018	24	127.06	53.13	0.03	26.26	29.50	84.45	10.04	26.33
28-29 June, 2018	24	150.23	40.52	0.04	28.15	29.05	76.17	11.74	27.56
29-30 June, 2018	24	201.10	59.36	0.08	19.93	21.31	77.79	11.63	27.67
Myanmar emission guideline value (24 hours)		-	200 (1 hour)	-	25	50	-	20	-

AQ4

Average values of ambient gaseous levels at AQ4 are shown in Table 1.2-8. CO and NO values are not specified in Myanmar emission guideline. NO_2, PM2.5, PM10 and SO_2 concentrations are within the standard according to the baseline monitoring survey. NO_2 emission standard per 24 hours is not specified in the Myanmar Emission Guideline. That's why NO_2 emission per 1 hour which is mentioned in guideline is just assessed. Hourly results of AQ4 described in appendix.

Table 1.2-8 Daily Ambient air quality results at AQ4

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	**hours**	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	**%**	µg/m3	**Deg. C**
06-07 July, 2018	24	155.4966	27.3400	0.0028	2.0551	6.6591	97.2707	8.2875	23.4201
07-08 July, 2018	24	117.2401	14.3253	0.0120	2.1250	8.1667	94.1806	12.4093	23.8104
08-09 July, 2018	24	139.6970	14.1221	0.0011	2.2097	8.0785	93.3889	8.6165	24.1583
Myanmar emission guideline value (24 hours)		-	200 (1 hour)	-	25	50	-	20	

AQ5

Average values of ambient gaseous levels at AQ5 are shown in Table 1.2-9. CO and NO values are not specified in Myanmar emission guideline. NO_2 emission standard per 24 hours is not specified in the Myanmar Emission Guideline. That's why NO_2 emission per 1 hour which is mentioned in guideline is just assessed. NO_2, PM2.5, PM10 and SO_2 concentrations are within the standard

according baseline monitoring survey expect SO_2 for first day of survey period. So, it generally means the area had a few emission source at the area. Hourly results of AQ5 described in appendix.

Table 1.2-9 Daily Ambient air quality results at AQ5

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	hours	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
30-01 June, 2018	24	123.5147	13.5488	0.0376	2.2657	7.6298	87.4824	22.8819	26.3508
01-02 June, 2018	24	135.3313	15.2064	0.0161	2.1042	6.5521	95.2938	11.9965	24.5556
02-03 June, 2018	24	123.1307	14.2016	0.0280	2.1549	8.4132	88.7958	13.9079	25.9868
Myanmar emission guideline value (24 hours)		-	200 (1 hour)	-	25	50	-	20	

AQ6

Average values of ambient gaseous levels at AQ6 are shown in Table 1.2-10. CO and NO values are not specified in Myanmar emission guideline. NO_2 emission standard per 24 hours is not specified in the Myanmar Emission Guideline. That's why NO_2 emission per 1 hour which is mentioned in guideline is just assessed. NO_2, PM2.5, PM10 and SO_2 concentrations are within the standard expect PM10 for last day of survey period. So, it generally means the area had few particulates sources at the area. Hourly results of AQ6 described in appendix.

Table 1.2-10 Daily Ambient air quality results at AQ6

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	hours	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
30-01 June, 2018	24	33.9304	3.8849	14.5193	5.3549	11.0063	86.4507	8.9327	26.9139
01-02 June, 2018	24	34.2989	5.3512	11.1005	12.3711	15.0998	85.5412	8.0398	26.4104
02-03 June, 2018	24	21.5327	3.5429	7.8182	9.2618	59.7192	93.2138	5.0873	25.6378
Myanmar emission guideline value (24 hours)		-	200 (1 hour)	-	25	50	-	20	

AQ7

Average values of ambient gaseous levels at AQ7 are shown in Table 1.2-11. CO and NO values are not specified in Myanmar emission guideline. NO_2 emission standard per 24 hours is not specified in the Myanmar Emission Guideline. That's why NO_2 emission per 1 hour which is mentioned in guideline is just assessed. NO_2, PM2.5, PM10 and SO_2 concentrations are within the standard.

Concentration of PM10 is higher than the standard for last day. This emission may be come from the landfilling activities. Near the air quality station had the site cleaning to construct the households. So, it generally means the area had few particulates sources at the area. Hourly results of AQ7 described in appendix.

Table 1.2-11 Daily Ambient air quality results at AQ7

Date	**Time**	**CO**	**NO2**	**NO**	**PM2.5**	**PM10**	**RH**	**SO2**	**TmpC**
D.M.Y	**hours**	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	**%**	µg/m3	**Deg. C**
30 June- 01 July, 2018	24	41.5269	20.0397	0.0083	24.3583	29.2413	86.5080	9.8419	28.4248
01 - 02 July, 2018	24	38.9521	17.9618	0.0158	17.8139	19.8501	90.5015	5.8975	24.2873
02 - 03 July, 2018	24	51.7841	18.6754	0.0116	24.8128	70.6468	89.4775	4.3755	27.6118
Myanmar emission guideline value (24 hours)		-	200 (1 hour)	-	25	50	-	20	

AQ8

Average values of ambient gaseous levels at AQ8/N8 are shown in Table 1.2-12. CO and NO values are not specified in Myanmar emission guideline. NO_2 emission standard per 24 hours is not specified in the Myanmar Emission Guideline. That's why NO_2 emission per 1 hour which is mentioned in guideline is just assessed. NO_2, PM2.5, PM10 and SO_2 concentrations are within the standard. Hourly results of AQ8 described in appendix.

Table 1.2-12 Daily Ambient air quality results at AQ8/N8

Date	**Time**	**CO**	**NO2**	**NO**	**PM2.5**	**PM10**	**RH**	**SO2**	**TmpC**
D.M.Y	**hours**	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	**%**	µg/m3	**Deg. C**
03-04 June, 2018	24	49.8537	13.5634	0.0081	19.3438	36.4646	94.6361	5.4534	25.3444
04-05 June, 2018	24	71.2967	21.6303	0.0044	21.9167	20.3319	94.7097	6.6437	25.6340
05-06 June, 2018	24	65.3659	15.2836	0.0030	3.6188	23.6257	98.6382	0.0052	24.2382
Myanmar emission guideline value (24 hours)		-	200 (1 hour)	-	25	50	-	20	

AQ9

Average values of ambient gaseous levels at AQ9 are shown in Table 1.2-13. CO and NO values are not specified in Myanmar emission guideline. NO_2 emission standard per 24 hours is not specified in the Myanmar Emission Guideline. That's why NO_2 emission per 1 hour which is mentioned in guideline is just assessed. NO_2, PM2.5, PM10 and SO_2 concentrations are within the standard. Hourly

results of AQ9 described in appendix.

Table 1.2-13 Daily Ambient air quality results at AQ9

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	hours	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
03-04 July, 2018	24	25.0949	7.9981	3.1421	24.3583	29.2413	97.7194	1.2164	24.7229
04-05 July, 2018	24	21.3929	1.2931	5.4162	8.0806	17.8910	98.0528	2.1113	24.6500
05-06 July, 2018	24	4.5291	30.3528	0.3993	19.3479	32.5674	88.2083	0.5135	25.0569
Myanmar emission guideline value (24 hours)		-	200 (1 hour)	-	25	50	-	20	

AQ10

Average values of ambient gaseous levels at AQ10 are shown in Table 1.2-14. CO and NO values are not specified in Myanmar emission guideline. NO_2 emission standard per 24 hours is not specified in the Myanmar Emission Guideline. That's why NO_2 emission per 1 hour which is mentioned in guideline is just assessed. NO_2, PM2.5, PM10 and SO_2 concentrations are within the standard. Hourly results of AQ10 described in appendix.

Table 1.2-14 Daily Ambient air quality results at AQ10

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	hours	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
03-04 July, 2018	24	67.1761	15.2012	0.0269	24.3583	29.2413	92.9859	5.6955	25.1116
04-05 July, 2018	24	71.0194	16.9260	0.0081	2.3588	8.9103	95.5035	3.6645	24.5629
05-06July, 2018	24	68.8941	14.2053	0.0077	2.3654	7.6927	98.9014	2.7897	23.6277
Myanmar emission guideline value		-	200 (1 hour)	-	25	50	-	20	

Wind Speed and Wind Direction

The average wind speed and direction were collected for 72 hours continuously in each location. According to the wind rose diagram and average wind speed of stations varies from 0.03 to 11.1 m/s in covering the all stations and varies in high range of wind speed in rainy season. Generally, Prevailing wind direction of all quality station are blowing from west, southwest, and southeast. By the wind rose diagram, the dominant wind direction are southeast and southwest quadrant. Wind speed and direction diagram of each stations are shown in Figure 1.2-

11 to 1.2-15.

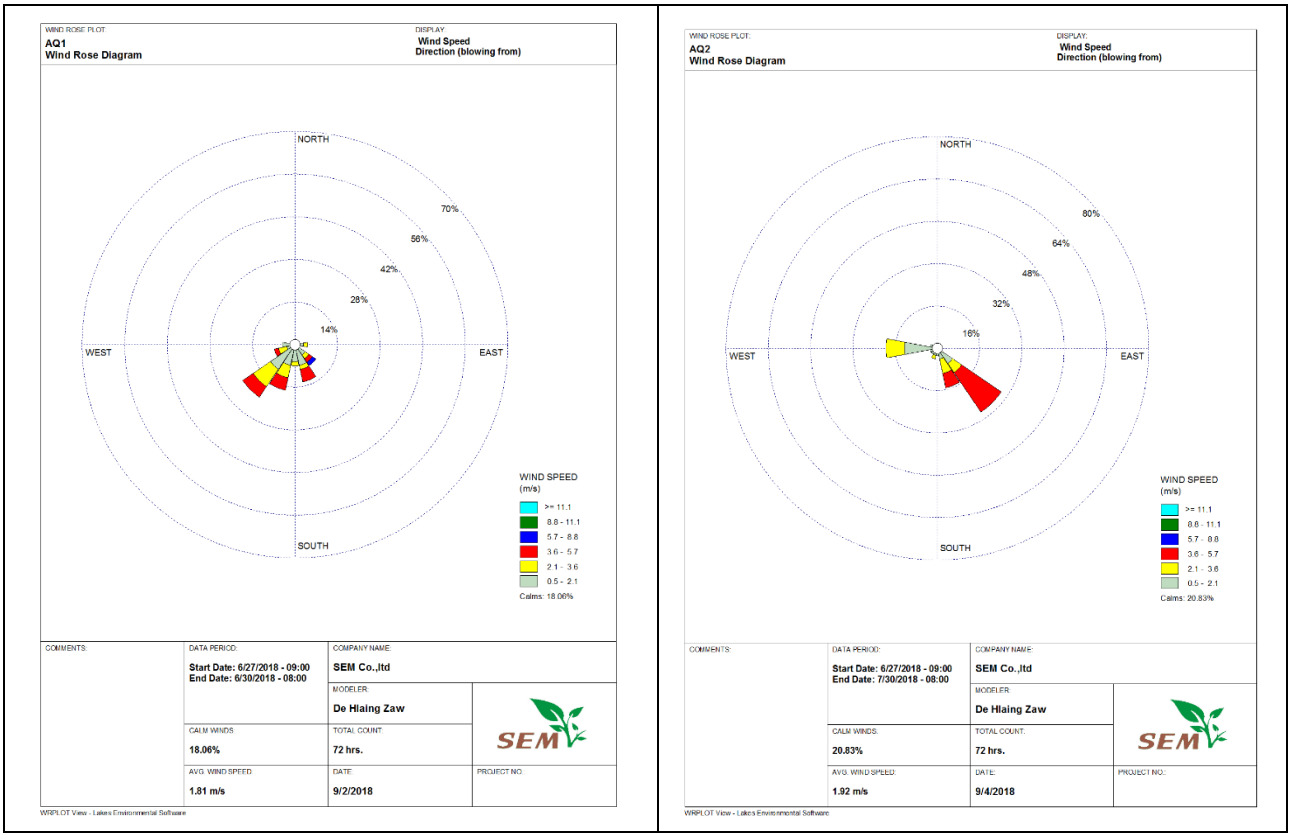


Figure 1.2-11 Wind speed and direction diagram at AQ1 and AQ2

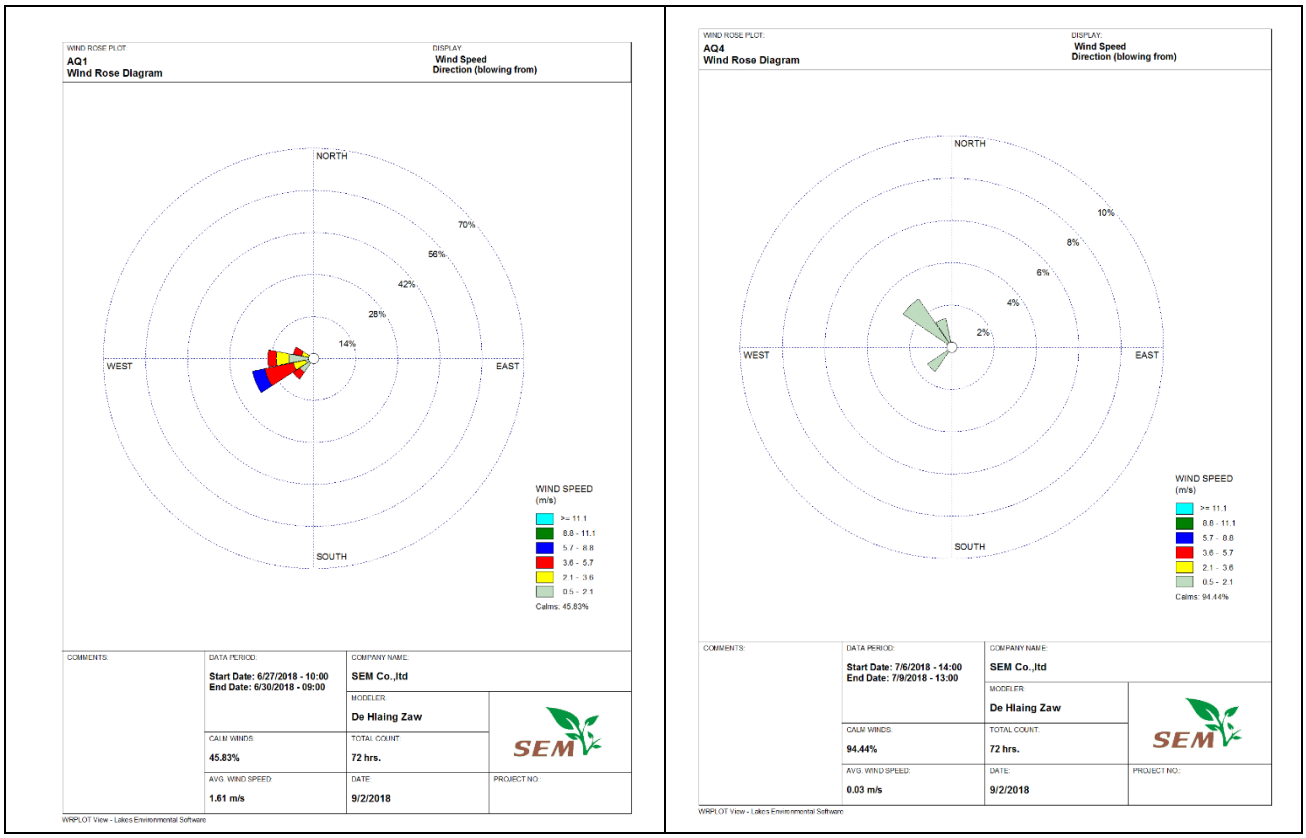


Figure 1.2-12 Wind speed and direction diagram at AQ3 and AQ4

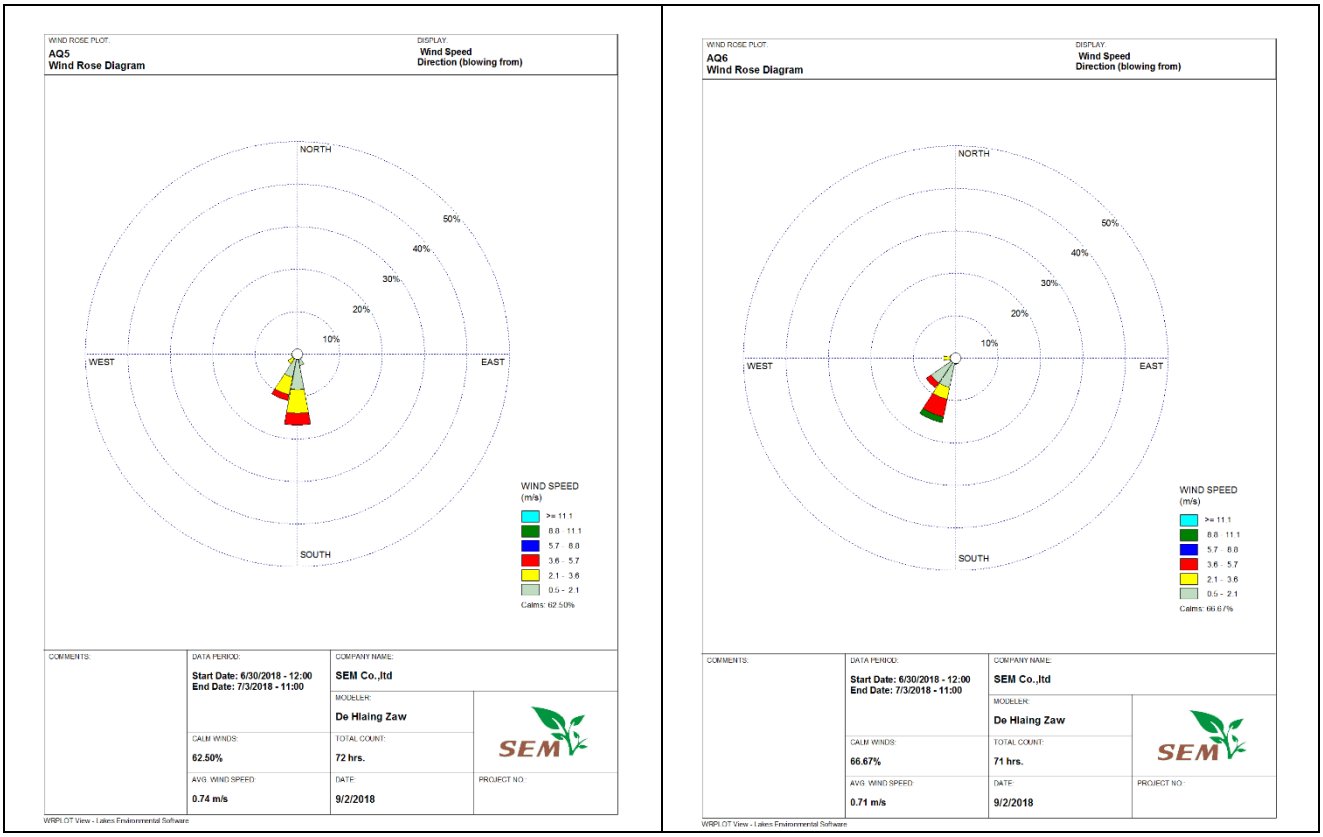


Figure 1.2-13 Wind speed and direction diagram at AQ5 and AQ6

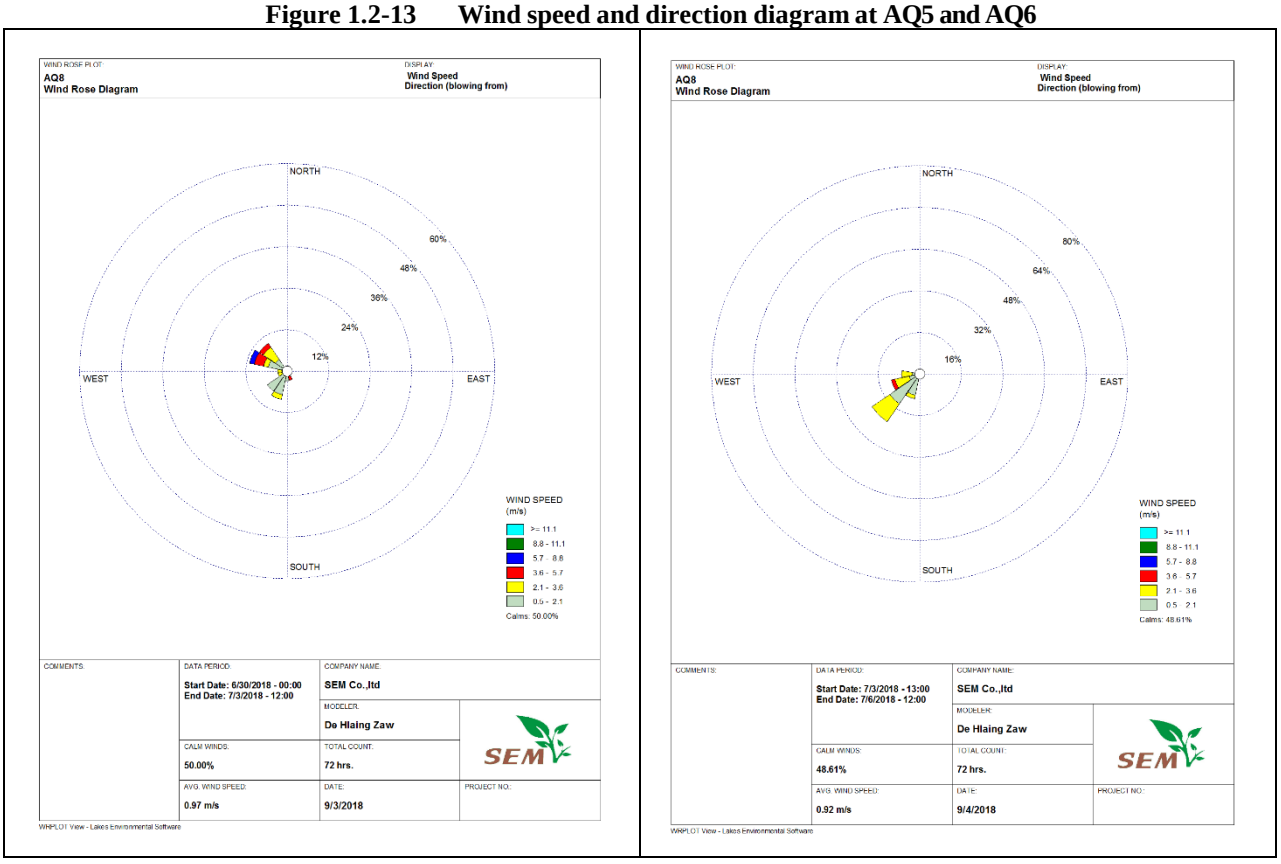


Figure 1.2-14 Wind speed and direction diagram at AQ7 and AQ8

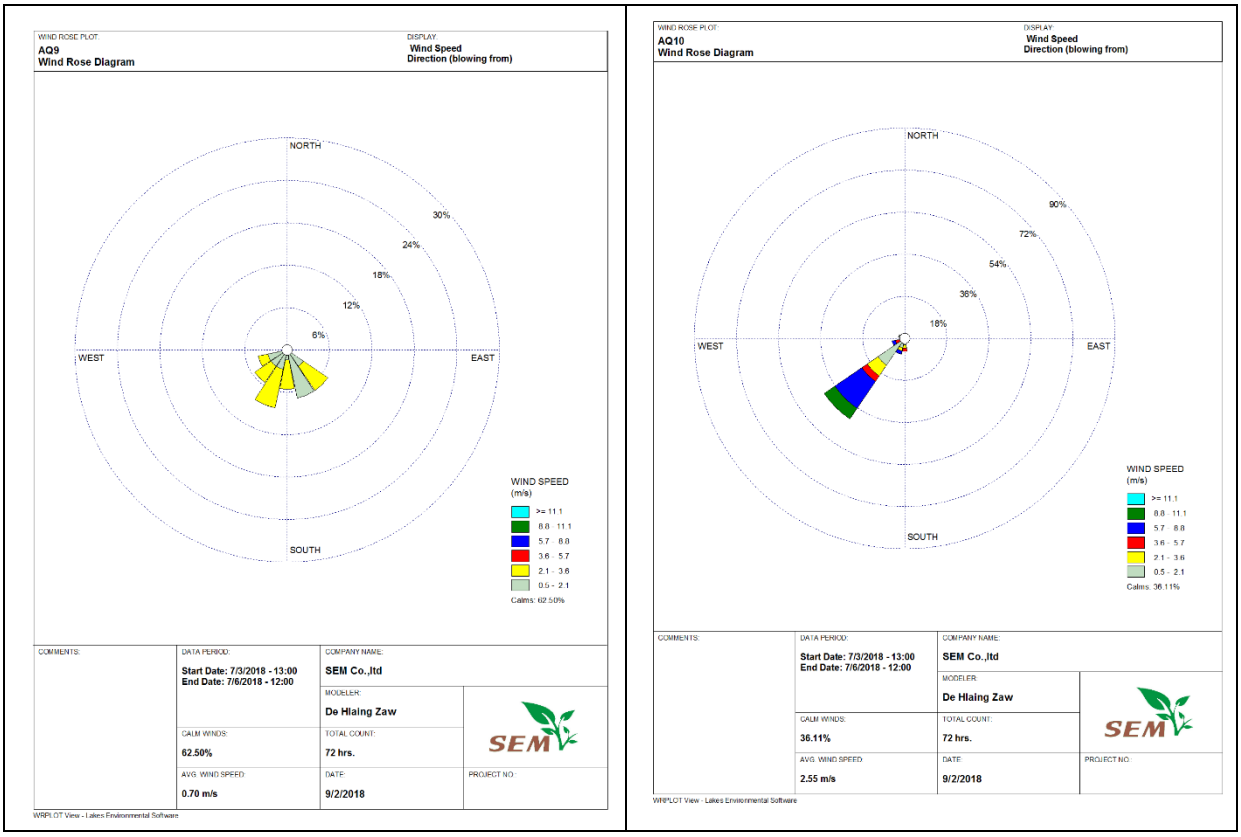


Figure 1.2-15 Wind speed and direction diagram at AQ9 and AQ10

1.3 Surface Water Quality

1.3.1 Survey Item

Parameters for water quality survey are determined so as to cover the parameters of existing environmental standards of Myanmar.

Table 1.3-1 Survey Parameters for Water Quality Survey

No.	Parameter	Unit	Myanmar Environmental Guideline Value
1	Temperature	^{o}C	-
2	pH	-	6 – 9
3	Dissolved Oxygen	mg/l	-
4	Electrical Conductivity (EC)	µS/cm	-
5	Total Dissolved Solid (TDS)	Ppm	-
6	BOD (5 days)	mg/l	50
7	COD	mg/l	250
8	Total Suspended Solids (TSS)	mg/l	50
9	Oil & Grease	mg/l	10
10	Total Coliform Bacteria	100 ml	400

Source: General Application; Wastewater, Storm water runoff, Effluent and sanitary discharges

(Myanmar National Environmental Guidelines (2015, Dec 29th))

1.3.2 Survey Locations

The coordinate locations of water samples and surveys are shown in Table 1.3-2.

Table 1.3-2 Sampling and survey points of surface water quality survey

Category	Sampling Point	Coordinates	Description of Sampling Points
Surface Water	SW 1	16°46'16.39"N 96° 7'26.42"E	Up stream of Gas Turbine, Yangon River, near about 0.25 kilometers West of Pipe line and south of project area.
Surface Water	SW 2	16° 46' 11.25"N 96° 7' 44.26"E	Upstream of Gas Turbine, Yangon River, near about 0.3 kilometers east of Pipe line.
Surface Water	SW 3	16° 45' 55.62"N 96° 7' 50.73"E	At mouth of Twantae Canal and near the pipe line.
Surface Water	SW 4	16° 46' 3.46"N 96° 8' 2.27"E	Downstream of Twantae Canal, near pipe line.
Surface Water	SW 5	16°43'44.85"N 96° 8'14.10"E	In the Ka Ma Aung Stream, in Nuaung Ngok To Village, near the pipe line.
Surface Water	SW 6	16°43'46.82"N 96° 8'15.25"E	In the Ka Ma Aung Stream, in Nuaung Ngok To Village, near about 0.03 kilometers east of gas pipe line.
Surface Water	SW 7	16°40'57.67"N 96° 8'54.64"E	At the middle of Pyaw Bwe Stream from bridge, in Pyaw Bwe Gyi village, near about 0.01 kilometers of pipe line
Surface Water	SW 8	16°40'58.36"N 96° 8'56.10"E	Downstream of Pyaw Bwe Stream, in Pyaw Bwe Gyi village, near about 0.02 kilometer southeast of pipe line
Surface Water	SW 9	16°40'14.17"N 96°10'19.41"E	In Pyaw Bwe Stream, northwest of Ya Kaing Gyaung village, near the gas pipe line
Surface Water	SW 10	16°40'14.04"N 96°10'18.72"E	Downstream of Pyaw Bwe Stream, northwest of Ya Kaing Gyaung Village, near about 0.02 kilometers southwest of pipe line
Surface Water	SW 11	16°39'39.81"N 96°11'9.78"E	Upstream of Ya Kaing Gyaung Stream, in Ya Kaing Gyaung Village, near about 0.02 kilometer southwest of pipe line
Surface Water	SW 12	16°39'40.99"N 96°11'10.60"E	Downstream of Ya Kaing Gyaung Stream, Ya Kaing Gyaung Village, northeast of gas pipe line
Surface Water	SW 13	16°39'42.26"N 96°13'49.15"E	Upstream of FSRU option 2, Yangon River and it lies about 1.05 kilometers at northwest of pipe line
Surface Water	SW 14	16°38'56.46"N 96°14'47.50"E	Downstream of FSRU Option 2, Yangon River, near about 0.25 kilometers at southeast of pipe line

SW1

SW1 was surveyed and collected at upstream of gas turbine in Yangon River, near about 0.25 kilometers west of pipe line and south of project area, Alone Township, Yangon. The Yangon River width of SW 1 is about 512.47 meters width (measured in Google Map). The flow rate of the river is generally about 0.2 m/s. The transparency of water is medium to high. The survey activities of SW1 are shown in Figure 1.3-1.

Figure 1.3-1 Water quality survey at SW1

SW2

SW2 was measured in downstream of gas turbine, Yangon River and near about 0.3 kilometers east of pipe line, Alone Township, Yangon Region. SW2 is near mouth of Twantae Canal. The flow rate of the river is about 0.1 m/s. The transparency of water is medium to high. This river is mainly used for fishing and transportation. The survey activities of SW2 are shown in Figure 1.3-2.

Figure 1.3-2 Water quality survey at SW2

SW3

SW3 was surveyed at mouth of Twantae Canal, near about 0.16 kilometers south of pipe line, Alone Township, Yangon. The canal width of SW 3 is about 387.95 meters width and the sampling point is located downstream of Twantae Canal. The flow rate of the water is about 1.5 m/s. The transparency of water is medium to high. The survey activities of SW3 are shown in Figure 1.3-3.

Figure 1.3-3 Water quality survey at SW3

SW4

SW4 was surveyed and collected at mouth of Twantae Canal and about 220 meters nearly northeast of pipe line, Dala Township, Yangon Region. The channel width of SW4 is about 459.09 meters width and the sampling point is located downstream of Twantae Canal. The flow rate of the river is about 0.2 m/s. The survey activities of SW4 are shown in Figure 1.3-4.

Figure 1.3-4 Water quality survey at SW4

SW5

SW5 was surveyed in the Ka Ma Aung Stream, in Nuaung Ngok To Village, Dala Township, Yangon Region. The stream width of SW5 is about 5.36 meters width. The transparency of water is medium and the salinity is 0.1 psu. The survey activities of SW5 are shown in Figure 1.3-5.

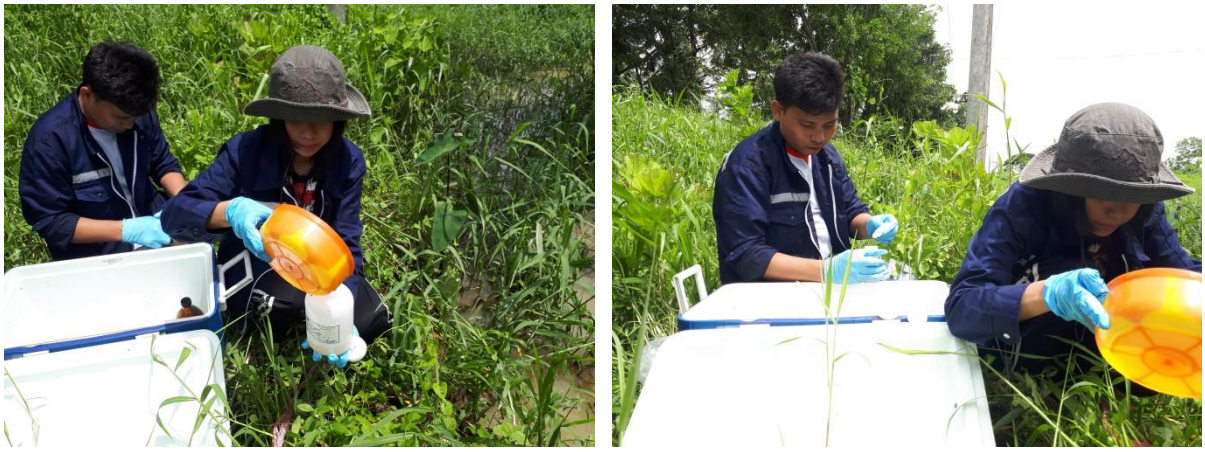


Figure 1.3-5 Water quality survey at SW5

SW6

SW6 was surveyed in the Ka Ma Aung Stream, in Nuaung Ngok To Village, Dala Township, Yangon Region. It is located near about 0.03 kilometers east of pipe line which will construct later. The sampling point is located upstream of pipe line and beside the car road. The transparency of water is medium and the salinity is 0.1 psu. The survey activities of SW6 are shown in Figure 1.3-6.

Figure 1.3-6 Water quality survey at SW6

SW7

SW7 was collected from the left side of Pyaw Bwe bridge, at Pyaw Bwe Gyi stream in Pyaw Bwe Gyi village, Dala Township, Yangon Region. The width of stream is about 5.56 meters width (measure on google map) and the sampling point is located near about 0.01 kilometer of pipe line. The medium transparency of water is found. The survey activities of SW7 are shown in Figure 1.3-7.

Figure 1.3-7 Water quality survey at SW7

SW8

SW8 was collected from the right side of Pyaw Bwe Bridge, at Pyaw Bwe Gyi Stream, in Pyaw Bwe Gyi village, Dala Township, Yangon Region. It is located near about 20 meter southeast of pipe line. SW8 was sampling in the Pyaw Bwe Stream where across from left to right bank distance is about 5.56 meters (measured in Google Map). The transparency of water is medium. The survey activities of SW8 are shown in Figure 1.3-8.

Figure 1.3-8 Water quality survey at SW8

SW9

SW9 was collected in the Pyaw Bwe Stream, northwest of Ya Kaing Gyaung village, Dala Township, Yangon Region. It is closely located southwest of pipe line. SW9 was sampling in the upstream of Pyaw Bwe Stream where across from left to right bank distance is about 5.56 meters (measured in Google Map), near Tha Net Pin bridge. The transparency of water is medium and the salinity is 0.1psu. The survey activities of SW8 are shown in Figure 1.3-9.

Figure 1.3-9 Water quality survey at SW9

SW10

SW10 was surveyed at downstream of Pyaw Bwe Stream, northwest of Ya Kaing Gyaung Village, Dala Township, Yangon Region. It is located near about 0.02 kilometers southwest of pipe line. SW10 was sampling in the Pyaw Bwe Stream near Tha Net Pin Bridge. The transparency of water is medium and the salinity is 0.1 psu. The survey activities of SW10 are shown in Figure 1.3-10.

Figure 1.3-10 Water quality survey at SW10

SW11

SW11 was surveyed and collected at upstream of Ya Kaing Gyaung Stream, in Ya Kaing Gyaung Village, Dala Township, Yangon Region. It is located near about 0.02 kilometers southwest of pipe line. SW11 was sampled at the middle of the Ya Kaing Gyaung Stream from the Ya Khaing Gyaung Bridge. The transparency of water is medium and the salinity is 0.1 psu. The survey activities of SW11 are shown in Figure 1.3-11.

Figure 1.3-11 Water quality survey at SW11

SW12

SW12 was surveyed and collected at downstream of Ya Kaing Gyaung Stream, Ya Kaing Gyaung Village, Dala Township, Yangon Region. It is located near about 0.02 kilometer northeast of pipe line. The Ya Kaing Gyaung Stream width of SW12 is about 45.87 meters width (measured in Google Map). The transparency of water is medium and the salinity is 0.1 psu. The survey activities of SW12 are shown in Figure 1.3-12.

Figure 1.3-12 Water quality survey at SW12

SW13

SW13 was surveyed and collected at upstream of FSRU option 2, Yangon River and it lies about 1.05 kilometers at northwest of pipe line and northwest of FSRU option 2, Dala Township, Yangon. The Yangon River width of SW13 is about 2,171.77 meters width (measured in Google Map). The flow rate of the river is generally about 0.5 m/s. The transparency of water is medium to high. The survey activities of SW13 are shown in Figure 1.3-13.

Figure 1.3-13 Water quality survey at SW13

SW14

SW14 was surveyed at downstream of FSRU Option 2, Yangon River, near about 0.25 kilometers at southeast of pipe line and southwest of project area, Alone Township, Yangon. The width of Yangon River is 2,003.88 meters (measured in Google Map). The location of SW14 is located near Chaung Oo village and the southwest of proposed FSRU Option 2. The flow rate of the river is generally about 0.27 m/s. The transparency of water is medium to high. The survey activities of SW14 are shown in Figure 1.3-14.

Figure 1.3-14 Water quality survey at SW14

1.3.3 Survey Period

The sampling and measuring of the surface water were conducted on 27th – 29th June, 2018.

1.3.4 Survey Method

Water samples were taken by Alpha horizontal water sampler and collected in plastic and sterilized glass sample containers. All sampling was in strict accordance with recognized standard procedures. The parameters as pH, temperature, dissolved oxygen (DO), electrical conductivity (EC), and total

dissolved solid including the odor and color in visual analyzing were measured at each site concurrently with sample collection and. According to the Laboratory standard, some samples were preserved using the chemicals. All samples were kept in iced boxes and were transported to the laboratory within 24 hours.

Moreover, the river survey; the flow rate, width and depth of river, was also measured using Vale port Flow Meter equipment and depth sounder.

Table 1.3-3 Field Equipment for surface water quality survey

No.	Equipment	Manufacturer	Originate Country	Model/Serial No.
1	SMART TROLL@ MP _Multi parameter for water	In_Situ Inc.	USA	SN - 346054
2	Multi Parameters for water quality	HANNA	USA	H17609823 (Turbidity Sensor)
3	Alpha Bottle (Water Sampler)m	Wildlife Supply Company®	Indonesia	Wildco P/N-1120-G45
4	Flow meter	GLOBAL WATER 800-876-1172	USA	FB211- Serial- 1449006336
5	Depth Sounder	Japan	Japan	FP211/1136160536

Table 1.3-4 Analysis Method for Water Samples

No	Item	Analysis Method
1	Temperature	SMART TROLL@MP Multi parameter for water (pH sensor)
2	pH	SMART TROLL@MP Multi parameter for water (DO sensor)
3	Dissolved Oxygen	SMART TROLL@MP Multi parameter for water (EC/TDS sensor)
4	Electrical Conductivity (EC)	SMART TROLL@MP Multi parameter for water (EC/TDS sensor)
5	Total Dissolved Solid (TDS)	SMART TROLL@MP Multi parameter for water (EC/TDS sensor)

1.3.5 Survey Result

Laboratories

Water samples were sent to the STS Green Laboratory in Thailand. Water quality results are shown in following Table 1.3-5.

Table 1.3-5 In-Situ Measurement and laboratory analysis of Surface Water Quality

No.	Sample No./ Physical Parameter	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8
1	Location	Up stream of Yangon River	Downstream of Yangon River	At mouth of Twantae Canal (up)	At mouth of Twantae Canal (below)	Ka Ma Aung Stream (down)	Up stream of Ka Ma Aung Stream	Downstream of Pyaw Bwe Stream	Up stream of Pyaw Bwe Stream
2	Date/Time	27.6.2018 13:04	27.6.2018 12:35	27.6.2018 11:30	27.6.2018 11:15	29.6.2018 13:20	29.6.2018 13:20	29.6.2018 12:10	29.6.2018 12:15
3	Weather	Rainy	Cloudy	Cloudy	Cloudy	Cloudy	Cloudy	Sunny	Sunny
4	Transparency	Medium to high	Medium to high	Medium to high	Medium to high	Medium	Medium	Medium	Medium
5	Color					Light Yellow	Light Yellow	Light Yellow	Light Yellow
6	Water Depth (m)	14	8.1	8.6	8.0	-	-	-	-
7	Depth (of sample taken) (m)	1	1	1	1	-	-	-	-
8	Flow rate/velocity (m/s)	0.2	0.1	1.5	0.2	-	-	-	-
9	Tem (°C) (air & water)	27.54	27.49/31.20	29.82/32	27.61/32	33.00/30.05	32.30/31.59	37.50/29.95	37.60/30.43
10	pH	7.53	7.50	7.86	7.11	6.58	6.68	6.71	6.39
11	DO (mg/l)	7.14	7.26	7.11	76.01	1.29	1.22	3.45	3.65
12	EC (µs/m)	121.0	126.23	241.7	135.51	190.8	129.0	66.4	54.1
13	TDS (ppm)	75.02	76.85	154.74	121.62	113.26	74.33	39.44	31.83
14	Remark	Sampling and In-situ test	Sampling and In-situ test	Sampling and In-situ test	Sampling and In-situ test	Sampled on 28/6/2018 13:15	Sampled on 28/6/2018 13:30	` Sampled on 28/6/2018 12:35	Sampled on 28/6/2018 12:50

No.	Sample No./ Physical Parameter	SW 9	SW 10	SW 11	SW 12	SW 13	SW 14
1	Location	Up stream of Pyaw Bwe Stream	Downstream of Pyaw Bwe Stream	Up stream of Ya Kaing Gyaung Stream	Downstream of Ya Kaing Gyaung Stream	Near FSRU Option 2, Yangon River	Near FSRU Option 2, Yangon River
2	Date/Time	29.6.2018 12:00	29.6.2018 11:50	29.6.2018 11:30	29.6.2018 11:40	28.6.2018 12:41	3.5.2018 12:00
3	Weather	Sunny	Sunny	Sunny	Sunny	Cloudy	Cloudy
4	Transparency	Medium	Medium	Medium	Medium	Medium to high	Medium to high
5	Color	Light Yellow	Light Yellow	Light Yellow	Light Yellow		
6	Water Depth (m)	-	-	-	-	10.5	7.9
7	Depth (of sample taken) (m)	-	-	-	-	1	1
8	Flow rate/velocity (m/s)	-	-	-	-	0.5	1.2
9	Tem (°C) (air & water)	39.00/29.44	37.90/29.29	40.10/29.37	39.50/29.10	32/28	31/28.1
10	pH	6.41	6.54	6.25	6.38	7.58	7.12
11	DO (mg/l)	3.76	4.18	3.65	3.45	6.38	5.65
12	EC (µs/m)	122.1	125.0	221.7	230.4	125.6	135
13	TDS (ppm)	73.19	75.11	132.93	138.89	77.20	64
14	Remark	Sampled on 28/6/2018 11:15	Sampled on 28/6/2018 11:30	Sampled on 28/6/2018 10:25	Sampled on 28/6/2018 10:47	Sampling and Insitu test	Sampling and Insitu test

1.4 Ground Water Quality

1.4.1 Survey Item

Parameters for water quality survey are determined so as to cover the parameters of existing environmental standards of Myanmar.

Table 1.4-1 Survey Parameters for Underground Water Quality Survey

No.	Parameter	Unit	Myanmar Environmental Guideline Value
1	Temperature	^{o}C	-
2	pH	-	6 – 9
3	Dissolved Oxygen	mg/l	-
4	Electrical Conductivity (EC)	µS/cm	-
5	Total Dissolved Solid (TDS)	Ppm	-
6	Total Suspended Solids (TSS)	mg/l	50

Source: General Application; Wastewater, Storm water runoff, Effluent and sanitary discharges (Myanmar National Environmental Guidelines (2015, Dec 29th))

1.4.2 Survey Locations

The locations of water samples and surveys are shown in Table 1.4-2. The detail of each sampling points are described as below.

Table 1.4-2 Sampling and survey points of underground water quality survey

Category	Sampling Point	Coordinates	Description of Sampling Point
Ground water	GW 1	16°40'59.81"N 96° 8'41.28"E	At well, Pyaw Bwe Gyi Village and about 0.09 kilometers at south of pipeline
Ground water	GW 2	16°45'0.67"N 96° 8'30.66"E	At well, beside the Botaza road, Dala,Township and about 0.04 kilometers at south of pipe line.
Ground water	GW 3	16°46'48.11"N 96° 8'11.26"E	At well, Tha Khin Mya park, Alone and about 0.001 kilometers at northeast of gas turbine.

GW1

GW1 was measured and collected at domestic well which is not fared from Dala main road and located about 0.09 kilometers from the proposed pipe line , Dala Township, Yangon Region. Although the survey location is surrounded by rice mills and houses; the well is used for domestic purposed especially for washing and not for drinking purpose. GW1 was surveyed and collected from the well at depth about 6 m. The transparency of water is high and salinity is 14.4psu . The survey activities of GW1 are shown in Figure 1.4-1.


Figure 1.4-1 Groundwater quality survey at GW1

GW2

GW2 was located beside the Botaza Road, Dala Township, and Yangon Region. The survey location is surrounded by many residential houses. It is located near about 0.04 kilometers south of gas pipe line. This well is mainly used for domestic purposes and not for drinking. Water colur is colorless. GW2 was surveyed and collected from the well at depth about 15 m. The transpency is high and salinity 2.8psu. The survey activities of GW2 are shown in Figure 1.4-2.


Figure 1.4-2 Groundwater quality survey at GW2

GW3

GW3 was surveyed and collected from the well situated in Tha Khin Mya Park, Alone Township, and Yangon Region. GW 3 is located at the corner of Lower Kyeemyindaing Road and Aung Yadana Street. This well is mainly used for domestics for residents. GW3 was surveyed and collected from the well at depth about 13.7 m. Water colour of GW3 is colourless. The transparency of water is high and salinity is 0.2psu. The survey activities of GW3 are shown in Figure 1.4-3.

Figure 1.4-3 Groundwater quality survey at GW 3

1.4.3 Survey Period

The sampling and measuring of the ground water were conducted on 28th- 29th June, 2018.

1.4.4 Survey Method

Water samples were taken by Alpha horizontal water sampler for some wells and collected in plastic and sterilized glass sample containers. All sampling was in strict accordance with recognized standard procedures. The parameters as pH, temperature, dissolved oxygen (DO), electrical conductivity (EC), and total dissolved solid including the odor and color in visual analyzing were measured at each site concurrently with sample collection and. According to the Laboratory standard, some samples were preserved using the chemicals. All samples were kept in iced boxes and were transported to the laboratory within 24 hours.

Table 1.4-3 Field Equipment for Ground water quality survey

No.	Equipment	Manufacturer	Originate Country	Model/Serial No.
1	SMART TROLL@ MP _Multi parameter for water	In_Situ Inc.	USA	SN - 346054
2	Multi Parameters for water quality	HANNA	USA	H17609823 (Turbidity Sensor)
3	Alpha Bottle (Water Sampler)	Wildlife Supply Company®	Indonesia	Wildco P/N-1120-G45

The following table provides the test method for water quality.

Table 1.4-4 Analysis Method for Water Samples

No.	Item	Analysis Method
1	Temperature	SMART TROLL@MP _Multi parameter for water (pH sensor)
2	pH	SMART TROLL@MP _Multi parameter for water (DO sensor)
3	Dissolved Oxygen	SMART TROLL@MP _Multi parameter for water (EC/TDS sensor)
4	Electrical Conductivity (EC)	SMART TROLL@MP _Multi parameter for water (EC/TDS sensor)
5	Total Dissolved Solid (TDS)	SMART TROLL@MP _Multi parameter for water (EC/TDS sensor)

1.4.5 Survey Result

Laboratories

Water samples were sent to the STS Green Laboratory in Thailand. Water quality results are shown in following Table 1.4-5.

1.4-5 In-situ groundwater quality results

No.	Sample No./ Physical Parameter	GW-1	GW-2	GW-3
1	Location	Pyaw Bwe Gyi Village	Beside the Botaza Road , Dala	Tha Khin Mya Park
2	Date/Time	30.6.2018 14:21	29.6.2018 13:30	29.6.2018 14:53
3	Weather	Sunny	Slightly Rain	Cloudy
4	Transparency	High	High	High
5	Color	Colorless	Colorless	Colorless
6	Well Depth (m)	6	15	13.7
7	Depth (of sample taken) (m)	-	-	-
8	Flow rate/velocity (m/s)	-	-	-
9	Tem (°C) (air & water)	30.71/34.30	28.63	28.31/31.70
10	pH	6.93	6.19	5.24
11	DO (mg/l)	0.00	1.98	0.00
12	EC (µs/m)	26022.6	5459.5	368.0
13	TDS (ppm)	15249.64	3318.18	224.99
14	Turbidity (FNU)	-	-	-
15	Remark	Sampled on 28/6/2018 12:15	Sampled on 28/6/2018 13:50	Sampled on 27/6/2018 11:20

1.5 Sediment

1.5.1 Survey Item

Parameters for sediment survey are determined so as to cover the parameters of existing available environmental standards. Sediment sample was taken by the Grab Sampler.

1.5.2 Survey Locations

The locations of sediment samples and surveys are shown in Table 1.5-1. The detail of each sampling points are described as below.

Table 1.5-1 Sampling and survey points of sediment survey

Category	Sampling Point	Coordinates	Description of Sampling Point
Sediment	SE 1	16°46'16.68"N 96° 7'29.64"E	Near about 0.16 kilometers in the left bank of Yangon River (Upstream), Dala Township, Yangon Region
Sediment	SE 2	16°46'12.72"N 96° 7'41.88"E	Near about 0.22 kilometers in the left bank of Yangon River (Downstream), Dala Township, Yangon Region
Sediment	SE 3	16°45'56.19"N 96° 7'47.98"E	Near about 0.19 kilometers in the right bank of Twantae Canal, which located near the mouth of Twantae Canal, Dala Township, Yangon Region

Sediment	SE 4	16°39'40.66"N 96°13'34.87"E	Near about 0.05 kilometers in the left bank of Yangon River which located near That Kai Kwin Village, Dala Township, Yangon Region
Sediment	SE 5	16°39'21.60"N 96°14'21.48"E	Near about 0.09 kilometers in the left bank of Yangon River which located in Dala Township, Yangon Region
Sediment	SE 6	16°39'3.28"N 96°14'36.81"E	Near about 0.03 kilometers in the left bank of Yangon River which located near Chaung Oo Village, Dala Township, Yangon Region

SE1

SE1 was collected in the left of Yangon River (upstream) located about 0.16 kilometers of gas pipeline which will construct later, Dala Township, Yangon Region. It's located at south of project area and southwest of Asia Terminal port. The sample was collected from a boat using grab sampler set up. SE1 was collected from the river at depth about 4.5 meters. The survey activities of SE1 are shown in Figure 1.5-1.

Figure 1.5-1 Sediment survey at SE 1

SE 2

SE 2 was collected at downstream of Yangon River, about 0.22 kilometers of proposed gas pipeline, Dala Township, Yangon Region. It's situated south of project area and Asia Terminal port. Sediment was caught to a depth 4.1 meters. The survey activities of SE2 are shown in Figure 1.5-2.

Figure 1.5-2 Sediment survey at SE2

SE3

SE3 was collected at upstream of Twantae Canal, about 0.09 kilometers fared from canal bank and near about 0.17 kilometers of proposed gas pipeline Dala Township, Yangon Region. It's situated south of project area and Asia Terminal port. The sample will be taken from a boat using grab sampler set up. SE3 was collected from the river at depth about 6.5 meters. The survey activities of SE3 are shown in Figure 1.5-3.

Figure 1.5-3 Sediment survey at SE3

SE4

SE4 was collected near about 0.05 kilometers in the left bank of Yangon River (upstream) which located near That Kai Kwin Village, Dala Township, and Yangon Region. It lies approximately 1.01 kilometers north-west of FSRU Option 2 which will construct later. SE4 was collected from the river at depth about 4.5 meters. The survey activities of SE4 are shown in Figure 1.5-4.

Figure 1.5-4 Sediment survey at SE4

SE5

SE5 was collected near about 0.09 kilometers in the left bank of Yangon River (upstream) in Dala Township, Yangon Region. It is lied approximately 0.17 kilometers of proposed FSRU Option 2. SE5 was collected from the river at depth about 5.4 meters. The survey activities of SE5 are shown in Figure 1.5-5.

Figure 1.5-5 Sediment survey at SE5

SE6

SE6 was collected near about 0.03 kilometers in the left bank of Yangon River (downstream) which located near Chaung Oo Village, Dala Township, and Yangon Region. It is located approximately 0.43 kilometers of proposed FSRU Option 2. SE6 was collected from the river at depth about 4.4 meters. The survey activities of SE6 are shown in Figure 1.5-6.

Figure 1.5-6 Sediment survey at SE6

1.5.3 Survey Period

The sampling and measuring of the sediment samples were conducted on 27th-28th June, 2018.

1.5.4 Survey Method

Methodology

River sea bed sediments were collected by dive-based sampling method. Six stations were collected

in this survey. At each station, sediment was collected in an amber glass bottle. Each benthic sample was then slowly sieved through a mesh size of 2.0, 1and 0.5mm. Firstly, benthic samples were sieved by 2.0 and 1.0mm mesh size. And then, it is continuously being sieved by 0.5mm size. Finally, the benthic samples were collected into the sieve of 1.0 and 0.5mm size. The specimens and coarse sediment that were retained in the sieve were collected in a plastic container and preserved in 10% formalin solution.

AQ1 (hourly wind speed and direction results)				AQ2 (hourly wind speed and direction results)			
Date	**Time**	**Wind Direction(Degree)**	**Wind Speed (kph)**	**Date**	**Time**	**Wind Direction(Degree)**	**Wind Speed (kph)**
27.6.2018	09:00-10:00	156	1.51	27.6.2018	09:00-10:00	140.38	1.50
27.6.2018	10:00-11:00	170	1.65	27.6.2018	10:00-11:00	139.57	3.95
27.6.2018	11:00-12:00	175	1.53	27.6.2018	11:00-12:00	138.52	3.71
27.6.2018	12:00-13:00	161	1.48	27.6.2018	12:00-13:00	138.07	3.93
27.6.2018	13:00-14:00	159	1.72	27.6.2018	13:00-14:00	139.83	3.57
27.6.2018	14:00-15:00	162	1.85	27.6.2018	14:00-15:00	135.18	3.73
27.6.2018	15:00-16:00	186	2.29	27.6.2018	15:00-16:00	138.68	4.36
27.6.2018	16:00-17:00	208	2.41	27.6.2018	16:00-17:00	151.72	2.93
27.6.2018	17:00-18:00	200	2.17	27.6.2018	17:00-18:00	158.08	3.07
27.6.2018	18:00-19:00	205	1.79	27.6.2018	18:00-19:00	139.22	2.92
27.6.2018	19:00-20:00	238	2.44	27.6.2018	19:00-20:00	169.72	2.01
27.6.2018	20:00-21:00	201	1.04	27.6.2018	20:00-21:00	189.30	0.58
27.6.2018	21:00-22:00	217	2.08	27.6.2018	21:00-22:00	198.95	0.39
27.6.2018	22:00-23:00	232	0.44	27.6.2018	22:00-23:00	194.23	0.61
27.6.2018	23:00-00:00	203	1.19	27.6.2018	23:00-00:00	150.53	1.97
28.6.2018	00:00-01:00	80	1.43	28.6.2018	00:00-01:00	140.72	1.09
28.6.2018	01:00-02:00	101	2.57	28.6.2018	01:00-02:00	131.57	1.27
28.6.2018	02:00-03:00	137	1.84	28.6.2018	02:00-03:00	142.95	3.17
28.6.2018	03:00-04:00	118	0.89	28.6.2018	03:00-04:00	144.13	3.68
28.6.2018	04:00-05:00	92	0.84	28.6.2018	04:00-05:00	151.10	4.16
28.6.2018	05:00-06:00	133	0.87	28.6.2018	05:00-06:00	145.92	4.34
28.6.2018	06:00-07:00	129	0.60	28.6.2018	06:00-07:00	158.23	4.51
28.6.2018	07:00-08:00	162	1.99	28.6.2018	07:00-08:00	142.62	4.80
28.6.2018	08:00-09:00	127	3.53	28.6.2018	08:00-09:00	146.35	4.53
28.6.2018	09:00-10:00	239	4.83	28.6.2018	09:00-10:00	143.65	3.56
28.6.2018	10:00-11:00	201	4.48	28.6.2018	10:00-11:00	147.23	4.56
28.6.2018	11:00-12:00	198	5.52	28.6.2018	11:00-12:00	144.38	4.48
28.6.2018	12:00-13:00	203	5.43	28.6.2018	12:00-13:00	139.05	4.33
28.6.2018	13:00-14:00	138	5.73	28.6.2018	13:00-14:00	146.92	4.66
28.6.2018	14:00-15:00	155	3.32	28.6.2018	14:00-15:00	163.98	3.18
28.6.2018	15:00-16:00	224	2.94	28.6.2018	15:00-16:00	143.55	2.14
28.6.2018	16:00-17:00	242	0.73	28.6.2018	16:00-17:00	158.97	2.59
28.6.2018	17:00-18:00	178	0.93	28.6.2018	17:00-18:00	193.60	2.83
28.6.2018	18:00-19:00	249	1.83	28.6.2018	18:00-19:00	276.83	1.36
28.6.2018	19:00-20:00	277	0.56	28.6.2018	19:00-20:00	292.85	0.59
28.6.2018	20:00-21:00	268	0.79	28.6.2018	20:00-21:00	296.43	0.19
28.6.2018	21:00-22:00	243	0.43	28.6.2018	21:00-22:00	300.63	0.11
28.6.2018	22:00-23:00	218	1.18	28.6.2018	22:00-23:00	228.55	0.28
28.6.2018	23:00-00:00	214	3.00	28.6.2018	23:00-00:00	145.85	0.52
29.6.2018	00:00-01:00	219	2.82	29.6.2018	00:00-01:00	192.58	0.03
29.6.2018	01:00-02:00	216	1.86	29.6.2018	01:00-02:00	216.93	0.13
29.6.2018	02:00-03:00	200	0.58	29.6.2018	02:00-03:00	129.48	0.71
29.6.2018	03:00-04:00	216	0.61	29.6.2018	03:00-04:00	166.97	1.55
29.6.2018	04:00-05:00	222	0.47	29.6.2018	04:00-05:00	176.05	0.28
29.6.2018	05:00-06:00	235	0.78	29.6.2018	05:00-06:00	164.83	0.46
29.6.2018	06:00-07:00	281	0.05	29.6.2018	06:00-07:00	171.38	0.02
29.6.2018	07:00-08:00	273	0.94	29.6.2018	07:00-08:00	172.42	0.14
29.6.2018	08:00-09:00	250	2.71	29.6.2018	08:00-09:00	213.07	0.65
29.6.2018	09:00-10:00	161	4.81	29.6.2018	09:00-10:00	253.26	1.52
29.6.2018	10:00-11:00	125	4.80	29.6.2018	10:00-11:00	267.05	1.07
29.6.2018	11:00-12:00	160	4.45	29.6.2018	11:00-12:00	219.23	0.97
29.6.2018	12:00-13:00	167	3.69	29.6.2018	12:00-13:00	274.58	2.00
29.6.2018	13:00-14:00	222	3.91	29.6.2018	13:00-14:00	279.77	2.13
29.6.2018	14:00-15:00	220	4.17	29.6.2018	14:00-15:00	280.47	1.93
29.6.2018	15:00-16:00	225	2.80	29.6.2018	15:00-16:00	276.77	1.60
29.6.2018	16:00-17:00	231	0.60	29.6.2018	16:00-17:00	179.04	0.20
29.6.2018	17:00-18:00	226	3.65	29.6.2018	17:00-18:00	249.55	0.16
29.6.2018	18:00-19:00	209	0.13	29.6.2018	18:00-19:00	280.30	0.05
29.6.2018	19:00-20:00	192	0.66	29.6.2018	19:00-20:00	286.03	0.51
29.6.2018	20:00-21:00	196	2.44	29.6.2018	20:00-21:00	227.30	1.95
29.6.2018	21:00-22:00	222	0.54	29.6.2018	21:00-22:00	274.90	0.50

29.6.2018	22:00-23:00	235	0.07	29.6.2018	22:00-23:00	272.90	0.09
29.6.2018	23:00-00:00	272	0.05	29.6.2018	23:00-00:00	166.93	0.02
30.6.2018	00:00-01:00	197	0.00	30.6.2018	00:00-01:00	165.38	0.00
30.6.2018	01:00-02:00	74	0.19	30.6.2018	01:00-02:00	267.83	2.25
30.6.2018	02:00-03:00	73	0.58	30.6.2018	02:00-03:00	252.40	1.60
30.6.2018	03:00-04:00	113	0.04	30.6.2018	03:00-04:00	263.13	1.17
30.6.2018	04:00-05:00	175	0.00	30.6.2018	04:00-05:00	277.62	2.60
30.6.2018	05:00-06:00	175	0.00	30.6.2018	05:00-06:00	271.42	2.08
30.6.2018	06:00-07:00	148	0.00	30.6.2018	06:00-07:00	274.02	2.48
30.6.2018	07:00-08:00	66	0.00	30.6.2018	07:00-08:00	272.78	1.25
30.6.2018	08:00-09:00	186	1.87	30.6.2018	08:00-09:00	268.85	1.99

AQ3 (hourly wind speed and direction results)				**AQ4 (hourly wind speed and direction results)**			
Date	**Time**	**Wind Direction (Degree)**	**Wind Speed (kph)**	**Date**	**Time**	**Wind Direction (Degree)**	**Wind Speed (kph**
27.6.2018	10:00-11:00	215.30	0.24	6.7.2018	14:00-15:00	304.50	0.04
27.6.2018	11:00-12:00	224.98	0.03	6.7.2018	15:00-16:00	307.27	0.31
27.6.2018	12:00-13:00	217.69	0.54	6.7.2018	16:00-17:00	301.00	0.31
27.6.2018	13:00-14:00	291.47	1.77	6.7.2018	17:00-18:00	323.18	0.05
27.6.2018	14:00-15:00	279.20	2.39	6.7.2018	18:00-19:00	283.15	0.24
27.6.2018	15:00-16:00	263.80	3.59	6.7.2018	19:00-20:00	330.67	0.32
27.6.2018	16:00-17:00	276.02	3.96	6.7.2018	20:00-21:00	328.32	0.18
27.6.2018	17:00-18:00	241.20	5.49	6.7.2018	21:00-22:00	319.75	0.14
27.6.2018	18:00-19:00	244.90	5.31	6.7.2018	22:00-23:00	303.75	0.53
27.6.2018	19:00-20:00	245.77	3.59	6.7.2018	23:00-00:00	278.30	0.27
27.6.2018	20:00-21:00	268.85	2.96	7.7.2018	00:00-01:00	270.02	0.10
27.6.2018	21:00-22:00	261.56	1.02	7.7.2018	01:00-02:00	282.92	0.00
27.6.2018	22:00-23:00	250.42	0.03	7.7.2018	02:00-03:00	308.77	0.10
27.6.2018	23:00-00:00	254.53	0.01	7.7.2018	03:00-04:00	253.00	0.00
28.6.2018	00:00-01:00	260.70	0.00	7.7.2018	04:00-05:00	255.50	0.10
28.6.2018	01:00-02:00	258.30	0.00	7.7.2018	05:00-06:00	302.63	0.00
28.6.2018	02:00-03:00	258.00	0.00	7.7.2018	06:00-07:00	327.42	0.46
28.6.2018	03:00-04:00	258.00	0.00	7.7.2018	07:00-08:00	321.10	0.51
28.6.2018	04:00-05:00	252.78	0.01	7.7.2018	08:00-09:00	280.03	0.15
28.6.2018	05:00-06:00	230.88	0.01	7.7.2018	09:00-10:00	270.58	0.20
28.6.2018	06:00-07:00	223.67	0.19	7.7.2018	10:00-11:00	293.15	0.11
28.6.2018	07:00-08:00	264.72	0.06	7.7.2018	11:00-12:00	291.47	0.13
28.6.2018	08:00-09:00	234.88	0.04	7.7.2018	12:00-13:00	285.43	0.12
28.6.2018	09:00-10:00	228.87	0.00	7.7.2018	13:00-14:00	285.08	0.17
28.6.2018	10:00-11:00	191.57	0.08	7.7.2018	14:00-15:00	269.73	0.12
28.6.2018	11:00-12:00	248.82	1.10	7.7.2018	15:00-16:00	224.23	0.17
28.6.2018	12:00-13:00	255.40	2.34	7.7.2018	16:00-17:00	225.23	0.12
28.6.2018	13:00-14:00	270.48	2.72	7.7.2018	17:00-18:00	226.00	0.12
28.6.2018	14:00-15:00	289.55	3.72	7.7.2018	18:00-19:00	233.42	0.14
28.6.2018	15:00-16:00	284.88	2.42	7.7.2018	19:00-20:00	236.00	0.11
28.6.2018	16:00-17:00	249.82	6.82	7.7.2018	20:00-21:00	248.33	0.10
28.6.2018	17:00-18:00	250.27	7.41	7.7.2018	21:00-22:00	274.00	0.00
28.6.2018	18:00-19:00	282.05	3.95	7.7.2018	22:00-23:00	274.10	0.00
28.6.2018	19:00-20:00	265.75	0.96	7.7.2018	23:00-00:00	274.37	0.18
28.6.2018	20:00-21:00	238.52	0.19	8.7.2018	00:00-01:00	285.73	0.14
28.6.2018	21:00-22:00	252.70	1.45	8.7.2018	01:00-02:00	304.75	0.12
28.6.2018	22:00-23:00	248.37	0.27	8.7.2018	02:00-03:00	259.25	0.00
28.6.2018	23:00-00:00	226.23	1.65	8.7.2018	03:00-04:00	280.53	0.00
29.6.2018	00:00-01:00	248.73	2.64	8.7.2018	04:00-05:00	283.18	0.00
29.6.2018	01:00-02:00	234.20	1.20	8.7.2018	05:00-06:00	299.87	0.00
29.6.2018	02:00-03:00	195.42	0.22	8.7.2018	06:00-07:00	253.67	0.18
29.6.2018	03:00-04:00	208.68	0.26	8.7.2018	07:00-08:00	255.63	0.34
29.6.2018	04:00-05:00	256.10	0.08	8.7.2018	08:00-09:00	301.80	0.00
29.6.2018	05:00-06:00	257.98	0.11	8.7.2018	09:00-10:00	318.45	0.16
29.6.2018	06:00-07:00	277.10	0.30	8.7.2018	10:00-11:00	313.02	0.11
29.6.2018	07:00-08:00	277.28	1.53	8.7.2018	11:00-12:00	264.98	0.14
29.6.2018	08:00-09:00	238.52	3.72	8.7.2018	12:00-13:00	287.08	0.14

29.6.2018	09:00-10:00	247.73	4.85	8.7.2018	13:00-14:00	290.93	0.10
29.6.2018	10:00-11:00	240.60	4.93	8.7.2018	14:00-15:00	294.33	0.11
29.6.2018	11:00-12:00	235.47	5.54	8.7.2018	15:00-16:00	287.73	0.14
29.6.2018	12:00-13:00	221.73	4.25	8.7.2018	16:00-17:00	285.45	0.18
29.6.2018	13:00-14:00	246.48	5.83	8.7.2018	17:00-18:00	245.48	0.15
29.6.2018	14:00-15:00	247.47	4.90	8.7.2018	18:00-19:00	224.43	0.18
29.6.2018	15:00-16:00	238.40	3.39	8.7.2018	19:00-20:00	225.70	0.51
29.6.2018	16:00-17:00	102.36	0.31	8.7.2018	20:00-21:00	226.75	0.23
29.6.2018	17:00-18:00	218.36	1.20	8.7.2018	21:00-22:00	236.00	0.00
29.6.2018	18:00-19:00	240.27	0.39	8.7.2018	22:00-23:00	236.00	0.17
29.6.2018	19:00-20:00	195.00	1.28	8.7.2018	23:00-00:00	261.00	0.40
29.6.2018	20:00-21:00	184.97	0.56	9.7.2018	00:00-01:00	274.00	0.13
29.6.2018	21:00-22:00	63.70	0.00	9.7.2018	01:00-02:00	274.10	0.23
29.6.2018	22:00-23:00	60.20	0.00	9.7.2018	02:00-03:00	274.37	0.00
29.6.2018	23:00-00:00	30.47	0.00	9.7.2018	03:00-04:00	293.40	0.00
30.6.2018	00:00-01:00	271.33	1.83	9.7.2018	04:00-05:00	297.00	0.12
30.6.2018	01:00-02:00	261.90	0.46	9.7.2018	05:00-06:00	297.00	0.11
30.6.2018	02:00-03:00	260.68	0.58	9.7.2018	06:00-07:00	297.00	0.00
30.6.2018	03:00-04:00	251.75	0.29	9.7.2018	07:00-08:00	297.00	0.12
30.6.2018	04:00-05:00	246.93	0.02	9.7.2018	08:00-09:00	297.00	0.13
30.6.2018	05:00-06:00	263.03	0.01	9.7.2018	09:00-10:00	297.00	0.12
30.6.2018	06:00-07:00	263.13	0.00	9.7.2018	10:00-11:00	297.00	0.10
30.6.2018	07:00-08:00	253.27	0.00	9.7.2018	11:00-12:00	297.00	0.12
30.6.2018	08:00-09:00	244.48	0.44	9.7.2018	12:00-13:00	297.00	0.13
30.6.2018	09:00-10:00	286.92	2.06	9.7.2018	13:00-14:00	297.00	0.00

AQ5 (hourly wind speed and direction results)				**AQ6 (hourly wind speed and direction results)**			
Date	**Time**	**Wind Direction (Degree)**	**Wind speed (kph)**	**Date**	**Time**	**Wind Direction (Degree)**	**Wind speed (kph)**
30.6.2018	12:00-13:00	200.60	1.29	30.6.2018	12:00-13:00	211.95	1.70
30.6.2018	13:00-14:00	186.83	2.06	30.6.2018	13:00-14:00	209.05	2.75
30.6.2018	14:00-15:00	228.95	2.15	30.6.2018	14:00-15:00	206.28	4.70
30.6.2018	15:00-16:00	42.18	0.00	30.6.2018	15:00-16:00	275.33	2.25
30.6.2018	16:00-17:00	102.67	0.02	30.6.2018	16:00-17:00	283.10	0.16
30.6.2018	17:00-18:00	252.17	0.86	30.6.2018	17:00-18:00	292.35	0.13
30.6.2018	18:00-19:00	201.60	1.78	30.6.2018	18:00-19:00	290.15	0.02
30.6.2018	19:00-20:00	231.30	0.07	30.6.2018	19:00-20:00	213.10	0.04
30.6.2018	20:00-21:00	189.23	0.01	30.6.2018	20:00-21:00	252.22	0.00
30.6.2018	21:00-22:00	182.75	0.01	30.6.2018	21:00-22:00	308.33	0.00
30.6.2018	22:00-23:00	177.00	0.00	30.6.2018	22:00-23:00	220.67	0.02
30.6.2018	23:00-00:00	177.00	0.00	30.6.2018	23:00-00:00	217.00	0.00
1.7.2018	00:00-01:00	182.63	0.00	1.7.2018	00:00-01:00	215.17	0.00
1.7.2018	01:00-02:00	200.00	0.00	1.7.2018	01:00-02:00	213.00	0.00
1.7.2018	02:00-03:00	177.02	0.02	1.7.2018	02:00-03:00	213.00	0.04
1.7.2018	03:00-04:00	168.00	0.00	1.7.2018	03:00-04:00	213.00	0.02
1.7.2018	04:00-05:00	168.00	0.00	1.7.2018	04:00-05:00	213.00	0.00
1.7.2018	05:00-06:00	167.90	0.00	1.7.2018	05:00-06:00	213.00	0.00
1.7.2018	06:00-07:00	164.98	0.09	1.7.2018	06:00-07:00	199.37	0.09
1.7.2018	07:00-08:00	175.22	0.75	1.7.2018	07:00-08:00	183.58	0.26
1.7.2018	08:00-09:00	189.87	0.87	1.7.2018	08:00-09:00	196.93	0.41
1.7.2018	09:00-10:00	180.27	1.86	1.7.2018	09:00-10:00	248.08	0.18
1.7.2018	10:00-11:00	189.47	2.40	1.7.2018	10:00-11:00	281.55	0.64
1.7.2018	11:00-12:00	204.90	3.12	1.7.2018	11:00-12:00	227.55	0.56
1.7.2018	12:00-13:00	156.57	0.80	1.7.2018	12:00-13:00	209.80	9.46
1.7.2018	13:00-14:00	111.00	0.00	1.7.2018	13:00-14:00	211.93	4.84
1.7.2018	14:00-15:00	111.00	0.00	1.7.2018	14:00-15:00	279.35	2.54
1.7.2018	15:00-16:00	111.00	0.00	1.7.2018	15:00-16:00	210.80	0.16
1.7.2018	16:00-17:00	129.83	0.86	1.7.2018	16:00-17:00	236.48	0.22
1.7.2018	17:00-18:00	211.95	3.09	1.7.2018	17:00-18:00	211.55	0.87
1.7.2018	18:00-19:00	272.88	0.00	1.7.2018	18:00-19:00	193.65	0.02
1.7.2018	19:00-20:00	212.90	0.00	1.7.2018	19:00-20:00	196.74	0.22

1.7.2018	20:00-21:00	216.97	0.00	1.7.2018	20:00-21:00	215.64	0.04
1.7.2018	21:00-22:00	203.65	0.00	1.7.2018	21:00-22:00	223.00	0.00
1.7.2018	22:00-23:00	178.00	0.00	1.7.2018	22:00-23:00	234.95	0.00
1.7.2018	23:00-00:00	178.00	0.00	1.7.2018	23:00-00:00	173.35	0.00
2.7.2018	00:00-01:00	178.00	0.00	2.7.2018	00:00-01:00	172.00	0.01
2.7.2018	01:00-02:00	175.65	0.00	2.7.2018	01:00-02:00	172.00	0.00
2.7.2018	02:00-03:00	166.00	0.00	2.7.2018	02:00-03:00	172.00	0.00
2.7.2018	03:00-04:00	166.00	0.00	2.7.2018	03:00-04:00	172.00	0.00
2.7.2018	04:00-05:00	165.38	0.10	2.7.2018	04:00-05:00	173.17	0.00
2.7.2018	05:00-06:00	165.77	0.03	2.7.2018	05:00-06:00	189.45	1.26
2.7.2018	06:00-07:00	169.00	0.00	2.7.2018	06:00-07:00	203.92	2.09
2.7.2018	07:00-08:00	171.58	0.09	2.7.2018	07:00-08:00	214.00	0.60
2.7.2018	08:00-09:00	177.68	0.40	2.7.2018	08:00-09:00	246.87	0.83
2.7.2018	09:00-10:00	177.48	0.62	2.7.2018	09:00-10:00	217.98	1.57
2.7.2018	10:00-11:00	174.23	1.19	2.7.2018	10:00-11:00	208.08	3.80
2.7.2018	11:00-12:00	196.87	1.01	2.7.2018	11:00-12:00	213.65	4.54
2.7.2018	12:00-13:00	227.68	1.56	2.7.2018	12:00-13:00	201.58	0.75
2.7.2018	13:00-14:00	270.92	2.53	2.7.2018	13:00-14:00	220.07	0.32
2.7.2018	14:00-15:00	189.50	4.29	2.7.2018	14:00-15:00	202.43	1.20
2.7.2018	15:00-16:00	179.58	5.48	2.7.2018	15:00-16:00	211.60	1.23
2.7.2018	16:00-17:00	202.70	3.06	2.7.2018	16:00-17:00	224.28	0.49
2.7.2018	17:00-18:00	197.80	0.62	2.7.2018	17:00-18:00	222.20	0.10
2.7.2018	18:00-19:00	167.52	0.10	2.7.2018	18:00-19:00	225.00	0.00
2.7.2018	19:00-20:00	179.88	0.48	2.7.2018	19:00-20:00	225.00	0.00
2.7.2018	20:00-21:00	185.95	0.42	2.7.2018	20:00-21:00	225.00	0.00
2.7.2018	21:00-22:00	178.75	0.19	2.7.2018	21:00-22:00	225.00	0.00
2.7.2018	22:00-23:00	168.28	0.16	2.7.2018	22:00-23:00	224.80	0.00
2.7.2018	23:00-00:00	151.27	0.00	2.7.2018	23:00-00:00	224.00	0.00
3.7.2018	00:00-01:00	151.12	0.00	3.7.2018	00:00-01:00	224.00	0.00
3.7.2018	01:00-02:00	164.68	0.00	3.7.2018	01:00-02:00	224.00	0.00
3.7.2018	02:00-03:00	172.00	0.00	3.7.2018	02:00-03:00	224.00	0.00
3.7.2018	03:00-04:00	172.00	0.00	3.7.2018	03:00-04:00	224.00	0.00
3.7.2018	04:00-05:00	172.00	0.00	3.7.2018	04:00-05:00	222.12	0.03
3.7.2018	05:00-06:00	172.00	0.00	3.7.2018	05:00-06:00	224.42	0.18
3.7.2018	06:00-07:00	159.45	0.00	3.7.2018	06:00-07:00	224.50	0.54
3.7.2018	07:00-08:00	157.33	0.51	3.7.2018	07:00-08:00	207.82	0.29
3.7.2018	08:00-09:00	179.07	2.17	3.7.2018	08:00-09:00	200.20	0.33
3.7.2018	09:00-10:00	191.25	3.32	3.7.2018	09:00-10:00	209.12	0.92
3.7.2018	10:00-11:00	202.57	3.96	3.7.2018	10:00-11:00	245.82	0.01
3.7.2018	11:00-12:00	111.00	0.00	3.7.2018	11:00-12:00	167.96	1.43

AQ7 (hourly wind speed and direction results)				**AQ8 (hourly wind speed and direction results)**			
Date	**Time**	**Wind Direction (Degree)**	**Wind speed (kph)**	**Date**	**Time**	**Wind Direction (Degree)**	**Wind speed (kph)**
30.6.2018	13:00-14:00	227.32	0.840	3.7.2018	13:00-14:00	216.58	1.08
30.6.2018	14:00-15:00	264.28	0.210	3.7.2018	14:00-15:00	248.80	2.69
30.6.2018	15:00-16:00	33.00	1.233	3.7.2018	15:00-16:00	228.90	2.66
30.6.2018	16:00-17:00	109.72	1.897	3.7.2018	16:00-17:00	239.03	2.38
30.6.2018	17:00-18:00	296.33	0.295	3.7.2018	17:00-18:00	231.92	1.77
30.6.2018	18:00-19:00	317.90	0.005	3.7.2018	18:00-19:00	228.20	3.17
30.6.2018	19:00-20:00	305.75	0.103	3.7.2018	19:00-20:00	254.67	3.49
30.6.2018	20:00-21:00	297.22	0.652	3.7.2018	20:00-21:00	268.22	3.50
30.6.2018	21:00-22:00	301.32	0.108	3.7.2018	21:00-22:00	281.32	1.56
30.6.2018	22:00-23:00	302.10	0.178	3.7.2018	22:00-23:00	274.65	2.93
30.6.2018	23:00-00:00	307.00	0.000	3.7.2018	23:00-00:00	284.05	0.74
1.7.2018	00:00-01:00	304.82	0.452	4.7.2018	00:00-01:00	269.42	0.31

1.7.2018	01:00-02:00	312.00	0.000	4.7.2018	01:00-02:00	257.62	0.98
1.7.2018	02:00-03:00	176.40	0.000	4.7.2018	02:00-03:00	235.38	1.49
1.7.2018	03:00-04:00	350.00	0.000	4.7.2018	03:00-04:00	230.90	0.32
1.7.2018	04:00-05:00	350.08	0.000	4.7.2018	04:00-05:00	208.80	0.07
1.7.2018	05:00-06:00	211.40	0.445	4.7.2018	05:00-06:00	204.10	0.76
1.7.2018	06:00-07:00	98.85	0.348	4.7.2018	06:00-07:00	212.72	0.32
1.7.2018	07:00-08:00	197.72	0.110	4.7.2018	07:00-08:00	214.72	0.01
1.7.2018	08:00-09:00	241.47	0.128	4.7.2018	08:00-09:00	216.97	0.19
1.7.2018	09:00-10:00	222.37	0.148	4.7.2018	09:00-10:00	230.43	0.58
1.7.2018	10:00-11:00	210.45	0.152	4.7.2018	10:00-11:00	215.83	0.04
1.7.2018	11:00-12:00	267.15	0.113	4.7.2018	11:00-12:00	215.23	1.87
1.7.2018	12:00-13:00	227.24	0.124	4.7.2018	12:00-13:00	216.67	3.43
1.7.2018	13:00-14:00	0.00	0.000	4.7.2018	13:00-14:00	253.35	0.14
1.7.2018	14:00-15:00	247.54	0.210	4.7.2018	14:00-15:00	212.90	2.10
1.7.2018	15:00-16:00	261.28	0.153	4.7.2018	15:00-16:00	244.93	1.02
1.7.2018	16:00-17:00	239.48	0.157	4.7.2018	16:00-17:00	218.68	2.66
1.7.2018	17:00-18:00	270.47	0.242	4.7.2018	17:00-18:00	244.75	4.63
1.7.2018	18:00-19:00	189.85	0.410	4.7.2018	18:00-19:00	264.80	3.54
1.7.2018	19:00-20:00	222.58	1.227	4.7.2018	19:00-20:00	223.70	3.01
1.7.2018	20:00-21:00	290.00	0.762	4.7.2018	20:00-21:00	211.03	1.20
1.7.2018	21:00-22:00	290.00	0.055	4.7.2018	21:00-22:00	270.30	0.63
1.7.2018	22:00-23:00	290.00	0.253	4.7.2018	22:00-23:00	244.95	0.62
1.7.2018	23:00-00:00	290.00	0.655	4.7.2018	23:00-00:00	239.28	0.10
2.7.2018	00:00-01:00	290.00	0.370	5.7.2018	00:00-01:00	236.08	0.09
2.7.2018	01:00-02:00	202.78	0.348	5.7.2018	01:00-02:00	223.75	0.02
2.7.2018	02:00-03:00	177.00	0.525	5.7.2018	02:00-03:00	217.28	0.00
2.7.2018	03:00-04:00	177.00	1.353	5.7.2018	03:00-04:00	214.90	0.09
2.7.2018	04:00-05:00	259.22	0.788	5.7.2018	04:00-05:00	215.15	0.18
2.7.2018	05:00-06:00	214.88	0.612	5.7.2018	05:00-06:00	211.53	0.00
2.7.2018	06:00-07:00	215.00	0.133	5.7.2018	06:00-07:00	213.32	0.76
2.7.2018	07:00-08:00	208.07	0.508	5.7.2018	07:00-08:00	216.98	0.48
2.7.2018	08:00-09:00	209.18	0.683	5.7.2018	08:00-09:00	223.10	0.57
2.7.2018	09:00-10:00	185.58	0.333	5.7.2018	09:00-10:00	224.80	0.17
2.7.2018	10:00-11:00	227.33	0.267	5.7.2018	10:00-11:00	288.23	0.07
2.7.2018	11:00-12:00	224.05	0.128	5.7.2018	11:00-12:00	267.30	0.07
2.7.2018	12:00-13:00	307.02	0.158	5.7.2018	12:00-13:00	252.53	0.37
2.7.2018	13:00-14:00	300.70	1.998	5.7.2018	13:00-14:00	223.82	0.27
2.7.2018	14:00-15:00	221.28	0.913	5.7.2018	14:00-15:00	221.83	0.14
2.7.2018	15:00-16:00	211.98	2.092	5.7.2018	15:00-16:00	208.55	0.12
2.7.2018	16:00-17:00	313.90	3.415	5.7.2018	16:00-17:00	210.83	0.11
2.7.2018	17:00-18:00	303.82	2.673	5.7.2018	17:00-18:00	213.67	0.26
2.7.2018	18:00-19:00	266.13	2.830	5.7.2018	18:00-19:00	216.88	0.96
2.7.2018	19:00-20:00	282.88	4.122	5.7.2018	19:00-20:00	210.00	0.99
2.7.2018	20:00-21:00	303.53	4.947	5.7.2018	20:00-21:00	212.00	0.49

2.7.2018	21:00-22:00	302.15	5.738	5.7.2018	21:00-22:00	207.12	0.08
2.7.2018	22:00-23:00	325.67	3.495	5.7.2018	22:00-23:00	219.45	0.51
2.7.2018	23:00-00:00	321.42	1.527	5.7.2018	23:00-00:00	218.00	0.04
3.7.2018	00:00-01:00	321.00	1.727	6.7.2018	00:00-01:00	217.33	0.03
3.7.2018	01:00-02:00	240.05	1.702	6.7.2018	01:00-02:00	217.00	0.03
3.7.2018	02:00-03:00	196.00	0.900	6.7.2018	02:00-03:00	216.42	0.01
3.7.2018	03:00-04:00	196.00	0.780	6.7.2018	03:00-04:00	222.53	0.00
3.7.2018	04:00-05:00	196.00	1.487	6.7.2018	04:00-05:00	217.28	0.01
3.7.2018	05:00-06:00	196.00	0.127	6.7.2018	05:00-06:00	217.07	0.01
3.7.2018	06:00-07:00	195.30	0.228	6.7.2018	06:00-07:00	216.95	1.39
3.7.2018	07:00-08:00	159.92	1.422	6.7.2018	07:00-08:00	217.10	0.44
3.7.2018	08:00-09:00	151.05	4.700	6.7.2018	08:00-09:00	203.62	0.55
3.7.2018	09:00-10:00	250.47	2.907	6.7.2018	09:00-10:00	200.68	0.28
3.7.2018	10:00-11:00	301.03	3.263	6.7.2018	10:00-11:00	217.85	0.18
3.7.2018	11:00-12:00	297.27	3.582	6.7.2018	11:00-12:00	215.30	2.11
3.7.2018	12:00-13:00	216.31	1.323	6.7.2018	12:00-13:00	237.45	2.64

AQ9 (hourly wind speed and direction results)				**AQ10 (hourly wind speed and direction results)**			
Date	**Time**	**Wind Direction (Degree)**	**Wind speed (kph)**	**Date**	**Time**	**Wind Direction (Degree)**	**Wind speed (kph)**
3.7.2018	13:00-14:00	210.13	2.16	3.7.2018	13:00-14:00	233.07	8.88
3.7.2018	14:00-15:00	212.60	0.02	3.7.2018	14:00-15:00	225.41	10.19
3.7.2018	15:00-16:00	207.23	2.17	3.7.2018	15:00-16:00	229.44	8.31
3.7.2018	16:00-17:00	235.88	2.40	3.7.2018	16:00-17:00	229.85	7.48
3.7.2018	17:00-18:00	220.15	0.02	3.7.2018	17:00-18:00	233.12	8.57
3.7.2018	18:00-19:00	196.00	0.00	3.7.2018	18:00-19:00	236.39	6.53
3.7.2018	19:00-20:00	226.02	1.41	3.7.2018	19:00-20:00	246.32	0.53
3.7.2018	20:00-21:00	237.22	0.17	3.7.2018	20:00-21:00	246.20	0.18
3.7.2018	21:00-22:00	238.00	0.00	3.7.2018	21:00-22:00	233.98	0.00
3.7.2018	22:00-23:00	238.00	0.00	3.7.2018	22:00-23:00	234.00	0.00
3.7.2018	23:00-00:00	228.68	0.04	3.7.2018	23:00-00:00	211.98	0.00
4.7.2018	00:00-01:00	238.80	0.00	4.7.2018	00:00-01:00	188.88	0.00
4.7.2018	01:00-02:00	231.52	0.00	4.7.2018	01:00-02:00	173.81	0.06
4.7.2018	02:00-03:00	230.00	0.00	4.7.2018	02:00-03:00	193.24	0.17
4.7.2018	03:00-04:00	230.00	0.00	4.7.2018	03:00-04:00	211.03	0.38
4.7.2018	04:00-05:00	228.30	0.01	4.7.2018	04:00-05:00	183.56	0.00
4.7.2018	05:00-06:00	221.00	0.00	4.7.2018	05:00-06:00	220.97	0.14
4.7.2018	06:00-07:00	245.12	0.00	4.7.2018	06:00-07:00	224.61	0.94
4.7.2018	07:00-08:00	221.77	0.16	4.7.2018	07:00-08:00	230.73	3.05
4.7.2018	08:00-09:00	247.90	1.21	4.7.2018	08:00-09:00	232.46	6.74
4.7.2018	09:00-10:00	232.65	1.09	4.7.2018	09:00-10:00	229.25	7.09
4.7.2018	10:00-11:00	243.58	0.02	4.7.2018	10:00-11:00	224.56	6.06
4.7.2018	11:00-12:00	241.33	0.00	4.7.2018	11:00-12:00	217.86	7.34

4.7.2018	12:00-13:00	242.68	0.00	4.7.2018	12:00-13:00	268.47	3.19
4.7.2018	13:00-14:00	244.00	0.00	4.7.2018	13:00-14:00	244.51	3.65
4.7.2018	14:00-15:00	240.95	0.00	4.7.2018	14:00-15:00	234.42	9.27
4.7.2018	15:00-16:00	227.30	0.00	4.7.2018	15:00-16:00	233.61	7.84
4.7.2018	16:00-17:00	221.00	0.00	4.7.2018	16:00-17:00	224.10	9.67
4.7.2018	17:00-18:00	221.00	0.00	4.7.2018	17:00-18:00	257.93	3.63
4.7.2018	18:00-19:00	221.00	0.00	4.7.2018	18:00-19:00	236.20	1.39
4.7.2018	19:00-20:00	221.00	0.00	4.7.2018	19:00-20:00	224.92	0.87
4.7.2018	20:00-21:00	221.00	0.00	4.7.2018	20:00-21:00	224.29	0.29
4.7.2018	21:00-22:00	221.00	0.00	4.7.2018	21:00-22:00	284.63	0.58
4.7.2018	22:00-23:00	221.00	0.00	4.7.2018	22:00-23:00	219.00	0.03
4.7.2018	23:00-00:00	221.00	0.00	4.7.2018	23:00-00:00	194.85	0.01
5.7.2018	00:00-01:00	180.78	0.00	5.7.2018	00:00-01:00	192.32	0.69
5.7.2018	01:00-02:00	131.00	0.00	5.7.2018	01:00-02:00	233.22	4.03
5.7.2018	02:00-03:00	133.30	0.00	5.7.2018	02:00-03:00	227.17	1.25
5.7.2018	03:00-04:00	135.00	0.00	5.7.2018	03:00-04:00	216.83	0.40
5.7.2018	04:00-05:00	135.00	0.00	5.7.2018	04:00-05:00	213.44	0.73
5.7.2018	05:00-06:00	165.60	0.08	5.7.2018	05:00-06:00	230.44	1.27
5.7.2018	06:00-07:00	219.47	0.00	5.7.2018	06:00-07:00	227.19	1.30
5.7.2018	07:00-08:00	206.60	0.00	5.7.2018	07:00-08:00	232.54	1.68
5.7.2018	08:00-09:00	132.65	0.05	5.7.2018	08:00-09:00	231.71	3.01
5.7.2018	09:00-10:00	153.08	0.00	5.7.2018	09:00-10:00	236.78	7.11
5.7.2018	10:00-11:00	209.93	0.67	5.7.2018	10:00-11:00	284.63	1.17
5.7.2018	11:00-12:00	239.72	0.98	5.7.2018	11:00-12:00	239.64	0.21
5.7.2018	12:00-13:00	233.80	0.23	5.7.2018	12:00-13:00	239.32	0.40
5.7.2018	13:00-14:00	182.95	2.23	5.7.2018	13:00-14:00	211.17	0.00
5.7.2018	14:00-15:00	139.73	2.65	5.7.2018	14:00-15:00	192.51	0.20
5.7.2018	15:00-16:00	142.33	2.01	5.7.2018	15:00-16:00	205.24	0.10
5.7.2018	16:00-17:00	134.08	1.97	5.7.2018	16:00-17:00	189.31	2.47
5.7.2018	17:00-18:00	144.35	2.35	5.7.2018	17:00-18:00	208.32	2.35
5.7.2018	18:00-19:00	139.73	2.05	5.7.2018	18:00-19:00	227.85	2.80
5.7.2018	19:00-20:00	156.50	1.86	5.7.2018	19:00-20:00	230.07	1.02
5.7.2018	20:00-21:00	160.90	0.50	5.7.2018	20:00-21:00	225.00	0.11
5.7.2018	21:00-22:00	165.48	0.60	5.7.2018	21:00-22:00	193.19	0.18
5.7.2018	22:00-23:00	133.27	0.40	5.7.2018	22:00-23:00	185.05	0.12
5.7.2018	23:00-00:00	113.65	0.22	5.7.2018	23:00-00:00	204.00	0.06
6.7.2018	00:00-01:00	159.23	0.06	6.7.2018	00:00-01:00	207.15	0.02
6.7.2018	01:00-02:00	167.25	1.32	6.7.2018	01:00-02:00	206.44	0.00
6.7.2018	02:00-03:00	174.12	2.69	6.7.2018	02:00-03:00	168.53	0.04
6.7.2018	03:00-04:00	192.33	2.67	6.7.2018	03:00-04:00	198.15	1.23
6.7.2018	04:00-05:00	221.45	2.27	6.7.2018	04:00-05:00	216.54	1.17
6.7.2018	05:00-06:00	178.12	1.85	6.7.2018	05:00-06:00	218.85	1.46
6.7.2018	06:00-07:00	176.68	3.00	6.7.2018	06:00-07:00	216.14	5.15
6.7.2018	07:00-08:00	48.32	0.10	6.7.2018	07:00-08:00	200.25	6.32

6.7.2018	08:00-09:00	150.52	2.02	6.7.2018	08:00-09:00	186.24	1.48
6.7.2018	09:00-10:00	247.70	3.17	6.7.2018	09:00-10:00	183.76	3.86
6.7.2018	10:00-11:00	196.47	2.69	6.7.2018	10:00-11:00	179.07	1.64
6.7.2018	11:00-12:00	207.98	0.52	6.7.2018	11:00-12:00	215.66	2.78
6.7.2018	12:00-13:00	249.48	0.17	6.7.2018	12:00-13:00	224.61	5.82

Hourly air quality results

AQ1 (first day)

Date	**Time**	**CO**	**NO2**	**NO**	**PM2.5**	**PM10**	**RH**	**SO2**	**TmpC**
D.M.Y	**H.M.S**	**µg/m3**	**µg/m3**	**µg/m3**	**µg/m3**	**µg/m3**	**%**	**µg/m3**	**Deg. C**
27.6.2018	09:00-10:00	129.29	370.16	0.00	2.46	16.59	76.46	2.55	25.83
27.6.2018	10:00-11:00	97.45	336.80	0.00	5.57	17.88	82.80	2.07	25.57
27.6.2018	11:00-12:00	113.31	178.70	0.00	3.00	8.05	74.97	7.09	27.32
27.6.2018	12:00-13:00	83.31	100.34	0.00	3.52	5.75	74.30	8.75	27.88
27.6.2018	13:00-14:00	96.04	82.72	0.00	5.38	15.07	80.25	4.92	26.92
27.6.2018	14:00-15:00	108.71	56.25	0.00	6.50	20.02	81.07	8.56	26.70
27.6.2018	15:00-16:00	113.06	45.59	0.03	4.67	9.45	79.13	14.11	27.23
27.6.2018	16:00-17:00	82.32	31.76	0.05	5.70	10.80	74.17	17.21	28.15
27.6.2018	17:00-18:00	115.94	50.36	0.00	6.82	17.95	73.33	36.66	28.18
27.6.2018	18:00-19:00	137.99	65.72	0.00	7.98	22.35	76.95	16.90	26.85
27.6.2018	19:00-20:00	125.01	39.45	0.00	7.82	23.50	78.28	18.78	26.12
27.6.2018	20:00-21:00	107.80	58.17	0.00	7.20	11.83	81.05	13.01	24.85
27.6.2018	21:00-22:00	83.54	46.34	0.00	6.12	6.80	82.25	10.44	24.67
27.6.2018	22:00-23:00	88.41	79.02	0.00	5.58	9.82	86.38	3.42	24.00
27.6.2018	23:00-00:00	96.89	86.39	0.01	6.03	12.10	95.08	2.44	23.23
28.6.2018	00:00-01:00	86.30	78.92	0.00	6.54	8.63	97.00	2.42	23.00
28.6.2018	01:00-02:00	88.09	85.54	0.01	6.32	18.43	95.85	3.17	22.85
28.6.2018	02:00-03:00	75.74	83.78	0.00	6.18	17.87	92.13	3.14	22.83
28.6.2018	03:00-04:00	93.14	84.32	0.03	4.98	16.47	95.50	2.76	22.50
28.6.2018	04:00-05:00	122.69	105.51	0.03	5.42	34.20	96.22	1.88	22.92
28.6.2018	05:00-06:00	93.44	72.75	0.01	5.53	13.85	99.23	3.45	22.83
28.6.2018	06:00-07:00	144.67	168.73	0.06	4.20	9.75	99.58	2.35	23.00
28.6.2018	07:00-08:00	171.95	169.86	0.08	2.90	13.95	94.38	11.54	24.55
28.6.2018	08:00-09:00	132.44	205.82	0.10	2.65	4.97	75.23	3.29	28.22

AQ1 (second day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
28.6.2018	09:00-10:00	129.36	224.83	0.23	4.78	10.77	59.80	0.09	32.07
28.6.2018	10:00-11:00	113.86	101.81	0.21	5.20	19.32	62.70	1.54	31.40
28.6.2018	11:00-12:00	42.46	51.80	0.01	5.23	15.43	60.12	3.29	31.85
28.6.2018	12:00-13:00	58.71	3.76	0.04	4.50	2.43	56.93	9.00	33.40

28.6.2018	13:00-14:00	55.56	7.09	0.00	8.23	9.10	57.80	1.85	32.92
28.6.2018	14:00-15:00	69.71	41.99	0.00	43.00	32.87	67.95	0.44	28.90
28.6.2018	15:00-16:00	85.94	53.68	0.00	70.98	40.28	73.00	3.36	27.27
28.6.2018	16:00-17:00	100.48	68.92	0.00	35.48	16.80	73.00	1.25	27.23
28.6.2018	17:00-18:00	125.16	66.38	0.00	2.27	5.47	72.32	2.32	27.23
28.6.2018	18:00-19:00	194.65	38.35	0.00	3.62	3.10	73.67	2.35	27.38
28.6.2018	19:00-20:00	130.30	14.36	0.00	5.32	10.38	76.13	1.88	27.00
28.6.2018	20:00-21:00	126.34	15.71	0.00	5.73	12.50	78.35	4.55	26.47
28.6.2018	21:00-22:00	157.62	44.84	0.00	5.68	9.67	79.43	0.34	26.07
28.6.2018	22:00-23:00	225.45	41.33	0.00	5.73	16.28	79.48	0.97	26.08
28.6.2018	23:00-00:00	78.68	50.11	0.00	6.17	10.32	79.23	0.94	26.03
29.6.2018	00:00-01:00	75.94	47.79	0.00	5.85	8.60	78.30	0.47	26.00
29.6.2018	01:00-02:00	83.99	37.25	0.00	5.47	7.45	78.35	1.41	26.00
29.6.2018	02:00-03:00	97.06	40.76	0.00	4.73	3.13	81.62	1.66	25.73
29.6.2018	03:00-04:00	110.40	44.71	0.00	5.30	9.88	82.48	1.22	25.75
29.6.2018	04:00-05:00	84.63	63.40	0.00	5.38	3.85	82.67	0.50	25.80
29.6.2018	05:00-06:00	112.92	75.32	0.00	4.98	8.83	83.55	1.32	25.82
29.6.2018	06:00-07:00	119.70	43.62	0.03	3.15	3.47	74.87	0.75	28.22
29.6.2018	07:00-08:00	107.12	27.19	0.15	5.00	11.97	64.83	0.72	30.85
29.6.2018	08:00-09:00	77.97	8.51	0.03	3.70	4.78	60.90	1.74	31.63

AQ1 (third day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
29.6.2018	09:00-10:00	0.00	3.76	0.00	3.08	13.92	55.85	12.16	33.08
29.6.2018	10:00-11:00	98.64	5.52	0.00	3.70	1.93	55.23	4.01	33.97
29.6.2018	11:00-12:00	74.16	3.76	0.00	3.42	1.37	52.12	4.11	35.58
29.6.2018	12:00-13:00	102.40	3.76	0.00	3.27	1.37	50.13	2.88	36.62
29.6.2018	13:00-14:00	105.00	3.76	0.00	4.53	7.40	51.65	5.52	35.48
29.6.2018	14:00-15:00	40.39	3.76	0.00	4.35	4.73	50.57	11.88	35.63
29.6.2018	15:00-16:00	12.15	10.25	0.00	7.88	31.25	73.28	9.56	28.40
29.6.2018	16:00-17:00	0.00	4.77	0.00	7.33	16.07	91.33	2.16	24.62
29.6.2018	17:00-18:00	14.13	4.01	0.00	6.20	2.83	89.18	4.52	25.00
29.6.2018	18:00-19:00	0.00	8.59	0.00	5.87	2.57	93.12	12.32	24.00
29.6.2018	19:00-20:00	22.87	13.48	0.05	4.10	10.88	92.72	12.07	24.77
29.6.2018	20:00-21:00	30.78	27.84	0.02	7.28	24.62	94.57	8.91	23.22
29.6.2018	21:00-22:00	33.28	15.02	0.00	6.70	7.20	94.35	8.47	23.28
29.6.2018	22:00-23:00	24.93	20.63	0.05	4.90	11.50	93.23	6.49	24.00
29.6.2018	23:00-00:00	46.31	18.37	0.01	7.93	15.22	93.63	2.45	23.60
30.6.2018	00:00-01:00	34.53	71.93	0.01	11.03	17.27	93.55	1.22	24.10
30.6.2018	01:00-02:00	56.54	91.72	0.00	59.27	28.12	91.08	1.98	25.00
30.6.2018	02:00-03:00	20.04	43.12	0.00	62.25	29.22	90.67	18.41	25.00
30.6.2018	03:00-04:00	25.62	4.86	0.00	63.83	26.75	90.33	7.24	25.13
30.6.2018	04:00-05:00	20.00	71.93	0.00	67.65	27.25	88.23	4.39	26.00

30.6.2018	05:00-06:00	19.93	57.10	0.00	67.57	28.23	86.03	5.86	26.70
30.6.2018	06:00-07:00	18.28	52.15	0.00	75.15	38.85	84.47	4.26	27.00
30.6.2018	07:00-08:00	51.07	85.16	0.04	66.75	28.88	79.52	4.73	27.65
30.6.2018	08:00-09:00	44.14	22.39	0.07	44.63	21.33	71.60	8.65	28.85

AQ2 (first day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
27.6.2018	09:00-10:00	63.34	36.18	5.80	43.44	10.13	77.56	3.29	25.00
27.6.2018	10:00-11:00	43.33	38.33	1.81	3.78	14.87	87.00	1.38	24.78
27.6.2018	11:00-12:00	18.80	7.48	5.35	6.50	1.00	83.17	0.06	25.52
27.6.2018	12:00-13:00	13.84	4.68	10.63	5.05	5.07	82.03	0.03	26.00
27.6.2018	13:00-14:00	12.02	9.10	3.15	9.73	31.85	85.52	0.00	25.87
27.6.2018	14:00-15:00	10.59	8.83	7.14	11.52	35.12	89.53	0.00	25.52
27.6.2018	15:00-16:00	13.46	10.87	11.16	8.40	55.47	86.13	3.42	26.17
27.6.2018	16:00-17:00	24.72	1.40	49.64	2.78	1.95	75.97	35.68	27.22
27.6.2018	17:00-18:00	24.14	1.16	24.23	10.23	7.88	75.85	4.17	27.02
27.6.2018	18:00-19:00	60.31	8.42	8.94	27.62	55.20	79.53	0.16	26.07
27.6.2018	19:00-20:00	21.00	1.83	1.64	10.07	27.08	82.80	0.13	25.52
27.6.2018	20:00-21:00	41.90	5.53	3.93	9.10	17.95	87.15	0.00	24.00
27.6.2018	21:00-22:00	30.92	11.34	5.36	15.53	23.92	91.58	0.75	24.00
27.6.2018	22:00-23:00	8.49	12.57	0.00	27.20	21.48	94.48	5.93	24.00
27.6.2018	23:00-00:00	69.00	5.85	7.21	4.05	2.65	90.47	0.94	24.90
28.6.2018	00:00-01:00	48.67	2.97	3.42	2.10	1.03	75.07	0.53	26.27
28.6.2018	01:00-02:00	58.69	3.75	20.20	4.53	2.83	74.73	0.16	26.00
28.6.2018	02:00-03:00	39.80	2.76	0.91	6.15	16.33	75.68	2.63	26.00
28.6.2018	03:00-04:00	50.20	3.34	0.58	11.50	32.57	77.95	3.70	25.52
28.6.2018	04:00-05:00	67.85	5.12	0.59	12.37	29.57	80.78	0.00	25.00
28.6.2018	05:00-06:00	63.75	6.02	1.11	8.10	5.43	81.57	0.00	25.00
28.6.2018	06:00-07:00	89.42	3.93	12.68	9.65	2.15	77.75	1.07	25.47
28.6.2018	07:00-08:00	103.54	1.15	48.90	4.42	1.20	71.22	23.33	27.28
28.6.2018	08:00-09:00	33.97	1.15	50.17	2.03	1.03	66.32	24.11	29.45

AQ2 (second day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
28.6.2018	09:00-10:00	41.80	3.76	26.01	12.40	10.47	64.78	26.46	30.10
28.6.2018	10:00-11:00	86.65	4.26	42.26	9.25	8.20	60.15	17.81	32.43
28.6.2018	11:00-12:00	46.00	7.00	37.33	13.05	10.32	57.95	9.12	33.57
28.6.2018	12:00-13:00	37.22	1.18	34.90	5.03	6.78	57.15	4.30	34.10
28.6.2018	13:00-14:00	53.92	2.14	28.78	5.30	4.77	57.52	5.24	33.62
28.6.2018	14:00-15:00	92.57	13.45	11.31	36.88	41.43	63.73	7.37	31.32
28.6.2018	15:00-16:00	71.29	21.10	0.86	23.22	18.83	67.63	7.43	30.32

28.6.2018	16:00-17:00	79.02	8.29	4.78	40.33	42.58	69.28	4.23	29.68
28.6.2018	17:00-18:00	66.80	19.31	0.58	37.60	40.57	70.30	8.43	29.00
28.6.2018	18:00-19:00	19.09	10.13	0.57	26.28	24.65	75.13	1.63	27.07
28.6.2018	19:00-20:00	37.89	7.04	1.85	18.47	33.58	79.12	0.44	25.75
28.6.2018	20:00-21:00	66.61	4.96	0.61	9.10	42.67	84.27	3.07	25.00
28.6.2018	21:00-22:00	62.13	4.80	0.88	9.27	39.18	88.88	0.22	25.00
28.6.2018	22:00-23:00	50.39	3.01	14.53	10.78	2.37	88.62	2.48	25.00
28.6.2018	23:00-00:00	4.29	2.52	53.74	7.43	1.87	87.27	0.00	25.00
29.6.2018	00:00-01:00	15.84	1.15	21.18	3.23	1.00	86.47	1.72	25.00
29.6.2018	01:00-02:00	19.09	2.14	17.41	4.18	2.98	85.67	2.51	25.00
29.6.2018	02:00-03:00	21.95	3.00	12.42	2.78	14.58	89.13	0.06	25.00
29.6.2018	03:00-04:00	18.45	22.81	0.25	10.67	14.47	93.37	4.92	24.70
29.6.2018	04:00-05:00	12.98	20.91	0.00	10.08	12.62	88.07	17.47	25.47
29.6.2018	05:00-06:00	24.51	12.85	0.00	10.80	18.08	77.98	16.96	27.37
29.6.2018	06:00-07:00	188.58	19.40	0.00	25.22	34.22	63.48	24.43	29.47
29.6.2018	07:00-08:00	210.05	26.80	0.00	23.48	29.02	61.55	18.75	30.25
29.6.2018	08:00-09:00	17.26	33.08	0.00	13.35	13.72	58.25	23.11	31.58

AQ2 (third day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
29.6.2018	09:00-10:00	24.38	1.15	37.63	15.87	29.16	62.32	57.59	31.19
29.6.2018	10:00-11:00	33.69	1.15	82.22	7.37	29.80	67.25	54.65	31.12
29.6.2018	11:00-12:00	8.78	1.15	67.89	2.08	1.08	64.97	58.82	32.32
29.6.2018	12:00-13:00	0.86	1.15	18.58	23.70	16.62	64.98	23.86	32.08
29.6.2018	13:00-14:00	31.87	1.96	0.91	18.60	15.13	64.93	0.69	31.90
29.6.2018	14:00-15:00	12.88	2.18	10.86	21.37	16.80	63.40	9.44	31.85
29.6.2018	15:00-16:00	34.93	28.66	1.92	39.90	79.38	82.95	1.54	25.88
29.6.2018	16:00-17:00	181.56	34.98	0.57	2.00	56.48	88.81	0.00	24.02
29.6.2018	17:00-18:00	5.85	21.23	1.58	47.94	45.30	53.64	0.00	24.09
29.6.2018	18:00-19:00	28.15	13.60	1.76	17.65	14.30	68.27	0.00	24.00
29.6.2018	19:00-20:00	306.05	5.32	8.34	23.70	23.48	72.45	47.88	24.00
29.6.2018	20:00-21:00	4.10	4.28	10.62	20.88	8.70	70.42	0.28	23.15
29.6.2018	21:00-22:00	19.47	8.03	8.68	4.55	3.20	70.90	0.00	23.00
29.6.2018	22:00-23:00	49.15	9.25	19.74	6.88	5.07	72.53	0.00	23.00
29.6.2018	23:00-00:00	131.79	4.77	38.88	7.92	6.22	76.03	2.19	23.00
30.6.2018	00:00-01:00	57.45	1.24	53.75	7.32	5.52	78.07	4.42	23.22
30.6.2018	01:00-02:00	32.64	1.44	46.18	8.18	31.93	85.78	56.13	24.00
30.6.2018	02:00-03:00	33.59	2.88	42.82	10.40	30.97	88.57	54.65	24.00
30.6.2018	03:00-04:00	11.07	1.49	36.50	11.17	31.80	86.13	61.99	24.98
30.6.2018	04:00-05:00	27.48	1.15	41.93	16.35	28.25	89.80	44.53	25.70
30.6.2018	05:00-06:00	25.00	1.58	44.34	9.90	29.95	90.92	53.02	26.00
30.6.2018	06:00-07:00	24.14	1.15	33.75	10.87	29.35	86.08	58.67	26.40
30.6.2018	07:00-08:00	73.20	1.15	39.98	24.85	22.57	88.95	60.14	27.47
30.6.2018	08:00-09:00	70.14	1.39	42.32	23.48	31.38	89.68	40.32	38.78

AQ3 (first day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
27.6.2018	10:00-11:00	29.00	35.37	0.00	20.05	25.00	85.00	2.16	25.70
27.6.2018	11:00-12:00	103.51	39.76	0.00	31.17	32.30	84.72	6.15	25.57
27.6.2018	12:00-13:00	76.11	51.51	0.00	23.05	28.38	80.05	5.29	26.24
27.6.2018	13:00-14:00	56.24	11.70	0.00	27.55	36.97	72.70	4.89	28.57
27.6.2018	14:00-15:00	89.18	3.76	0.16	14.90	17.93	69.95	11.79	28.78
27.6.2018	15:00-16:00	23.81	4.83	0.33	19.05	23.02	76.95	4.58	28.32
27.6.2018	16:00-17:00	0.00	3.76	0.04	19.25	15.08	72.67	24.58	29.18
27.6.2018	17:00-18:00	54.22	19.32	0.10	25.97	26.50	73.15	6.71	28.03
27.6.2018	18:00-19:00	105.19	112.79	0.04	22.50	16.38	76.02	2.38	28.25
27.6.2018	19:00-20:00	185.70	86.01	0.00	19.95	14.72	72.30	4.61	28.57
27.6.2018	20:00-21:00	130.43	20.13	0.00	26.22	29.80	83.13	4.86	25.87
27.6.2018	21:00-22:00	188.81	144.29	0.00	10.77	10.15	93.10	2.46	24.38
27.6.2018	22:00-23:00	312.97	120.57	0.00	17.67	29.07	93.43	3.14	25.00
27.6.2018	23:00-00:00	256.62	88.36	0.00	32.27	50.10	92.65	17.34	25.00
28.6.2018	00:00-01:00	265.11	84.10	0.00	29.33	46.37	91.68	24.43	25.00
28.6.2018	01:00-02:00	193.51	76.07	0.00	37.62	44.77	91.63	14.96	25.00
28.6.2018	02:00-03:00	170.08	67.82	0.00	40.10	42.12	90.77	24.55	25.00
28.6.2018	03:00-04:00	47.62	37.22	0.00	30.42	33.22	90.28	1.98	25.00
28.6.2018	04:00-05:00	20.30	30.35	0.00	25.17	24.35	90.00	2.01	25.00
28.6.2018	05:00-06:00	72.32	26.40	0.02	22.52	25.58	89.78	17.94	25.50
28.6.2018	06:00-07:00	74.89	51.39	0.02	21.82	22.62	89.67	7.34	25.87
28.6.2018	07:00-08:00	100.62	56.57	0.02	25.07	28.88	89.17	3.17	26.00
28.6.2018	08:00-09:00	219.18	52.71	0.04	43.27	40.83	89.12	18.88	26.00
28.6.2018	09:00-10:00	274.09	50.39	0.03	44.53	43.85	88.83	24.83	26.00

AQ3 (second day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
28.6.2018	10:00-11:00	294.95	65.70	0.00	45.92	54.84	85.73	41.39	27.14
28.6.2018	11:00-12:00	190.58	29.88	0.01	43.22	44.42	71.25	10.16	29.50
28.6.2018	12:00-13:00	105.99	4.45	0.02	38.77	37.85	68.07	25.52	30.00
28.6.2018	13:00-14:00	131.02	6.68	0.02	38.47	31.78	66.45	18.25	30.33
28.6.2018	14:00-15:00	96.61	3.76	0.01	24.82	18.15	67.98	8.09	30.08
28.6.2018	15:00-16:00	86.50	3.83	0.18	23.92	27.53	68.85	4.70	29.65
28.6.2018	16:00-17:00	60.93	3.76	0.29	21.12	21.62	65.60	12.01	30.65
28.6.2018	17:00-18:00	170.78	15.80	0.05	21.93	22.75	73.23	17.31	28.40
28.6.2018	18:00-19:00	312.82	85.76	0.00	20.02	15.52	76.63	4.23	27.17
28.6.2018	19:00-20:00	317.03	89.90	0.00	24.87	18.32	77.02	2.51	26.00
28.6.2018	20:00-21:00	294.54	99.84	0.00	33.50	18.77	80.17	1.98	26.00
28.6.2018	21:00-22:00	159.41	85.89	0.00	28.03	20.97	81.47	5.68	26.00

28.6.2018	22:00-23:00	143.42	70.27	0.00	31.32	30.08	80.75	6.24	26.00
28.6.2018	23:00-00:00	67.79	31.04	0.00	17.27	22.08	81.23	8.50	26.00
29.6.2018	00:00-01:00	12.51	28.47	0.00	18.05	22.17	84.25	6.02	25.25
29.6.2018	01:00-02:00	47.46	41.08	0.00	15.73	15.12	84.33	6.90	25.33
29.6.2018	02:00-03:00	87.04	71.78	0.01	14.68	12.27	82.72	3.20	25.98
29.6.2018	03:00-04:00	34.76	54.12	0.00	15.42	16.53	82.60	3.29	25.40
29.6.2018	04:00-05:00	120.25	41.99	0.00	26.18	25.13	81.30	24.21	26.00
29.6.2018	05:00-06:00	270.41	74.57	0.03	55.78	62.98	82.65	11.48	26.00
29.6.2018	06:00-07:00	183.81	41.83	0.00	31.62	48.48	80.03	5.86	26.48
29.6.2018	07:00-08:00	202.01	12.79	0.00	33.20	48.02	73.28	21.89	27.78
29.6.2018	08:00-09:00	101.03	5.61	0.02	29.22	33.87	66.27	13.95	29.72
29.6.2018	09:00-10:00	113.80	3.76	0.35	22.63	28.07	66.13	18.50	30.52

AQ3 (third day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
29.6.2018	10:00-11:00	155.78	13.55	1.15	18.47	17.85	64.42	13.01	31.33
29.6.2018	11:00-12:00	120.27	3.98	0.03	21.18	20.82	61.05	22.89	33.53
29.6.2018	12:00-13:00	170.82	6.21	0.33	17.25	20.12	58.73	22.29	35.03
29.6.2018	13:00-14:00	165.56	10.32	0.21	12.78	19.33	57.80	25.05	35.12
29.6.2018	14:00-15:00	186.13	24.43	0.02	14.25	21.25	53.75	22.45	36.37
29.6.2018	15:00-16:00	320.96	296.57	0.05	18.60	16.88	67.30	1.91	30.25
29.6.2018	16:00-17:00	314.96	114.36	0.00	9.36	13.05	80.57	2.08	26.45
29.6.2018	17:00-18:00	365.72	121.18	0.00	21.43	19.66	89.00	5.05	24.93
29.6.2018	18:00-19:00	500.91	42.21	0.00	19.42	17.20	88.08	14.20	25.00
29.6.2018	19:00-20:00	327.70	23.71	0.00	30.02	36.77	85.55	23.45	25.23
29.6.2018	20:00-21:00	128.44	77.61	0.00	8.93	7.20	89.60	14.86	24.25
29.6.2018	21:00-22:00	124.16	46.19	0.00	15.38	17.42	89.95	1.88	24.00
29.6.2018	22:00-23:00	85.39	13.11	0.00	20.50	20.73	89.68	5.49	24.00
29.6.2018	23:00-00:00	130.45	9.19	0.00	17.60	21.35	89.97	25.18	24.00
30.6.2018	00:00-01:00	206.68	95.70	0.07	17.02	18.17	86.77	1.91	25.05
30.6.2018	01:00-02:00	316.46	103.82	0.00	15.22	18.27	84.13	4.52	26.00
30.6.2018	02:00-03:00	214.99	68.23	0.00	25.17	31.03	82.02	2.88	26.00
30.6.2018	03:00-04:00	175.79	72.18	0.00	30.27	27.05	82.20	5.24	26.00
30.6.2018	04:00-05:00	197.59	78.39	0.00	23.87	23.90	81.32	10.28	26.00
30.6.2018	05:00-06:00	144.18	57.19	0.00	22.63	24.57	81.93	7.71	26.00
30.6.2018	06:00-07:00	113.99	49.67	0.00	22.68	21.80	81.93	2.07	26.00
30.6.2018	07:00-08:00	77.12	47.94	0.03	18.83	18.47	75.43	13.86	27.00
30.6.2018	08:00-09:00	158.08	45.25	0.00	29.18	32.03	75.68	18.03	27.32
30.6.2018	09:00-10:00	124.22	3.76	0.02	28.17	26.52	70.10	12.73	29.18

AQ4 (first day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
6.7.2018	14:00-15:00	29.33	207.70	0.00	1.15	2.55	100.00	1.88	23.00
6.7.2018	15:00-16:00	126.47	33.68	0.00	2.00	4.33	100.00	2.79	23.80
6.7.2018	16:00-17:00	145.40	26.37	0.00	2.00	12.43	100.00	21.01	24.00
6.7.2018	17:00-18:00	136.82	22.65	0.00	2.02	4.43	95.15	16.12	24.00
6.7.2018	18:00-19:00	151.52	17.91	0.00	2.00	6.27	95.35	3.10	24.00
6.7.2018	19:00-20:00	181.44	15.59	0.00	2.02	8.05	96.02	4.14	24.00
6.7.2018	20:00-21:00	124.85	10.24	0.00	2.02	5.82	97.28	8.94	23.72
6.7.2018	21:00-22:00	78.22	14.57	0.00	1.90	6.97	100.00	6.74	22.00
6.7.2018	22:00-23:00	95.48	18.23	0.00	2.57	9.30	100.00	1.94	22.07
6.7.2018	23:00-00:00	90.13	20.48	0.00	2.02	9.78	100.00	8.00	22.00
7.7.2018	00:00-01:00	73.01	20.39	0.00	2.02	10.60	100.00	9.22	22.05
7.7.2018	01:00-02:00	79.40	21.20	0.00	2.03	4.98	100.00	4.55	22.17
7.7.2018	02:00-03:00	81.82	19.26	0.00	2.00	4.68	100.00	3.73	22.87
7.7.2018	03:00-04:00	71.83	16.63	0.00	2.00	11.07	100.00	3.92	22.85
7.7.2018	04:00-05:00	160.90	21.40	0.00	2.02	3.57	100.00	10.41	22.38
7.7.2018	05:00-06:00	178.86	23.94	0.00	2.00	7.83	100.00	2.85	22.98
7.7.2018	06:00-07:00	191.62	22.57	0.00	2.04	8.88	100.00	5.14	23.00
7.7.2018	07:00-08:00	391.42	18.22	0.03	2.00	4.00	99.96	19.23	23.67
7.7.2018	08:00-09:00	261.57	16.68	0.03	2.02	5.82	96.47	10.19	24.00
7.7.2018	09:00-10:00	178.44	16.11	0.00	2.02	8.42	90.97	8.94	24.00
7.7.2018	10:00-11:00	345.93	17.59	0.00	2.00	6.15	96.47	26.87	23.67
7.7.2018	11:00-12:00	177.78	19.37	0.00	2.47	3.83	94.88	12.70	24.00
7.7.2018	12:00-13:00	172.87	18.28	0.01	3.33	4.17	84.13	3.36	25.87
7.7.2018	13:00-14:00	206.80	17.09	0.00	1.70	5.88	87.82	3.14	26.00

AQ4 (second day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
7.7.2018	14:00-15:00	74.59	14.84	0.00	3.83	9.52	90.17	1.88	25.58
7.7.2018	15:00-16:00	198.65	15.16	0.00	2.57	5.07	100.00	9.19	22.00
7.7.2018	16:00-17:00	212.15	18.60	0.00	1.63	7.33	95.97	27.37	23.10
7.7.2018	17:00-18:00	123.88	9.90	0.00	1.37	7.92	87.70	4.14	25.00
7.7.2018	18:00-19:00	131.87	10.15	0.00	2.00	11.47	89.10	16.46	25.00
7.7.2018	19:00-20:00	148.64	15.05	0.00	2.00	4.22	92.78	19.47	24.42
7.7.2018	20:00-21:00	129.50	20.39	0.00	2.00	7.73	96.43	1.88	23.00
7.7.2018	21:00-22:00	52.70	17.26	0.00	2.00	3.70	96.53	2.13	23.00
7.7.2018	22:00-23:00	142.26	14.97	0.00	2.00	13.28	98.53	15.05	22.63
7.7.2018	23:00-00:00	95.85	20.55	0.00	2.02	13.72	100.00	2.51	23.00
8.7.2018	00:00-01:00	57.76	17.02	0.00	2.00	6.20	100.00	5.08	22.97

8.7.2018	01:00-02:00	48.85	12.65	0.00	2.05	9.67	100.00	12.10	22.42
8.7.2018	02:00-03:00	63.75	15.45	0.00	2.00	11.50	100.00	7.49	22.00
8.7.2018	03:00-04:00	76.15	14.05	0.00	2.00	10.75	100.00	6.21	22.00
8.7.2018	04:00-05:00	87.52	13.55	0.00	2.00	7.30	100.00	8.40	22.00
8.7.2018	05:00-06:00	180.11	15.09	0.00	2.02	3.88	100.00	7.75	22.00
8.7.2018	06:00-07:00	189.94	20.62	0.00	2.02	6.27	100.00	6.84	22.13
8.7.2018	07:00-08:00	194.28	20.05	0.00	2.02	10.33	99.97	21.07	23.00
8.7.2018	08:00-09:00	120.28	29.31	0.04	2.60	3.68	96.50	7.81	23.97
8.7.2018	09:00-10:00	99.82	15.07	0.10	2.88	9.00	87.77	15.80	25.63
8.7.2018	10:00-11:00	132.77	5.31	0.08	2.00	5.27	85.72	30.16	26.00
8.7.2018	11:00-12:00	66.36	2.72	0.00	2.33	4.22	82.97	30.45	26.12
8.7.2018	12:00-13:00	88.82	4.00	0.05	2.10	10.50	81.03	21.10	26.98
8.7.2018	13:00-14:00	97.26	2.04	0.03	1.57	13.48	79.17	17.47	27.50

AQ4 (third day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
8.7.2018	14:00-15:00	119.89	2.62	0.00	1.92	11.93	79.20	6.77	27.08
8.7.2018	15:00-16:00	98.18	2.81	0.00	2.00	11.75	79.27	7.96	26.97
8.7.2018	16:00-17:00	88.40	8.12	0.00	2.00	9.87	80.02	2.35	26.33
8.7.2018	17:00-18:00	103.96	15.23	0.00	2.00	5.92	82.07	1.91	26.00
8.7.2018	18:00-19:00	243.86	16.40	0.00	1.92	4.73	86.45	10.82	25.40
8.7.2018	19:00-20:00	200.88	12.99	0.00	2.45	8.57	87.15	13.55	25.12
8.7.2018	20:00-21:00	131.68	17.22	0.00	2.02	12.37	90.87	5.11	24.72
8.7.2018	21:00-22:00	159.81	19.60	0.00	2.12	12.35	94.75	3.39	24.00
8.7.2018	22:00-23:00	166.17	19.04	0.00	2.35	8.53	95.60	3.57	24.05
8.7.2018	23:00-00:00	50.07	16.97	0.00	2.02	2.92	93.65	3.76	24.83
9.7.2018	00:00-01:00	68.59	15.78	0.00	2.03	4.08	92.55	10.25	24.23
9.7.2018	01:00-02:00	75.33	13.25	0.00	2.03	7.63	93.22	3.45	24.08
9.7.2018	02:00-03:00	87.12	16.30	0.00	2.02	3.15	94.78	2.54	24.00
9.7.2018	03:00-04:00	87.00	15.82	0.02	2.03	8.08	95.88	3.42	24.00
9.7.2018	04:00-05:00	110.48	16.34	0.00	1.88	10.65	98.63	4.11	23.98
9.7.2018	05:00-06:00	126.13	20.90	0.00	2.85	11.15	99.83	2.41	24.00
9.7.2018	06:00-07:00	263.05	15.05	0.00	2.53	8.88	99.93	16.68	23.07
9.7.2018	07:00-08:00	108.55	9.35	0.00	2.65	9.08	99.77	11.79	23.50
9.7.2018	08:00-09:00	121.80	9.96	0.00	2.80	5.92	97.72	24.18	23.90
9.7.2018	09:00-10:00	56.42	19.61	0.00	2.75	4.73	100.00	9.19	22.00
9.7.2018	10:00-11:00	200.17	10.76	0.00	2.00	10.07	100.00	6.77	22.00
9.7.2018	11:00-12:00	178.54	13.97	0.00	2.40	4.58	100.00	3.70	22.00
9.7.2018	12:00-13:00	239.15	16.23	0.00	2.18	8.05	100.00	32.86	22.00
9.7.2018	13:00-14:00	267.50	14.61	0.00	2.08	8.88	100.00	16.24	22.53

AQ5 (first day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
30.6.2018	12:00-13:00	143.38	68.75	0.00	2.09	10.35	58.63	35.70	33.19
30.6.2018	13:00-14:00	13.33	1.15	0.00	1.17	7.35	57.88	95.76	33.08
30.6.2018	14:00-15:00	44.86	1.63	0.00	1.88	5.40	83.07	35.43	26.53
30.6.2018	15:00-16:00	331.98	20.28	0.00	2.87	7.08	96.27	21.64	25.63
30.6.2018	16:00-17:00	223.54	4.59	0.00	2.87	9.60	80.55	22.95	27.97
30.6.2018	17:00-18:00	198.50	1.71	0.00	2.13	8.78	78.40	34.90	27.68
30.6.2018	18:00-19:00	77.10	14.10	0.00	1.82	11.83	94.05	5.27	24.60
30.6.2018	19:00-20:00	158.87	22.01	0.00	2.50	10.30	96.85	3.23	24.00
30.6.2018	20:00-21:00	145.28	15.21	0.00	2.87	5.08	96.68	4.04	24.00
30.6.2018	21:00-22:00	83.20	13.55	0.00	2.07	5.58	97.60	2.19	23.98
30.6.2018	22:00-23:00	89.07	17.64	0.00	2.02	13.05	98.17	1.88	23.97
30.6.2018	23:00-00:00	85.37	17.45	0.00	2.08	11.12	99.72	10.25	24.00
1.7.2018	00:00-01:00	70.08	11.67	0.00	2.03	4.85	99.33	4.14	24.00
1.7.2018	01:00-02:00	114.56	14.70	0.00	2.20	3.78	100.00	8.59	23.03
1.7.2018	02:00-03:00	92.13	19.11	0.00	2.02	5.55	100.00	17.03	23.17
1.7.2018	03:00-04:00	84.94	19.01	0.00	2.15	5.13	100.00	18.12	23.00
1.7.2018	04:00-05:00	246.13	15.02	0.00	2.37	7.65	100.00	42.64	23.00
1.7.2018	05:00-06:00	280.88	14.03	0.00	2.07	8.08	100.00	27.56	23.00
1.7.2018	06:00-07:00	137.84	15.05	0.00	2.53	4.38	99.15	8.84	23.90
1.7.2018	07:00-08:00	81.52	9.41	0.05	2.85	8.70	90.32	24.21	25.77
1.7.2018	08:00-09:00	71.20	1.92	0.10	3.65	10.43	76.55	31.73	28.58
1.7.2018	09:00-10:00	60.31	1.15	0.25	2.50	10.77	68.38	40.17	31.03
1.7.2018	10:00-11:00	63.47	1.29	0.46	1.57	4.20	65.77	36.47	32.23
1.7.2018	11:00-12:00	66.80	4.76	0.04	2.08	4.05	62.22	16.40	33.07

AQ5 (second day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
1.7.2018	12:00-13:00	193.90	12.02	0.00	2.15	9.57	86.07	12.17	26.37
1.7.2018	13:00-14:00	78.71	12.61	0.00	2.00	4.60	100.00	4.77	23.00
1.7.2018	14:00-15:00	164.25	13.99	0.00	2.02	4.17	100.00	11.76	22.77
1.7.2018	15:00-16:00	151.33	11.60	0.00	2.00	6.68	100.00	2.51	23.00
1.7.2018	16:00-17:00	118.88	20.38	0.00	1.65	5.82	92.23	11.85	24.57
1.7.2018	17:00-18:00	101.25	20.59	0.00	1.38	2.50	91.42	4.58	24.73
1.7.2018	18:00-19:00	114.51	25.91	0.00	2.02	10.48	100.00	2.54	23.00
1.7.2018	19:00-20:00	229.17	25.26	0.00	2.00	5.15	100.00	2.54	23.23
1.7.2018	20:00-21:00	176.41	20.78	0.00	2.02	6.53	100.00	9.44	23.72
1.7.2018	21:00-22:00	226.82	19.22	0.00	2.02	6.42	100.00	16.74	23.52
1.7.2018	22:00-23:00	133.13	16.95	0.00	2.00	5.57	100.00	14.17	23.08
1.7.2018	23:00-00:00	141.70	17.84	0.00	2.03	4.75	100.00	16.24	23.00

2.7.2018	00:00-01:00	108.49	17.24	0.00	2.00	6.53	100.00	8.40	23.00
2.7.2018	01:00-02:00	84.25	16.49	0.00	2.00	10.28	100.00	2.19	23.00
2.7.2018	02:00-03:00	89.08	16.47	0.00	2.05	8.23	100.00	5.49	23.08
2.7.2018	03:00-04:00	93.22	18.08	0.00	2.18	5.55	100.00	8.53	23.63
2.7.2018	04:00-05:00	123.64	18.61	0.00	2.00	4.30	100.00	16.46	24.00
2.7.2018	05:00-06:00	129.38	17.50	0.00	2.28	9.08	100.00	11.95	24.00
2.7.2018	06:00-07:00	314.51	16.98	0.00	2.13	4.98	100.00	38.38	24.00
2.7.2018	07:00-08:00	144.74	13.88	0.00	2.80	3.50	97.67	9.25	25.08
2.7.2018	08:00-09:00	97.48	5.46	0.04	2.68	9.82	88.93	29.73	26.75
2.7.2018	09:00-10:00	91.55	3.75	0.09	2.72	7.30	82.37	19.32	28.42
2.7.2018	10:00-11:00	73.03	1.42	0.18	2.40	9.92	75.60	17.21	30.00
2.7.2018	11:00-12:00	68.53	1.92	0.07	1.97	5.52	72.77	11.70	30.38

AQ5 (third day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
2.7.2018	12:00-13:00	54.29	1.80	0.00	1.63	6.82	64.45	13.80	32.38
2.7.2019	13:00-14:00	64.56	1.27	0.21	1.58	11.40	63.60	30.92	32.63
2.7.2020	14:00-15:00	61.04	2.52	0.00	2.13	10.38	63.80	8.65	32.53
2.7.2021	15:00-16:00	74.63	10.97	0.00	2.38	10.67	78.98	2.79	27.27
2.7.2022	16:00-17:00	95.75	17.67	0.00	2.47	8.85	84.37	2.73	25.53
2.7.2023	17:00-18:00	138.79	22.21	0.00	2.43	12.20	89.97	2.38	23.90
2.7.2024	18:00-19:00	185.21	25.42	0.00	2.45	9.90	94.30	3.07	23.88
2.7.2025	19:00-20:00	126.40	19.97	0.00	2.28	9.25	95.23	2.23	24.00
2.7.2026	20:00-21:00	89.37	17.01	0.01	2.03	9.77	94.33	1.98	24.00
2.7.2027	21:00-22:00	113.12	17.87	0.00	2.02	11.62	95.25	4.42	24.00
2.7.2028	22:00-23:00	86.99	18.49	0.00	2.05	8.45	96.12	3.48	24.00
2.7.2029	23:00-00:00	85.73	20.31	0.00	2.00	4.28	96.83	1.91	24.00
2.7.2030	00:00-01:00	90.04	19.62	0.00	2.02	5.30	99.28	3.04	24.00
3.7.2030	01:00-02:00	81.40	17.52	0.00	2.00	5.07	100.00	5.93	23.60
3.7.2030	02:00-03:00	134.02	23.66	0.00	2.02	10.05	100.00	24.36	23.57
3.7.2030	03:00-04:00	84.97	16.39	0.00	2.05	10.23	100.00	31.04	23.10
3.7.2030	04:00-05:00	272.96	19.53	0.00	2.02	11.55	100.00	29.16	23.00
3.7.2030	05:00-06:00	211.49	16.74	0.00	2.00	9.38	100.00	10.91	23.57
3.7.2030	06:00-07:00	282.27	18.56	0.03	2.37	5.97	99.00	8.09	24.28
3.7.2030	07:00-08:00	192.90	12.53	0.04	2.93	3.85	93.52	13.77	25.58
3.7.2030	08:00-09:00	68.82	4.37	0.08	3.47	4.35	81.13	20.44	28.88
3.7.2030	09:00-10:00	94.97	2.59	0.19	2.17	4.38	74.47	50.52	30.60
3.7.2030	10:00-11:00	70.05	1.55	0.11	1.18	11.92	66.47	22.67	32.65
3.7.2030	11:00-12:00	195.38	12.28	0.00	2.03	6.28	100.00	35.50	22.72

AQ6 (First day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
30.6.2018	12:00-13:00	44.95	2.65	4.98	2.17	13.15	83.78	2.95	26.55
30.6.2018	13:00-14:00	54.87	1.45	21.19	2.28	1.17	77.98	13.11	27.80
30.6.2018	14:00-15:00	32.54	1.99	25.40	14.20	40.35	77.35	11.54	28.13
30.6.2018	15:00-16:00	32.07	12.83	1.24	26.67	53.50	88.08	0.38	25.35
30.6.2018	16:00-17:00	53.63	9.30	0.75	5.20	67.43	90.17	0.00	25.00
30.6.2018	17:00-18:00	7.25	1.83	2.32	2.15	1.00	87.00	0.00	25.85
30.6.2018	18:00-19:00	40.56	3.01	1.91	4.00	1.27	87.22	0.19	25.75
30.6.2018	19:00-20:00	13.17	5.64	1.12	7.72	12.05	88.58	0.00	25.00
30.6.2018	20:00-21:00	23.29	5.90	1.00	5.87	13.68	89.67	0.00	25.00
30.6.2018	21:00-22:00	12.98	5.54	0.69	4.67	5.63	92.20	0.00	25.00
30.6.2018	22:00-23:00	20.52	7.10	0.57	7.33	29.45	94.17	0.00	25.00
30.6.2018	23:00-00:00	16.89	6.24	0.65	3.07	1.50	95.47	0.00	25.00
1.7.2018	00:00-01:00	23.38	7.64	1.07	2.37	1.22	96.40	0.00	25.00
1.7.2018	01:00-02:00	19.95	6.79	2.65	3.32	1.63	97.45	0.00	25.00
1.7.2018	02:00-03:00	36.26	2.09	1.17	7.17	4.53	97.97	0.53	25.00
1.7.2018	03:00-04:00	78.83	2.33	1.84	7.40	5.17	98.50	6.55	25.00
1.7.2018	04:00-05:00	143.15	2.73	5.15	5.73	2.35	99.60	15.33	25.08
1.7.2018	05:00-06:00	62.13	1.15	14.64	3.00	1.07	92.88	12.82	26.38
1.7.2018	06:00-07:00	22.33	1.30	23.69	3.30	2.35	86.75	9.66	27.15
1.7.2018	07:00-08:00	13.07	1.15	25.38	2.32	1.23	82.00	5.36	28.17
1.7.2018	08:00-09:00	16.61	1.15	34.91	2.03	1.02	76.60	10.88	29.47
1.7.2018	09:00-10:00	21.85	1.15	43.36	2.25	1.10	69.78	27.12	31.33
1.7.2018	10:00-11:00	13.84	1.15	45.36	2.17	1.17	62.72	39.38	34.33
1.7.2018	11:00-12:00	10.21	1.15	87.43	2.15	1.13	62.50	58.57	34.58

AQ6 (second day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
1.7.2018	12:00-13:00	25.67	19.93	19.17	47.27	43.75	75.02	12.92	28.22
1.7.2018	13:00-14:00	58.79	32.29	1.23	29.75	29.50	78.23	0.44	26.73
1.7.2018	14:00-15:00	32.26	2.58	0.57	17.92	11.43	78.07	0.00	25.80
1.7.2018	15:00-16:00	123.59	12.30	0.57	4.02	61.05	85.77	16.49	24.92
1.7.2018	16:00-17:00	48.96	2.92	0.69	4.00	13.37	85.53	16.24	25.00
1.7.2018	17:00-18:00	23.19	3.16	0.68	4.65	1.17	86.55	1.35	25.00
1.7.2018	18:00-19:00	38.65	1.92	1.58	4.75	1.83	85.13	1.94	25.07
1.7.2018	19:00-20:00	21.87	1.57	2.00	3.74	1.57	87.59	0.93	25.00
1.7.2018	20:00-21:00	19.99	2.49	2.08	7.12	3.31	87.90	0.10	25.00
1.7.2018	21:00-22:00	18.70	1.99	3.37	4.07	1.45	90.03	0.00	25.23
1.7.2018	22:00-23:00	12.12	1.70	0.59	8.25	6.30	91.98	0.00	25.25
1.7.2018	23:00-00:00	25.10	1.36	0.75	8.40	11.98	93.47	0.00	25.00

2.7.2018	00:00-01:00	16.41	2.11	0.57	9.90	14.98	94.85	0.00	25.00
2.7.2018	01:00-02:00	17.56	1.91	0.66	8.50	8.42	94.40	0.00	25.00
2.7.2018	02:00-03:00	51.53	1.56	0.58	7.65	19.82	97.07	2.98	25.00
2.7.2018	03:00-04:00	89.23	1.78	0.94	12.60	28.53	97.98	4.92	25.00
2.7.2018	04:00-05:00	107.17	1.15	3.88	10.82	4.60	97.22	15.15	25.08
2.7.2018	05:00-06:00	5.54	1.15	10.95	6.88	1.42	92.12	2.79	26.27
2.7.2018	06:00-07:00	9.93	1.15	35.50	2.10	1.07	81.45	25.52	28.08
2.7.2018	07:00-08:00	4.58	1.15	39.86	4.17	2.68	73.25	5.68	30.30
2.7.2018	08:00-09:00	14.41	1.15	71.54	2.58	1.52	66.52	41.36	32.37
2.7.2018	09:00-10:00	12.12	15.46	1.73	51.27	50.12	82.87	1.16	27.38
2.7.2018	10:00-11:00	32.07	14.52	13.44	11.48	1.57	77.55	11.98	29.22
2.7.2018	11:00-12:00	13.74	1.15	53.48	25.03	40.97	72.45	31.01	28.93

AQ6 (third day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
2.7.2018	12:00-13:00	22.14	4.42	3.29	5.47	4.60	95.58	0.85	24.47
2.7.2019	13:00-14:00	25.86	1.77	6.66	4.72	1.80	99.67	0.06	25.00
2.7.2020	14:00-15:00	9.83	3.28	0.63	8.68	16.72	99.98	0.00	24.25
2.7.2021	15:00-16:00	12.02	5.97	0.70	5.77	35.27	98.40	0.00	24.00
2.7.2022	16:00-17:00	3.34	2.89	0.73	10.38	1169.10	92.02	0.00	24.00
2.7.2023	17:00-18:00	16.89	5.49	0.96	2.23	7.98	94.30	0.00	24.00
2.7.2024	18:00-19:00	17.18	2.23	0.94	2.12	1.60	97.95	0.09	24.00
2.7.2025	19:00-20:00	21.19	2.19	1.65	2.02	1.02	100.00	0.00	24.12
2.7.2026	20:00-21:00	15.17	3.15	2.92	3.53	1.22	100.00	0.13	24.00
2.7.2027	21:00-22:00	18.80	2.61	2.54	3.92	2.27	100.00	0.00	24.08
2.7.2028	22:00-23:00	20.71	3.36	0.91	2.92	1.40	99.38	0.03	24.32
2.7.2029	23:00-00:00	13.55	5.48	0.67	2.82	7.38	100.00	0.00	24.00
2.7.2030	00:00-01:00	31.59	6.24	0.85	4.40	14.83	100.00	0.13	24.00
3.7.2030	01:00-02:00	62.70	1.28	2.46	16.65	15.55	100.00	17.78	24.88
3.7.2030	02:00-03:00	93.43	1.29	5.07	40.10	39.83	100.00	26.34	24.98
3.7.2030	03:00-04:00	15.46	1.22	6.16	12.05	10.02	99.77	0.16	25.55
3.7.2030	04:00-05:00	12.88	1.15	29.76	2.02	1.00	93.95	14.93	26.73
3.7.2030	05:00-06:00	4.68	1.15	39.31	2.00	1.03	82.75	26.43	28.33
3.7.2030	06:00-07:00	0.48	1.18	46.50	12.47	9.97	77.08	22.04	29.22
3.7.2030	07:00-08:00	2.58	4.07	1.19	27.58	23.88	76.40	0.47	29.12
3.7.2030	08:00-09:00	13.55	1.20	1.31	22.48	25.12	76.55	0.38	29.00
3.7.2030	09:00-10:00	19.95	6.46	5.29	22.33	32.15	87.72	1.47	27.15
3.7.2030	10:00-11:00	32.16	9.20	1.34	2.30	5.90	84.32	0.41	27.83
3.7.2030	11:00-12:00	30.65	7.76	25.81	3.33	3.63	81.31	10.40	28.27

AQ7 (first day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
30.6.2018	13:00-14:00	22.27	1.50	0.02	10.87	23.43	66.28	1.00	35.72
30.6.2018	14:00-15:00	40.19	2.82	0.00	57.30	164.32	82.90	6.55	29.70
30.6.2018	15:00-16:00	32.58	11.29	0.00	38.87	13.35	86.93	213.91	27.35
30.6.2018	16:00-17:00	39.12	27.24	0.00	11.90	1.85	82.17	0.00	29.12
30.6.2018	17:00-18:00	10.93	23.97	0.00	13.38	24.90	79.63	0.00	29.18
30.6.2018	18:00-19:00	24.22	33.56	0.00	14.63	50.15	93.35	0.00	25.43
30.6.2018	19:00-20:00	61.52	33.29	0.00	15.73	30.43	94.28	0.09	24.93
30.6.2018	20:00-21:00	81.62	31.10	0.00	16.02	13.85	93.67	0.00	24.25
30.6.2018	21:00-22:00	54.61	32.53	0.00	5.00	2.98	94.82	0.00	24.52
30.6.2018	22:00-23:00	36.58	27.09	0.00	8.38	10.17	94.65	0.00	24.83
30.6.2018	23:00-00:00	50.10	28.30	0.00	33.67	1.20	96.62	0.00	24.57
1.7.2018	00:00-01:00	36.67	30.97	0.00	29.13	10.63	96.90	0.00	24.33
1.7.2018	01:00-02:00	75.57	21.07	0.00	19.97	9.93	100.00	0.00	23.82
1.7.2018	02:00-03:00	72.77	20.27	0.00	21.13	18.43	100.00	0.00	24.12
1.7.2018	03:00-04:00	40.30	28.15	0.00	8.15	27.87	100.00	0.00	23.95
1.7.2018	04:00-05:00	47.03	26.20	0.00	62.68	38.18	100.00	0.00	23.50
1.7.2018	05:00-06:00	54.01	19.37	0.00	61.98	41.22	100.00	0.00	23.42
1.7.2018	06:00-07:00	28.94	13.18	0.00	17.68	8.80	98.97	0.00	23.92
1.7.2018	07:00-08:00	44.76	11.09	0.03	2.33	1.00	85.40	0.41	28.05
1.7.2018	08:00-09:00	40.10	35.51	0.08	3.53	2.10	77.55	3.26	30.80
1.7.2018	09:00-10:00	43.88	12.22	0.05	18.80	3.70	69.68	3.76	34.78
1.7.2018	10:00-11:00	22.34	2.15	0.01	2.00	14.48	58.60	4.73	42.50
1.7.2018	11:00-12:00	20.21	3.09	0.00	37.47	1.27	60.17	2.13	41.28
1.7.2018	12:00-13:00	16.32	5.00	0.00	39.92	23.41	63.63	0.35	38.12

AQ7 (second day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
1.7.2018	13:00-14:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.7.2018	14:00-15:00	20.04	3.17	0.13	6.65	139.77	91.27	1.16	25.35
1.7.2018	15:00-16:00	34.07	16.64	0.04	3.27	9.33	89.12	1.03	26.37
1.7.2018	16:00-17:00	37.12	20.58	0.01	3.80	2.17	86.28	4.73	27.85
1.7.2018	17:00-18:00	51.98	22.38	0.00	30.17	43.07	94.82	53.49	25.60
1.7.2018	18:00-19:00	16.40	32.00	0.00	27.23	48.28	100.00	47.16	22.95
1.7.2018	19:00-20:00	49.80	21.17	0.00	19.23	40.52	99.92	0.31	23.10
1.7.2018	20:00-21:00	74.26	33.74	0.00	34.22	36.57	99.88	0.00	23.15
1.7.2018	21:00-22:00	53.98	30.49	0.00	22.10	4.37	100.00	0.00	23.12
1.7.2018	22:00-23:00	50.35	30.66	0.00	20.98	15.73	100.00	0.00	23.45
1.7.2018	23:00-00:00	38.61	24.76	0.00	29.72	20.90	100.00	0.00	22.67

2.7.2018	00:00-01:00	43.29	25.12	0.00	19.42	3.35	100.00	0.00	22.92
2.7.2018	01:00-02:00	39.72	34.34	0.00	19.07	6.48	100.00	0.00	22.95
2.7.2018	02:00-03:00	13.71	3.84	0.00	16.77	7.98	100.00	0.00	22.90
2.7.2018	03:00-04:00	21.84	3.70	0.00	14.58	5.17	100.00	0.00	22.93
2.7.2018	04:00-05:00	45.17	3.57	0.00	42.37	27.95	100.00	0.00	23.07
2.7.2018	05:00-06:00	31.03	5.12	0.00	34.23	16.42	100.00	0.00	23.13
2.7.2018	06:00-07:00	45.26	20.54	0.00	28.52	9.85	100.00	0.00	23.25
2.7.2018	07:00-08:00	69.15	35.47	0.01	11.93	9.12	99.27	0.00	24.63
2.7.2018	08:00-09:00	72.62	16.40	0.04	3.27	1.02	91.83	0.00	26.77
2.7.2018	09:00-10:00	27.82	2.77	0.05	3.00	1.03	86.40	3.10	28.62
2.7.2018	10:00-11:00	25.93	3.17	0.08	3.53	2.82	80.32	8.28	31.55
2.7.2018	11:00-12:00	25.33	15.78	0.02	6.27	1.82	79.30	16.56	32.37
2.7.2018	12:00-13:00	47.37	25.68	0.00	9.40	2.85	73.63	5.71	34.22

AQ7 (third day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
2.7.2018	13:00-14:00	22.12	25.77	0.03	18.35	22.30	68.97	0.03	37.48
2.7.2019	14:00-15:00	65.42	31.42	0.05	56.08	96.67	75.17	0.00	34.72
2.7.2020	15:00-16:00	50.16	35.27	0.00	21.65	30.37	84.48	35.37	29.25
2.7.2021	16:00-17:00	15.87	17.32	0.00	26.27	37.05	84.52	23.74	27.40
2.7.2022	17:00-18:00	49.93	12.68	0.00	18.77	13.07	88.13	24.71	25.00
2.7.2023	18:00-19:00	31.14	13.90	0.00	12.98	17.20	93.00	19.28	24.73
2.7.2024	19:00-20:00	66.76	25.40	0.00	13.40	26.47	94.23	0.00	24.78
2.7.2025	20:00-21:00	68.33	24.39	0.00	11.48	9.70	92.55	0.00	24.95
2.7.2026	21:00-22:00	70.72	23.70	0.00	14.40	7.93	94.53	0.00	24.90
2.7.2027	22:00-23:00	65.18	28.70	0.00	14.55	15.78	95.68	0.00	24.83
2.7.2028	23:00-00:00	62.88	28.31	0.00	20.75	28.08	96.83	0.00	25.00
3.7.2030	00:00-01:00	60.52	30.09	0.00	20.80	7.27	99.62	0.00	24.58
3.7.2030	01:00-02:00	63.51	23.39	0.00	23.85	9.50	99.92	0.00	24.40
3.7.2030	02:00-03:00	47.95	19.66	0.00	32.20	17.33	100.00	0.00	23.65
3.7.2030	03:00-04:00	59.58	26.48	0.00	34.58	25.72	100.00	0.00	23.87
3.7.2030	04:00-05:00	59.17	16.71	0.00	66.75	43.13	100.00	0.00	23.43
3.7.2030	05:00-06:00	66.63	18.30	0.00	54.58	19.35	100.00	0.00	23.82
3.7.2030	06:00-07:00	64.53	14.04	0.00	30.10	13.82	98.77	0.00	24.37
3.7.2030	07:00-08:00	64.64	8.15	0.03	16.55	6.82	92.00	0.00	26.82
3.7.2030	08:00-09:00	45.67	4.16	0.05	4.92	1.00	80.40	1.54	32.13
3.7.2030	09:00-10:00	50.26	1.64	0.08	37.58	346.53	80.00	0.00	32.97
3.7.2030	10:00-11:00	17.20	2.75	0.01	10.32	743.47	72.32	0.34	35.82
3.7.2030	11:00-12:00	53.33	7.13	0.02	32.59	103.82	73.73	0.00	35.09
3.7.2030	12:00-13:00	21.32	8.85	0.00	2.00	53.15	82.62	0.00	28.69

AQ8 (first day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
3.7.2018	13:00-14:00	67.42	9.20	0.06	10.97	22.78	84.70	0.91	28.50
3.7.2018	14:00-15:00	62.39	5.28	0.00	25.12	48.93	93.13	0.85	25.40
3.7.2018	15:00-16:00	21.19	5.15	0.00	16.10	230.27	99.32	122.82	23.40
3.7.2018	16:00-17:00	56.57	17.09	0.00	22.00	1.00	99.93	0.00	23.72
3.7.2018	17:00-18:00	72.83	16.30	0.00	10.98	58.42	100.00	0.00	22.98
3.7.2018	18:00-19:00	72.46	20.96	0.00	12.98	43.22	100.00	0.00	22.73
3.7.2018	19:00-20:00	30.73	10.59	0.00	5.65	36.65	96.43	0.00	22.92
3.7.2018	20:00-21:00	32.97	6.01	0.00	7.93	92.32	96.72	0.00	22.77
3.7.2018	21:00-22:00	41.96	19.45	0.00	8.57	50.77	97.37	0.00	23.03
3.7.2018	22:00-23:00	15.47	3.27	0.00	13.48	4.78	99.45	0.00	23.12
3.7.2018	23:00-00:00	47.31	14.09	0.00	16.55	20.42	100.00	0.00	23.50
4.7.2018	00:00-01:00	60.88	33.52	0.00	19.87	7.97	100.00	0.00	23.57
4.7.2018	01:00-02:00	54.48	32.27	0.00	22.90	16.40	100.00	0.00	23.43
4.7.2018	02:00-03:00	18.97	11.42	0.00	21.72	36.70	100.00	0.00	23.98
4.7.2018	03:00-04:00	21.83	9.05	0.00	19.83	9.57	100.00	0.00	24.07
4.7.2018	04:00-05:00	33.92	12.96	0.00	20.12	25.70	100.00	0.00	24.42
4.7.2018	05:00-06:00	38.66	20.52	0.00	43.20	20.22	100.00	0.00	23.95
4.7.2018	06:00-07:00	19.96	1.80	0.00	40.77	39.92	99.43	0.00	24.70
4.7.2018	07:00-08:00	67.75	18.94	0.00	14.47	1.05	94.18	0.00	25.45
4.7.2018	08:00-09:00	89.98	21.45	0.02	4.82	1.03	88.28	0.00	27.98
4.7.2018	09:00-10:00	98.93	26.39	0.04	21.18	4.47	78.70	3.95	32.20
4.7.2018	10:00-11:00	56.49	4.27	0.06	60.33	47.27	82.70	1.60	30.65
4.7.2018	11:00-12:00	53.73	4.00	0.00	3.35	2.75	80.97	0.75	30.70
4.7.2018	12:00-13:00	59.61	1.55	0.01	21.37	52.57	79.95	0.00	31.10

AQ8 (second day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
4.7.2018	13:00-14:00	67.99	15.74	0.00	8.07	19.32	84.83	32.42	30.03
4.7.2018	14:00-15:00	60.77	15.55	0.00	2.73	6.80	82.13	7.53	30.75
4.7.2018	15:00-16:00	76.79	23.51	0.00	30.45	21.85	88.08	0.13	27.53
4.7.2018	16:00-17:00	79.02	21.89	0.03	24.47	2.97	83.17	0.22	29.27
4.7.2018	17:00-18:00	72.56	19.46	0.06	73.50	14.62	86.00	0.28	28.68
4.7.2018	18:00-19:00	81.08	27.59	0.00	29.63	19.62	90.30	60.05	25.88
4.7.2018	19:00-20:00	54.68	18.22	0.00	71.18	19.15	89.63	33.83	25.53
4.7.2018	20:00-21:00	60.13	18.40	0.00	24.75	11.82	94.13	0.00	25.25
4.7.2018	21:00-22:00	57.11	20.75	0.00	29.00	13.85	96.13	0.00	24.85
4.7.2018	22:00-23:00	62.84	19.96	0.00	11.03	31.10	98.68	0.00	24.00
4.7.2018	23:00-00:00	64.20	27.90	0.00	21.62	9.10	99.80	0.00	24.25
5.7.2018	00:00-01:00	35.80	18.17	0.00	37.47	27.40	100.00	0.00	24.78

5.7.2018	01:00-02:00	62.79	22.32	0.00	19.12	17.27	98.93	0.00	25.12
5.7.2018	02:00-03:00	73.92	22.26	0.00	27.32	19.15	99.80	0.00	25.02
5.7.2018	03:00-04:00	76.60	23.33	0.00	19.27	31.95	100.00	0.00	25.02
5.7.2018	04:00-05:00	75.92	27.32	0.00	13.10	27.25	100.00	0.00	24.87
5.7.2018	05:00-06:00	74.59	29.79	0.00	18.23	29.57	100.00	0.00	24.53
5.7.2018	06:00-07:00	75.95	22.07	0.00	5.08	34.78	98.42	0.00	24.57
5.7.2018	07:00-08:00	88.25	17.86	0.00	4.25	31.42	96.20	0.00	24.97
5.7.2018	08:00-09:00	85.29	21.39	0.01	2.70	21.88	94.73	0.00	25.75
5.7.2018	09:00-10:00	87.72	22.46	0.00	13.18	27.07	93.95	0.00	25.77
5.7.2018	10:00-11:00	84.43	17.38	0.00	37.77	20.58	98.10	0.00	23.52
5.7.2018	11:00-12:00	85.45	22.82	0.00	1.08	22.90	100.00	24.99	22.68
5.7.2018	12:00-13:00	67.24	23.01	0.00	1.00	6.57	100.00	0.00	22.60

AQ8 (third day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
5.7.2018	13:00-14:00	76.17	13.03	0.00	1.00	6.13	100.00	0.00	22.73
5.7.2018	14:00-15:00	79.33	16.34	0.00	1.00	9.50	100.00	0.00	23.05
5.7.2018	15:00-16:00	74.34	13.65	0.00	1.00	14.30	100.00	0.00	23.52
5.7.2018	16:00-17:00	66.20	10.77	0.00	1.00	13.28	99.42	0.00	23.65
5.7.2018	17:00-18:00	75.64	15.33	0.00	1.00	13.70	97.75	0.00	24.73
5.7.2018	18:00-19:00	69.78	13.90	0.00	1.00	16.22	98.28	0.00	24.73
5.7.2018	19:00-20:00	71.96	20.85	0.00	1.00	45.47	98.93	0.00	24.55
5.7.2018	20:00-21:00	70.93	21.54	0.00	1.00	18.70	99.95	0.00	23.98
5.7.2018	21:00-22:00	71.26	21.83	0.00	1.00	13.92	99.95	0.00	24.15
5.7.2018	22:00-23:00	50.87	12.61	0.00	1.00	27.62	99.65	0.00	24.12
5.7.2018	23:00-00:00	40.38	12.83	0.00	1.00	25.58	100.00	0.00	23.93
6.7.2018	00:00-01:00	41.96	12.55	0.00	1.00	16.85	100.00	0.00	23.43
6.7.2018	01:00-02:00	60.18	17.34	0.00	1.00	24.67	100.00	0.00	23.77
6.7.2018	02:00-03:00	63.00	24.83	0.00	1.00	28.25	99.97	0.00	23.90
6.7.2018	03:00-04:00	71.82	13.88	0.00	1.00	3.73	98.83	0.00	24.32
6.7.2018	04:00-05:00	69.41	15.71	0.00	1.00	22.83	99.88	0.00	23.77
6.7.2018	05:00-06:00	80.84	21.67	0.00	1.00	41.07	99.80	0.00	23.92
6.7.2018	06:00-07:00	79.33	20.82	0.00	1.00	34.40	99.22	0.00	23.32
6.7.2018	07:00-08:00	60.47	15.45	0.00	1.00	73.70	100.00	0.00	23.32
6.7.2018	08:00-09:00	55.13	13.37	0.00	1.00	53.65	99.97	0.00	23.90
6.7.2018	09:00-10:00	71.60	22.13	0.02	4.65	12.85	98.60	0.00	24.47
6.7.2018	10:00-11:00	73.02	9.02	0.01	1.00	4.23	93.75	0.00	26.10
6.7.2018	11:00-12:00	48.34	3.60	0.03	1.00	17.58	88.85	0.00	27.87
6.7.2018	12:00-13:00	46.83	3.78	0.01	60.20	28.78	94.52	0.13	26.50

AQ9 (first day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
3.7.2018	13:00-14:00	87.61	73.90	0.57	22.83	94.47	100.00	0.00	24.67
3.7.2018	14:00-15:00	44.38	8.91	1.01	2.95	136.45	98.02	0.22	25.23
3.7.2018	15:00-16:00	10.40	1.15	27.28	2.18	1.15	85.90	19.66	26.73
3.7.2018	16:00-17:00	0.00	1.15	0.99	19.22	45.17	87.67	0.56	25.00
3.7.2018	17:00-18:00	15.36	1.15	1.57	5.28	15.15	86.78	0.00	25.00
3.7.2018	18:00-19:00	25.19	1.15	0.58	2.55	21.42	98.38	0.00	25.00
3.7.2018	19:00-20:00	10.12	1.15	2.73	10.52	5.28	96.05	0.00	24.68
3.7.2018	20:00-21:00	8.88	4.92	0.57	17.20	66.02	99.97	0.00	24.00
3.7.2018	21:00-22:00	29.11	6.74	0.67	2.60	1.43	100.00	0.03	24.22
3.7.2018	22:00-23:00	17.27	4.09	1.79	2.58	1.20	100.00	0.00	24.80
3.7.2018	23:00-00:00	9.07	2.42	1.73	2.62	7.43	100.00	0.06	25.00
4.7.2018	00:00-01:00	15.36	1.38	1.84	3.70	1.92	100.00	0.06	25.00
4.7.2018	01:00-02:00	15.36	1.32	2.19	6.18	4.35	100.00	0.16	25.00
4.7.2018	02:00-03:00	33.21	1.66	2.00	10.87	10.87	100.00	2.48	25.00
4.7.2018	03:00-04:00	18.13	1.15	2.11	8.98	6.83	100.00	1.00	25.00
4.7.2018	04:00-05:00	16.51	1.20	1.43	7.10	5.35	100.00	0.28	25.00
4.7.2018	05:00-06:00	21.47	1.15	4.30	8.93	16.75	100.00	0.41	25.02
4.7.2018	06:00-07:00	21.38	1.15	9.58	5.62	12.42	100.00	2.04	25.80
4.7.2018	07:00-08:00	8.21	1.15	8.67	6.85	14.85	100.00	0.03	26.00
4.7.2018	08:00-09:00	64.61	34.52	1.48	19.50	87.13	99.97	2.19	24.18
4.7.2018	09:00-10:00	27.77	36.89	0.57	6.85	85.83	98.42	0.00	23.00
4.7.2018	10:00-11:00	35.02	1.20	0.57	2.00	4.73	97.50	0.00	23.00
4.7.2018	11:00-12:00	20.23	1.17	0.57	2.13	230.93	97.18	0.00	23.40
4.7.2018	12:00-13:00	47.62	1.29	0.58	2.50	30.68	99.43	0.00	23.62

AQ9 (second day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
4.7.2018	13:00-14:00	40.85	1.15	0.57	3.23	62.43	100.00	0.00	23.78
4.7.2018	14:00-15:00	63.75	1.24	0.57	8.47	46.25	97.88	0.03	23.90
4.7.2018	15:00-16:00	58.02	1.15	1.03	9.38	3.00	98.60	0.00	24.27
4.7.2018	16:00-17:00	46.57	1.15	0.85	6.40	6.05	100.00	0.00	25.00
4.7.2018	17:00-18:00	9.16	1.15	0.57	8.63	48.47	100.00	0.00	24.98
4.7.2018	18:00-19:00	50.29	1.15	0.57	9.08	24.57	100.00	0.31	24.08
4.7.2018	19:00-20:00	66.13	1.15	0.71	11.78	1.00	100.00	0.09	24.00
4.7.2018	20:00-21:00	7.63	1.15	5.16	8.87	5.42	100.00	1.41	24.03
4.7.2018	21:00-22:00	1.34	1.15	5.19	8.80	6.97	100.00	4.48	24.00
4.7.2018	22:00-23:00	1.05	1.15	5.07	6.35	3.97	100.00	2.26	24.00
4.7.2018	23:00-00:00	7.73	1.15	5.56	5.42	3.32	100.00	2.82	24.03
5.7.2018	00:00-01:00	4.01	1.15	2.82	3.98	17.65	100.00	0.41	24.00

5.7.2018	01:00-02:00	7.73	1.15	3.07	6.63	4.63	100.00	0.06	24.00
5.7.2018	02:00-03:00	3.05	1.15	3.04	6.00	27.65	100.00	0.41	24.00
5.7.2018	03:00-04:00	31.59	1.15	7.35	8.32	9.35	100.00	11.92	24.00
5.7.2018	04:00-05:00	44.66	1.15	6.07	20.25	20.62	100.00	11.51	24.07
5.7.2018	05:00-06:00	3.82	1.15	7.89	6.32	4.93	99.98	0.00	24.62
5.7.2018	06:00-07:00	18.99	1.17	11.97	3.32	4.62	97.45	0.38	25.20
5.7.2018	07:00-08:00	27.20	1.15	20.11	10.10	19.35	94.63	7.37	25.97
5.7.2018	08:00-09:00	3.34	1.15	17.36	6.92	16.70	91.22	1.00	26.02
5.7.2018	09:00-10:00	3.24	1.15	4.19	5.50	13.02	92.25	4.42	26.20
5.7.2018	10:00-11:00	0.29	1.15	16.96	2.42	1.62	88.93	0.63	26.78
5.7.2018	11:00-12:00	8.59	4.55	0.86	25.67	76.82	100.00	1.16	25.00
5.7.2018	12:00-13:00	4.39	1.16	2.44	2.10	1.00	92.32	0.00	25.67

AQ9 (third day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
5.7.2018	13:00-14:00	5.63	22.23	9.21	16.98	22.13	82.75	1.54	26.82
5.7.2018	14:00-15:00	0.00	32.65	0.00	16.35	26.28	82.20	0.00	27.00
5.7.2018	15:00-16:00	1.05	36.50	0.00	16.17	29.18	81.78	2.95	26.70
5.7.2018	16:00-17:00	0.00	34.47	0.00	15.57	28.50	82.23	0.00	26.82
5.7.2018	17:00-18:00	2.96	35.30	0.00	17.98	27.28	83.32	0.00	26.63
5.7.2018	18:00-19:00	0.00	38.08	0.00	23.77	33.45	85.05	0.06	26.25
5.7.2018	19:00-20:00	5.25	36.45	0.00	30.35	42.43	84.93	0.69	26.07
5.7.2018	20:00-21:00	4.39	36.66	0.01	31.97	45.98	83.27	0.00	26.00
5.7.2018	21:00-22:00	0.00	30.42	0.00	19.88	34.62	82.20	0.00	26.12
5.7.2018	22:00-23:00	10.31	21.79	0.00	9.95	21.23	82.57	0.00	25.03
5.7.2018	23:00-00:00	14.31	32.92	0.00	23.00	32.67	83.10	0.00	24.25
6.7.2018	00:00-01:00	5.06	28.38	0.01	26.87	47.95	83.72	0.00	24.00
6.7.2018	01:00-02:00	0.00	34.57	0.05	30.30	60.42	82.58	1.19	23.83
6.7.2018	02:00-03:00	8.97	31.30	0.00	33.37	56.88	82.18	0.47	23.00
6.7.2018	03:00-04:00	0.00	28.66	0.04	33.38	52.92	78.77	0.47	23.00
6.7.2018	04:00-05:00	3.63	30.34	0.02	33.40	56.25	94.57	0.19	23.23
6.7.2018	05:00-06:00	8.49	41.20	0.03	9.90	24.45	100.00	0.00	24.15
6.7.2018	06:00-07:00	8.02	14.36	0.07	23.80	47.95	96.80	0.60	25.33
6.7.2018	07:00-08:00	10.78	30.43	0.00	7.63	16.92	100.00	1.57	26.37
6.7.2018	08:00-09:00	3.05	28.87	0.08	25.73	41.35	87.25	0.28	26.20
6.7.2018	09:00-10:00	1.62	25.47	0.00	3.88	11.60	97.88	0.38	22.97
6.7.2018	10:00-11:00	5.06	30.67	0.00	4.07	6.87	99.93	0.38	23.45
6.7.2018	11:00-12:00	4.49	23.17	0.01	3.45	5.57	99.92	0.22	24.00
6.7.2018	12:00-13:00	5.63	23.58	0.03	6.60	8.73	100.00	1.35	24.15

AQ10 (first day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
3.7.2018	13:00-14:00	11.72	13.91	0.00	1.29	11.14	86.61	2.42	26.51
3.7.2018	14:00-15:00	55.11	30.55	0.00	2.00	4.98	99.41	2.01	24.02
3.7.2018	15:00-16:00	67.33	21.83	0.00	2.56	7.69	99.85	1.88	23.76
3.7.2018	16:00-17:00	73.81	19.59	0.00	2.69	8.85	100.00	1.88	23.00
3.7.2018	17:00-18:00	68.79	17.14	0.00	2.00	9.56	100.00	1.98	22.93
3.7.2018	18:00-19:00	71.12	18.30	0.00	2.02	7.85	100.00	3.57	22.73
3.7.2018	19:00-20:00	70.77	13.74	0.00	2.00	10.93	100.00	2.07	22.71
3.7.2018	20:00-21:00	71.44	17.00	0.00	2.02	11.03	100.00	2.87	22.95
3.7.2018	21:00-22:00	74.57	12.81	0.00	2.30	7.73	100.00	2.54	23.00
3.7.2018	22:00-23:00	74.84	15.72	0.00	2.00	4.10	100.00	2.90	23.00
3.7.2018	23:00-00:00	72.35	18.20	0.00	2.02	4.61	100.00	2.71	23.00
4.7.2018	00:00-01:00	74.82	16.28	0.00	2.00	8.51	100.00	2.46	23.00
4.7.2018	01:00-02:00	69.58	17.55	0.00	2.00	11.15	100.00	1.88	23.00
4.7.2018	02:00-03:00	71.39	15.59	0.00	2.00	5.31	100.00	2.04	23.00
4.7.2018	03:00-04:00	69.59	14.27	0.00	2.00	8.90	100.00	3.64	23.00
4.7.2018	04:00-05:00	75.30	12.25	0.00	2.00	11.68	100.00	14.25	23.32
4.7.2018	05:00-06:00	85.79	15.72	0.00	2.00	7.25	100.00	5.13	23.81
4.7.2018	06:00-07:00	77.98	12.48	0.02	2.08	10.07	95.36	2.74	25.15
4.7.2018	07:00-08:00	72.50	8.32	0.06	2.46	5.00	82.83	6.15	27.92
4.7.2018	08:00-09:00	59.05	1.37	0.25	2.75	8.69	67.46	18.75	32.29
4.7.2018	09:00-10:00	115.32	36.44	0.31	1.98	11.05	68.97	18.24	31.83
4.7.2018	10:00-11:00	28.68	1.83	0.01	1.64	4.61	75.08	25.16	30.10
4.7.2018	11:00-12:00	43.52	1.31	0.00	4.53	5.24	71.83	7.53	30.75
4.7.2018	12:00-13:00	56.89	12.64	0.00	1.75	11.54	84.27	1.88	27.90

AQ10 (second day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
4.7.2018	13:00-14:00	76.91	12.62	0.00	3.97	13.20	86.36	2.04	27.76
4.7.2018	14:00-15:00	63.10	13.29	0.04	1.00	5.61	86.34	2.87	27.12
4.7.2018	15:00-16:00	68.49	17.04	0.01	2.39	10.25	92.19	2.04	25.98
4.7.2018	16:00-17:00	66.66	6.01	0.10	2.42	11.73	84.59	2.30	27.53
4.7.2018	17:00-18:00	64.90	15.77	0.00	1.78	10.10	88.00	1.98	25.34
4.7.2018	18:00-19:00	75.55	18.45	0.00	2.86	5.76	90.05	2.07	25.00
4.7.2018	19:00-20:00	73.71	22.57	0.00	2.29	7.68	92.39	1.98	24.54
4.7.2018	20:00-21:00	80.61	20.93	0.00	1.92	12.69	96.63	7.49	24.44
4.7.2018	21:00-22:00	67.24	19.49	0.00	3.10	13.24	96.92	4.40	23.63
4.7.2018	22:00-23:00	68.03	23.01	0.00	2.61	6.81	99.92	2.17	23.97
4.7.2018	23:00-00:00	71.22	17.43	0.00	2.36	10.20	100.00	1.88	23.49

5.7.2018	00:00-01:00	77.12	15.06	0.00	2.00	9.56	100.00	1.88	23.58
5.7.2018	01:00-02:00	69.51	15.61	0.00	2.00	5.24	100.00	1.88	24.00
5.7.2018	02:00-03:00	65.82	15.78	0.00	2.00	4.75	100.00	2.26	24.00
5.7.2018	03:00-04:00	70.55	17.05	0.00	2.00	5.29	100.00	2.30	24.00
5.7.2018	04:00-05:00	70.63	13.50	0.00	2.00	13.17	100.00	1.88	24.00
5.7.2018	05:00-06:00	83.10	32.74	0.00	2.41	14.19	100.00	1.88	24.00
5.7.2018	06:00-07:00	87.36	23.27	0.00	2.12	9.44	99.02	4.62	24.53
5.7.2018	07:00-08:00	70.89	17.00	0.01	2.56	4.07	94.92	7.69	25.00
5.7.2018	08:00-09:00	71.14	11.21	0.02	2.31	9.47	92.90	17.57	25.98
5.7.2018	09:00-10:00	61.87	8.06	0.01	2.98	11.14	92.56	7.81	25.24
5.7.2018	10:00-11:00	64.99	14.43	0.00	3.49	8.68	99.32	2.58	22.39
5.7.2018	11:00-12:00	72.98	19.19	0.00	2.02	7.95	100.00	2.17	22.00
5.7.2018	12:00-13:00	62.08	16.70	0.00	2.03	3.63	100.00	2.20	22.00

AQ10 (third day)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	%	µg/m3	Deg. C
5.7.2018	13:00-14:00	71.29	13.98	0.00	2.80	4.83	100.00	1.88	22.90
5.7.2018	14:00-15:00	78.15	16.57	0.00	1.68	7.24	100.00	1.88	22.92
5.7.2018	15:00-16:00	75.82	14.86	0.00	3.69	5.14	100.00	1.88	23.00
5.7.2018	16:00-17:00	77.20	14.99	0.01	2.88	7.71	100.00	3.38	23.12
5.7.2018	17:00-18:00	76.99	14.56	0.00	2.44	8.00	99.93	5.87	24.00
5.7.2018	18:00-19:00	73.21	11.14	0.00	2.00	8.69	99.97	3.70	24.00
5.7.2018	19:00-20:00	76.13	12.61	0.00	2.00	11.88	100.00	2.42	24.00
5.7.2018	20:00-21:00	83.77	15.23	0.00	2.00	10.97	100.00	2.23	23.46
5.7.2018	21:00-22:00	76.04	14.68	0.00	2.00	9.00	100.00	1.88	23.00
5.7.2018	22:00-23:00	56.83	11.46	0.00	2.90	4.64	100.00	1.88	23.00
5.7.2018	23:00-00:00	64.32	14.92	0.00	2.17	5.22	100.00	2.58	23.00
5.7.2018	00:00-01:00	69.45	17.87	0.00	2.15	4.20	100.00	1.95	23.00
6.7.2018	01:00-02:00	68.75	16.78	0.00	2.17	4.78	100.00	1.88	23.00
6.7.2018	02:00-03:00	68.74	14.05	0.00	2.02	6.59	100.00	1.88	23.00
6.7.2018	03:00-04:00	62.66	14.90	0.00	2.00	9.71	100.00	1.88	23.00
6.7.2018	04:00-05:00	54.14	15.95	0.00	2.00	10.05	100.00	2.77	23.00
6.7.2018	05:00-06:00	62.08	17.13	0.00	2.08	10.71	100.00	3.48	23.00
6.7.2018	06:00-07:00	64.02	17.28	0.00	2.00	5.93	100.00	3.41	22.90
6.7.2018	07:00-08:00	67.10	20.50	0.00	2.80	8.19	100.00	1.88	23.00
6.7.2018	08:00-09:00	72.65	13.88	0.00	2.61	7.05	100.00	1.98	23.20
6.7.2018	09:00-10:00	61.90	12.68	0.03	2.15	11.73	100.00	2.68	24.00
6.7.2018	10:00-11:00	63.99	10.34	0.02	2.62	10.15	97.62	6.33	25.12
6.7.2018	11:00-12:00	64.28	7.07	0.06	4.42	8.75	87.42	4.59	27.47
6.7.2018	12:00-13:00	63.94	7.51	0.06	1.19	3.46	88.69	2.65	26.98

APPENDIX N PHYSICAL BASELINE DATA ANALYSIS FOR WET SEASON FROM STS GREEN

Surface Water Analysis Result

Project Name: Ahlone Expansion Combined Cycle Power Plant and FSRU Project to supply power to the Republic of the Union of Myanmar

Sampling by: ERM-Siam Co., Ltd.

Parameter	Unit	Method Analysis	LOQ	Results							Laboratory
				SW1	SW2	SW3	SW4	SW5	SW6	SW7	
Sampling Date				27/6/2018	27/6/2018	27/6/2018	27/6/2018-	28/6/2018	28/6/2018	29/6/2018	
Alkalinity	mg/L as $CaCO_3$	Titration Method	1.0	42.8	42.4	49.3	47.0	27.4	24.2	13.8	STS Green Co., Ltd.
Biochemical Oxygen Demand (BOD)	mg/L	5-Day BOD Test, Azide Modification Method	-	0.6	0.6	1.8	0.8	1.8	2.8	1.0	STS Green Co., Ltd.
Total Suspended Solids (TSS)	mg/L	Dried at 103-105 °C Method	10.0	557	574	831	904	165	117	437	STS Green Co., Ltd.
Total Dissolved Solids (TDS)	mg/L	Dried at 180 °C Method	50.0	76.0	86.0	108	94.0	198	164	202	STS Green Co., Ltd.
Turbidity	NTU	Nephelometric Method	0.02	902	887	959	893	295	329	752	STS Green Co., Ltd.
Hardness as $CaCO_3$	mg/L as $CaCO_3$	EDTA Titrimetric Method	5.0	59.5	60.5	68.0	70.0	27.4	24.4	15.2	STS Green Co., Ltd.
Cyanide (CN)	mg/L	APHA (2012), 4500-CN (C),(E)	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	ALS Laboratory Group (Thailand)
Fluoride (F)	mg/L	APHA (2012), 4110B	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ALS Laboratory Group (Thailand)
Sulfide	mg/L	Iodometric Method	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	STS Green Co., Ltd.
Total Organic Carbon	mg/L	Based on APHA (2012), 5310 B	0.05	4.27	5.82	5.04	5.67	6.99	8.99	9.61	ALS Laboratory Group (Thailand)
Ammonium-Nitrogen	mg/L	Phenate Method	0.010	0.047	0.132	0.148	0.077	0.259	0.362	0.398	STS Green Co., Ltd.
Sulfate (SO_4)	mg/L	Turbidimetric Method	1.0	4.7	1.2	4.7	3.4	5.3	7.5	4.5	STS Green Co., Ltd.
Nitrate (NO_3)	mg/L	Cadmium Reduction Method	0.005	2.40	2.00	2.21	2.22	0.694	0.725	0.576	STS Green Co., Ltd.
Chromium (Cr)	mg/L	Electrothermal AAS Method	0.0005	0.0427	0.0508	0.0798	0.0669	0.0200	0.0207	0.0396	STS Green Co., Ltd.
Calcium (Ca)	mg/L	Direct Nitrous Oxide-Acetylene Flame Method	0.02	7.32	8.16	10.56	9.91	<0.02	<0.02	<0.02	STS Green Co., Ltd.
Magnesium (Mg)	mg/L	Direct Air-Acetylene Flame Method	0.003	8.99	9.94	13.29	14.85	4.47	3.66	4.89	STS Green Co., Ltd.
Sodium (Na)	mg/L	Direct Air-Acetylene Flame Method	0.01	4.43	5.01	5.24	5.86	13.72	9.27	7.39	STS Green Co., Ltd.
Potassium (K)	mg/L	Direct Air-Acetylene Flame Method	0.01	2.38	2.46	3.01	3.25	2.37	2.60	3.04	STS Green Co., Ltd.
Mercury (Hg)	mg/L	Cold-Vapor AAS Method	0.0003	0.0023	0.0021	0.0020	0.0024	0.0030	0.0025	0.0019	STS Green Co., Ltd.
Lead (Pb)	mg/L	Electrothermal AAS Method	0.0020	0.0062	0.0082	0.0131	0.0116	0.0097	0.0089	0.0155	STS Green Co., Ltd.
Cadmium (Cd)	mg/L	Electrothermal AAS Method	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00009	<0.00005	<0.00005	STS Green Co., Ltd.
Copper (Cu)	mg/L	Direct Air-Acetylene Flame Method	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	STS Green Co., Ltd.
Iron (Fe)	mg/L	Direct Air-Acetylene Flame Method	0.10	27.35	26.32	44.89	44.92	13.32	13.82	27.12	STS Green Co., Ltd.
Tin (Sn)	mg/L	Based on APHA (2012), 3125	0.0001	0.0008	0.0003	0.0003	0.0002	<0.0001	0.0001	0.0001	ALS Laboratory Group (Thailand)
Manganese (Mn)	mg/L	Direct Air-Acetylene Flame Method	0.04	0.34	0.40	0.85	0.76	0.14	0.16	0.22	STS Green Co., Ltd.
Total Nitrogen	mg/L	Based on APHA (2012), Calculated	1.0	1.1	<1.0	<1.0	<1.0	<1.0	1.2	1.1	ALS Laboratory Group (Thailand)
Total Phosphorous	mg/L	Acid Digestion/Ascorbic Acid Method	0.005	0.279	0.290	0.456	0.400	0.156	0.268	0.220	STS Green Co., Ltd.
Zinc (Zn)	mg/L	Direct Air-Acetylene Flame Method	0.02	0.04	0.06	0.10	0.08	<0.02	0.03	0.06	STS Green Co., Ltd.
Nickel (Ni)	mg/L	Electrothermal AAS Method	0.0005	0.0503	0.0545	0.1297	0.1059	0.0160	0.0191	0.0336	STS Green Co., Ltd.
Chloride (Cl)	mg/L	Mercuric Nitrate Method	1.0	3.3	3.8	4.3	5.0	17.9	10.4	9.2	STS Green Co., Ltd.
Oil and Grease	mg/L	Liquid-Liquid, Partition-Gravimetric Method	2.0	3.0	5.0	4.0	<2.0	2.0	3.1	2.1	STS Green Co., Ltd.

Parameter	Unit	Method Analysis	LOQ	Results							Laboratory
				SW1	SW2	SW3	SW4	SW5	SW6	SW7	
Sampling Date				27/6/2018	27/6/2018	27/6/2018	27/6/2018-	28/6/2018	28/6/2018	29/6/2018	
Chemical Oxygen Demand (COD)	mg/L	Open Reflux Method	5.0	37.8	22.0	25.2	18.9	63.0	75.6	81.9	STS Green Co., Ltd.

Parameter	Unit	Method Analysis	LOQ	Results							Laboratory
				SW8	SW9	SW10	SW11	SW12	SW13	SW14	
Sampling Date				28/6/2018	28/6/2018	28/6/2018	28/6/2018	28/6/2018	-	-	
Alkalinity	mg/L as $CaCO_3$	Titration Method	1.0	9.5	8.2	10.8	11.9	10.8	46.0	43.1	STS Green Co., Ltd.
Biochemical Oxygen Demand (BOD)	mg/L	5-Day BOD Test, Azide Modification Method	-	2.1	1.4	1.6	1.2	2.2	0.5	0.8	STS Green Co., Ltd.
Total Suspended Solids (TSS)	mg/L	Dried at 103-105 °C Method	10.0	268	355	360	376	369	475	597	STS Green Co., Ltd.
Total Dissolved Solids (TDS)	mg/L	Dried at 180 °C Method	50.0	212	216	180	212	246	112	108	STS Green Co., Ltd.
Turbidity	NTU	Nephelometric Method	0.02	683	754	751	693	704	769	968	STS Green Co., Ltd.
Hardness as $CaCO_3$	mg/L as $CaCO_3$	EDTA Titrimetric Method	5.0	21.0	30.5	23.7	25.0	23.3	54.4	54.6	STS Green Co., Ltd.
Cyanide (CN)	mg/L	APHA (2012), 4500-CN (C),(E)	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	ALS Laboratory Group (Thailand)
Fluoride (F)	mg/L	APHA (2012), 4110B	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ALS Laboratory Group (Thailand)
Sulfide	mg/L	Iodometric Method	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	STS Green Co., Ltd.
Total Organic Carbon	mg/L	Based on APHA (2012), 5310 B	0.05	8.89	6.88	11.1	9.52	9.17	3.12	5.91	ALS Laboratory Group (Thailand)
Ammonium-Nitrogen	mg/L	Phenate Method	0.010	0.543	0.621	0.403	0.462	0.347	0.171	0.190	STS Green Co., Ltd.
Sulfate (SO_4)	mg/L	Turbidimetric Method	1.0	7.6	<1.0	5.5	9.4	6.0	9.8	14.4	STS Green Co., Ltd.
Nitrate (NO_3)	mg/L	Cadmium Reduction Method	0.005	0.431	0.420	0.598	0.814	0.622	1.70	2.04	STS Green Co., Ltd.
Chromium (Cr)	mg/L	Electrothermal AAS Method	0.0005	0.0349	0.0383	0.0405	0.0386	0.0382	0.0441	0.0562	STS Green Co., Ltd.
Calcium (Ca)	mg/L	Direct Nitrous Oxide-Acetylene Flame Method	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	6.41	5.67	STS Green Co., Ltd.
Magnesium (Mg)	mg/L	Direct Air-Acetylene Flame Method	0.003	3.83	2.01	4.85	5.83	6.13	9.30	10.92	STS Green Co., Ltd.
Sodium (Na)	mg/L	Direct Air-Acetylene Flame Method	0.01	6.41	4.52	10.38	18.61	18.10	5.56	7.84	STS Green Co., Ltd.
Potassium (K)	mg/L	Direct Air-Acetylene Flame Method	0.01	2.61	1.46	3.07	3.18	3.04	2.52	2.75	STS Green Co., Ltd.
Mercury (Hg)	mg/L	Cold-Vapor AAS Method	0.0003	0.0023	0.0053	0.0026	0.0038	0.0027	0.0023	0.0028	STS Green Co., Ltd.
Lead (Pb)	mg/L	Electrothermal AAS Method	0.0020	0.0139	0.0142	0.0136	0.0128	0.0124	0.0109	0.0102	STS Green Co., Ltd.
Cadmium (Cd)	mg/L	Electrothermal AAS Method	0.00005	0.00011	<0.00005	<0.00005	0.00007	0.00013	0.00031	0.00008	STS Green Co., Ltd.
Copper (Cu)	mg/L	Direct Air-Acetylene Flame Method	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	STS Green Co., Ltd.
Iron (Fe)	mg/L	Direct Air-Acetylene Flame Method	0.10	22.15	26.16	27.34	30.38	26.38	24.56	32.24	STS Green Co., Ltd.
Tin (Sn)	mg/L	Based on APHA (2012), 3125	0.0001	<0.0001	<0.0001	0.0001	0.0002	0.0002	0.0001	<0.0001	ALS Laboratory Group (Thailand)
Manganese (Mn)	mg/L	Direct Air-Acetylene Flame Method	0.04	0.17	0.22	0.24	0.28	0.25	0.33	0.43	STS Green Co., Ltd.
Total Nitrogen	mg/L	Based on APHA (2012), Calculated	1.0	1.2	1.6	1.4	1.6	1.4	<1.0	1.2	ALS Laboratory Group (Thailand)
Total Phosphorous	mg/L	Acid Digestion/Ascorbic Acid Method	0.005	0.155	0.226	0.234	0.263	0.242	0.283	0.287	STS Green Co., Ltd.
Zinc (Zn)	mg/L	Direct Air-Acetylene Flame Method	0.02	0.05	0.05	0.06	0.06	0.06	0.05	0.06	STS Green Co., Ltd.
Nickel (Ni)	mg/L	Electrothermal AAS Method	0.0005	0.0312	0.0317	0.0337	0.0338	0.0338	0.0168	0.0554	STS Green Co., Ltd.
Chloride (Cl)	mg/L	Mercuric Nitrate Method	1.0	7.5	14.1	16.0	31.1	31.5	6.2	8.8	STS Green Co., Ltd.
Oil and Grease	mg/L	Liquid-Liquid, Partition-Gravimetric Method	2.0	<2.0	<2.0	2.0	2.8	2.7	<2.0	2.2	STS Green Co., Ltd.
Chemical Oxygen Demand (COD)	mg/L	Open Reflux Method	5.0	72.4	72.4	75.6	69.3	44.1	69.3	58.3	STS Green Co., Ltd.

Groundwater Analysis Result

Project Name: Ahlone Expansion Combined Cycle Power Plant and FSRU Project to supply power to the Republic of the Union of Myanmar

Sampling by: ERM-Siam Co., Ltd.

Parameter	Unit	Method Analysis	LOQ	Results			Laboratory
				GW1	GW2	GW3	
Sampling Date				28/6/2018	28/6/2018	27/6/2018	
Alkalinity	mg/L as $CaCO_3$	Titration Method	1.0	596	199	11.5	STS Green Co., Ltd.
Biochemical Oxygen Demand (BOD)	mg/L	5-Day BOD Test, Azide Modification Method	-	0.1	0.2	0.2	STS Green Co., Ltd.
Total Suspended Solids (TSS)	mg/L	Dried at 103-105 °C Method	10.0	42.2	12.4	<10.0	STS Green Co., Ltd.
Total Dissolved Solids (TDS)	mg/L	Dried at 180 °C Method	50.0	14,440	3,722	246	STS Green Co., Ltd.
Turbidity	NTU	Nephelometric Method	0.02	265	236	0.36	STS Green Co., Ltd.
Total Hardness as $CaCO_3$	mg/L as $CaCO_3$	EDTA Titrimetric Method	5.0	2,816	417.0	75.9	STS Green Co., Ltd.
Cyanide (CN)	mg/L	APHA (2012), 4500-CN (C),(E)	0.005	<0.005	<0.005	<0.005	ALS Laboratory Group (Thailand)
Fluoride (F)	mg/L	APHA (2012), 4110B	0.1	<0.1	<0.1	<0.1	ALS Laboratory Group (Thailand)
Sulfide	mg/L	Iodometric Method	1.0	<1.0	<1.0	<1.0	STS Green Co., Ltd.
Total Organic Carbon	mg/L	Based on APHA (2012), 5310 B	0.05	4.79	0.90	0.32	ALS Laboratory Group (Thailand)
Ammonium-Nitrogen	mg/L	Phenate Method	0.010	2.51	1.91	0.081	STS Green Co., Ltd.
Sulfate (SO_4)	mg/L	Turbidimetric Method	1.0	322	11.6	17.6	STS Green Co., Ltd.
Nitrate (NO_3)	mg/L	Cadmium Reduction Method	0.005	0.612	0.280	18.65	STS Green Co., Ltd.
Chromium (Cr)	mg/L	Electrothermal AAS Method	0.0005	<0.0005	<0.0005	0.0049	STS Green Co., Ltd.
Calcium (Ca)	mg/L	Direct Nitrous Oxide-Acetylene Flame Method	0.02	150.77	19.91	13.57	STS Green Co., Ltd.

Parameter	Unit	Method Analysis	LOQ	Results			Laboratory
				GW1	GW2	GW3	
Magnesium (Mg)	mg/L	Direct Air-Acetylene Flame Method	0.003	494.94	66.97	6.21	STS Green Co., Ltd.
Sodium (Na)	mg/L	Direct Air-Acetylene Flame Method	0.01	3,694	780.63	29.43	STS Green Co., Ltd.
Potassium (K)	mg/L	Direct Air-Acetylene Flame Method	0.01	111.62	33.63	3.49	STS Green Co., Ltd.
Mercury (Hg)	mg/L	Cold-Vapor AAS Method	0.0003	<0.0003	<0.0003	<0.0003	STS Green Co., Ltd.
Lead (Pb)	mg/L	Electrothermal AAS Method	0.0020	<0.0020	<0.0020	<0.0020	STS Green Co., Ltd.
Cadmium (Cd)	mg/L	Electrothermal AAS Method	0.00005	0.00006	<0.00005	<0.00005	STS Green Co., Ltd.
Copper (Cu)	mg/L	Direct Air-Acetylene Flame Method	0.05	<0.05	<0.05	<0.05	STS Green Co., Ltd.
Iron (Fe)	mg/L	Direct Air-Acetylene Flame Method	0.10	0.31	1.28	<0.10	STS Green Co., Ltd.
Tin (Sn)	mg/L	Based on APHA (2012), 3125	0.0001	0.0002	<0.0001	<0.0001	ALS Laboratory Group (Thailand)
Manganese (Mn)	mg/L	Direct Air-Acetylene Flame Method	0.04	0.41	1.90	<0.04	STS Green Co., Ltd.
Total Nitrogen	mg/L	Based on APHA (2012), Calculated	1.0	12.1	1.1	5.2	ALS Laboratory Group (Thailand)
Total Phosphorous	mg/L	Acid Digestion/Ascorbic Acid Method	0.005	1.63	0.036	0.036	STS Green Co., Ltd.
Zinc (Zn)	mg/L	Direct Air-Acetylene Flame Method	0.02	<0.02	0.53	0.02	STS Green Co., Ltd.
Nickel (Ni)	mg/L	Electrothermal AAS Method	0.0005	<0.0005	0.0036	0.0191	STS Green Co., Ltd.
Chloride (Cl)	mg/L	Mercuric Nitrate Method	1.0	6,861	1,516	73.6	STS Green Co., Ltd.

Sediment Analysis Result

Project Name: Ahlone Expansion Combined Cycle Power Plant and FSRU Project to supply power to the Republic of the Union of Myanmar

Sampling by: ERM-Siam Co., Ltd.

Parameter	Unit	Method Analysis	LOQ	Results						Laboratory
				SED1	SED2	SED3	SED4	SED5	SED6	
Particle Size Distribution										
- Sand	%	Hydrometer Analysis	-	51.7	6.5	2.4	1.3	1.0	5.7	STS Instrument Co., Ltd.
- Silt	%	Hydrometer Analysis	-	27.4	69.4	60.6	61.7	49.2	38.2	STS Instrument Co., Ltd.
- Clay	%	Hydrometer Analysis	-	20.9	24.1	37.0	37.0	49.8	56.1	STS Instrument Co., Ltd.
Total Organic Carbon (TOC)	%	Based on US EPA, Method 9060	0.1	0.15	0.19	0.30	0.29	0.37	0.63	ALS Laboratory Group (Thailand)
TPH (C10 – C36)										ALS Laboratory Group (Thailand)
- C10-C14	mg/kg	Based on US EPA, Method 3570 and 8015B	5	<5	<5	<5	<5	<5	<5	
- C15-C28	mg/kg	Based on US EPA, Method 3570 and 8015B	10	<10	<10	<10	<10	<10	<10	
- C29-C36	mg/kg	Based on US EPA, Method 3570 and 8015B	10	<10	<10	<10	<10	<10	<10	
Total Oil	mg/kg (wet)	Soxhlet Extraction Method	20.0	34.97	264	125	145	200	232	STS Green Co., Ltd.
	mg/kg (dry)	Soxhlet Extraction Method	20.0	70.72	431	198	273	321	410	
Arsenic	mg/kg	Hydride Generation AAS Method	0.04	0.34	0.40	0.35	0.39	0.30	0.42	STS Green Co., Ltd.
Barium	mg/kg	Direct Nitrous Oxide-Acetylene Flame Method	5.00	12.65	24.39	25.72	24.99	17.06	12.41	STS Green Co., Ltd.
Cadmium	mg/kg	Direct Air-Acetylene Flame Method	1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	STS Green Co., Ltd.
Chromium	mg/kg	Direct Air-Acetylene Flame Method	2.50	16.49	26.96	30.99	32.74	31.47	31.04	STS Green Co., Ltd.
Copper	mg/kg	Direct Air-Acetylene Flame Method	1.50	14.12	21.61	27.21	24.04	26.09	28.99	STS Green Co., Ltd.
Lead	mg/kg	Direct Air-Acetylene Flame Method	5.00	14.57	20.84	23.96	24.08	21.92	26.50	STS Green Co., Ltd.
Mercury	mg/kg	Cold-Vapor AAS Method	0.10	0.14	0.18	0.23	0.21	0.24	0.27	STS Green Co., Ltd.
Nickel	mg/kg	Direct Air-Acetylene Flame Method	2.00	47.63	68.88	81.12	78.37	80.58	78.57	STS Green Co., Ltd.

Benthos Analysis Result

Project Name: Ahlone Expansion Combined Cycle Power Plant and FSRU Project to supply power to the Republic of the Union of Myanmar

Sampling by: ERM-Siam Co., Ltd.

Phylum/Species	Stations				
	SED1	SED3	SED4	SED5	SED6
PHYLUM ANNELIDA					
Class Polychaeta (ไส้เดือนทะเล)					
Order Sabellida					
Family Oweniidae	16				
Class Sipunculidea					
Order Sipunculiformes					
Family Sipunculidae (หนอนถั่ว)					8
PHYLUM NEMERTEA					
Class Enopla					
Order Heteronemertea (ริบบิ้น)		8			
PHYLUM ARTHROPODA					
Class Malacostraca					
Order Decapoda					
Family Alpheidae					
Alpheus sp.	24				
Family Dorippidae					
Dorippe sp.	8				
Family Penaeidae					
Penaeus sp.			24	8	
Order Isopoda					
Family Cymothoidae (เห็บปลา)				8	8
PHYLUM MOLLUSCA					
Class Gastropoda (หอยฝาเดียว)					
Order Neogastropoda					
Family Nassariidae					
Nassarius sp.		8			
Total (Orgs/m^2)	**48**	**16**	**24**	**16**	**16**
Number of Species	**3**	**2**	**1**	**2**	**2**
Diversity Index	**1.01**	**0.69**	**-**	**0.69**	**0.69**
Richness Index	**0.52**	**0.36**	**-**	**0.36**	**0.36**
Evenness Index	**0.92**	**1.00**	**-**	**1.00**	**1.00**

APPENDIX O INVASIVE SPECIES IN MYANMAR

Taxonomic group	Species	Common name	IUCN Red List Category
Bacteria	*Yersinia pestis*	Bubonic Plague	NL
Birds	*Acridotheres tristis*	Common Myna	LC
Birds	*Anas platyrhynchos*	Mallard	NL
Birds	*Anser anser*	Greylag Goose	LC
Birds	*Columba livia*	Rock Dove	LC
Birds	*Gallus gallus*	Red Junglefowl	LC
Birds	*Passer domesticus*	House Sparrow	LC
Birds	*Porphyrio porphyrio*	Purple Swamphen	LC
Birds	*Psittacula krameri*	Rose-ringed Parakeet	LC
Birds	*Pycnonotus jocosus*	Red-whiskered Bulbul	LC
Birds	*Streptopelia decaocto*	Eurasian Collared-dove	LC
Birds	*Zosterops japonicus*	Japanese White-eye	LC
Coral	*Tubastraea coccinea*	Orange-Cup Coral	NL
Fish	*Clarias gariepinus*	African Catfish	LC
Fish	*Ctenopharyngodon idella*	Myak sar nga chin	NL
Fish	*Cyprinus carpio*	Shwe war nga gyin	NL
Fish	*Gambusia affinis*	Western Mosquitofish	LC
Fish	*Hypophthalmichthys nobilis*	Bighead Carp	DD
Fish	*Oreochromis aureus*	Blue Tilapia	NL
Fish	*Oreochromis spp.*	Freshwater Snapper	NL
Fish	*Poecilia reticulata*	Guppy	NL
Fish	*Carassius auratus*	Goldfish	LC
Fish	*Channa marulius*	Nga-yan-daing	LC
Fish	*Clarias batrachus*	Nga-khoo	LC
Fish	*Lutjanus kasmira*	Common Bluestripe Snapper	LC
Fish	*Misgurnus anguillicaudatus*	Pond loach	LC
Fish	*Monopterus albus*	Rice swampeel	LC
Fungi	*Raffaelea lauricola*	-	NL
Invertebrates	*Aedes aegypti*	Yellow Fever Mosquito	NL
Invertebrates	*Brontispa longissima*	Coconut Hispid Beetle	NL
Invertebrates	*Paratrechina longicornis*	Crazy Ant	NL
Invertebrates	*Solenopsis geminata*	Fire Ant	NL
Invertebrates	*Tapinoma melanocephalum*	Black-Headed Ant	NL
Invertebrates	*Trogoderma granarium*	Khapra Beetle	NL

Taxonomic group	Species	Common name	IUCN Red List Category
Invertebrates	*Anoplolepis gracilipes*	Yellow Crazy Ant	NL
Invertebrates	*Anoplophora chinensis*	Citrus Longhorn Beetle	NL
Invertebrates	*Bellamya chinensis*	Chinese Mystery Snail	LC
Invertebrates	*Diaphorina citri*	Asian citrus psyllid	NL
Invertebrates	*Maconellicoccus hirsutus*	Hirsutus mealybug	NL
Invertebrates	*Monomorium floricola*	Bicoloured trailing ant	NL
Invertebrates	*Oryctes rhinoceros*	Coconut rhinoceros beetle	NL
Invertebrates	*Xyleborus glabratus*	Redbay ambrosia beetle	NL
Invertebrates	*Xylosandrus mutilatus*	Camphor shoot beetle	NL
Mammals	*Rattus exulans*	Polynesian rat	LC
Mammals	*Herpestes auropunctatus*	Small Indian Mongoose	LC
Mammals	*Macaca mulatta*	Rhesus Monkey	LC
Mammals	*Rusa unicolor*	Sambar	VU
Mammals	*Suncus murinus*	House Shrew	LC
Mammals	*Viverricula indica*	Small Indian Civet	LC
Plants	*Acacia longifolia*	Alpine Wattle	LC
Plants	*Acacia mangium*	Black Wattle	NL
Plants	*Alternanthera philoxeroides*	Alligatorweed	NL
Plants	*Cardamine flexuosa*	Wavy Bittercress	NL
Plants	*Chromolaena odorata*	Bitter Bush	NL
Plants	*Eichhornia crassipes*	Water Hyacinth	NL
Plants	*Imperata cylindrica*	Blady Grass	NL
Plants	*Leucaena leucocephala*	Lead Tree	NL
Plants	*Limnocharis flava*	Sawah-Flower Rush	NL
Plants	*Prosopis spp.*	Mesquite	NL
Plants	*Ziziphus mauritiana*	Indian jujube	NL
Plants	*Acanthophora spicifera*	Red Alga	NL
Plants	*Adenanthera pavonina*	Bead Tree	NL
Plants	*Abrus precatorius*	Bead Vine	NL
Plants	*Albizia julibrissin*	Mimosa	NL
Plants	*Alpinia zerumbet*	Shell-Ginger	NL
Plants	*Alternanthera sessilis*	Sessile Joyweed	LC
Plants	*Ardisia crenata*	Coral Berry Tree	NL
Plants	*Arundo donax*	Giant Reed	NL

Taxonomic group	Species	Common name	IUCN Red List Category
Plants	*Caesalpinia decapetala*	Mauritius thorn	NL
Plants	*Casuarina equisetifolia*	Australian pine tree	NL
Plants	*Colubrina asiatica*	Asian nakedwood	NL
Plants	*Dalbergia sissoo*	Indian Rosewood	NL
Plants	*Dioscorea bulbifera*	Air Yam	NL
Plants	*Epipremnum pinnatum*	Centipede Tongavine	NL
Plants	*Ficus microcarpus*	Chinese banyan	NL
Plants	*Hiptage benghalensis*	Hiptage	NL
Plants	*Hygrophila polysperma*	Dwarf Hygrophila	LC
Plants	*Lespedeza cuneata*	Chinese bush-clover	LC
Plants	*Limnophila sessiliflora*	Asian marshweed	LC
Plants	*Lotus corniculatus*	Common Bird's-foot-trefoil	NL
Plants	*Melilotus alba*	White Sweet Clover	NL
Plants	*Neyraudia reynaudiana*	Burma reed	NL
Plants	*Nypa fruticans*	Nypa Palm	NL
Plants	*Paederia foetida*	Chinese fever vine	NL
Plants	*Paspalum scrobiculatum*	Kodo Millet	LC
Plants	*Persicaria perfoliata (L.) H. Gross*	Asiatic tearthumb	NL
Plants	*Rottboellia cochinchinensis*	Corn grass	NL
Plants	*Rubus niveus*	Snowpeaks raspberry	NL
Plants	*Rumex crispus*	Curly Dock	NL
Plants	*Senegalia catechu*	Black catechu	NL
Plants	*Syzygium cumini*	Java Plum	NL
Plants	*Terminalia catappa*	Indian-almond	NL
Plants	*Trachycarpus fortunei*	Chinese fan palm	NL
Plants	*Zizania latifolia*	Manchurian wild rice	NL
Reptiles	*Hemidactylus frenatus*	Asian house gecko	LC
Reptiles	*Python molurus bivittatus*	Burmese Python	VU
Virus	*Babuvirus: Banana bunchy top virus*	-	NL

Notes: *NE – Not Evaluated*
VU – Vulnerable
DD – Data Deficient
LC – Least Concern
NL – Not Listed

APPENDIX P EXAMPLE TOOLS USED FOR SOCIAL BASELINE PRIMARY DATA COLLECTION

Women's Focus Group Discussion (အမျိုးသမီးများနှင့် အုပ်စုတွေ့ဆုံနေးပွဲ)

We are conducting a survey on behalf of Tun Thwin Minning Company Limited (TTMC intends to develop a 600MW coal Fire Power Plant (CCPP) to supply power to the Republic Union of Myanmar through a Power Purchase Agreement (PPA) with the Ministry of Electric Power (MOEP) in Kalewa. A Public meeting will be held in the coming weeks to explain more about the Proposed Project

MUPA ၏ကုမ္ပဏီခွဲတစ်ခုဖြစ်သော ကိုယ်စား လေ့လာဆန်းစစ်ခြင်းလုပ်ငန်းများကို ကျွန်တော်တို့က ဆောင်ရွက်မည်ဖြစ်ပါသည်။
ထားဝယ်အထူးစီးပွားရေးဇုံ ဖွံ့ဖြိုးမှုကနဦးအဆင့်တွက် MIEH နှင့် ထားဝယ်အထူးစီးပွားရေးဇုံ
ဖွံ့ဖြိုးမှုကော်မတီတို့သည် ပြုလုပ်ခွင့်သဘောတူညီမှုအား လက်မှတ်ရေးထိုးခဲ့ပါသည်။

The proposed Project site is located in Kalewa Township, Kale District, Sagaing Region, Myanmar. The closest villages to the Project site are Nan Maw Ke, Ma Htu and Yaw Su.

ရေသန့်စင်စက်ရုံမှ စက်မှုဇုံ၏ အသေးစားနှင့် အလတ်စားစက်မှုလုပ်ငန်းတွေကို စက်ရုံသုံးရေ ပိုမိုထောက်ပံ့ပေးနိုင်မှာ ဖြစ်ပါသည်။
အဆိုပြုထားသော ရေသန့်စင်စက်ရုံမှာ ပယ်မိန်းဖြူရေလှောင်တမံအနီး ထားဝယ်အထူးစီးပွားရေးဇုံ၏ အရှေ့ ၁၅ ကီလိုမီတာခန့်အကွာတွင် တည်ဆောက်ရန်လျာထားပါသည်။

Environmental Resources Management (ERM), with Sustainable Environment Myanmar (SEM), has been asked by TTMC to do the ESIA Study of the Project to satisfy the New EIA Procedure and other relevant requirements.

MUPA မှ Environmental Resources Management (ERM) နှင့် Sustainable Environment Myanmar (SEM) တို့ကို
ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်လေ့လာခြင်းပြုလုပ်ရန် တာဝန်ပေးခဲ့ပါသည်။

The purpose of the ESIA process is to assess the potential impacts of the Project activities on the biophysical and socio-economic environments and establish measures to mitigate the impacts.

ကနဦးပတ်ဝန်းကျင်လေ့လာဆန်းစစ်ရခြင်းရည်ရွယ်ချက်မှာ စီမံကိန်းလုပ်ဆောင်ရာတွင် ဇီဝရုပ်ပိုင်းဆိုင်ရာ နှင့်
ပတ်ဝန်းကျင်လူမှုစီးပွားရေးဆိုင်ရာ ဖြစ်ပေါ် လာနိုင်သည့် ထိခိုက်မှုများကို လေ့လာဆန်းစစ်ခြင်းနှင့်
ထိခိုက်မှုများကို လျော့ချနိုင်မည့်နည်းလမ်းများ ရှာဖွေခြင်း ဖြစ်ပါသည်။

The ESIA involves:

ကနဦးပတ်ဝန်းကျင်လေ့လာဆန်းစစ်ခြင်းတွင် အောက်ပါလုပ်ငန်းစဉ်များ ပါဝင်ပါသည်။

-Baseline studies, which are undertaken to establish an understanding of the existing environment.

-မူလပတ်ဝန်းကျင်ဆိုင်ရာ အခြေခံအချက်အလက်များလေ့လာခြင်း။

-An impact assessment, which identifies what impacts that are likely to occur as a result of the Project – i.e. how will the baseline change.

-စီမံကိန်းကြောင့်ဖြစ်လာနိုင်မည့် ထိခိုက်မှုများကို အမျိုးအစားခွဲခြားခြင်း။(ဥပမာ-မူလပတ်ဝန်းကျင်ဆိုင်ရာအခြေခံအချက်အလက်များ
စီမံကိန်းကြောင့်ပြောင်းလဲသွားမှု ရှိ၊ မရှိ)

-Development of management measures, which are designed to minimise the likely negative impacts and enhance the potential positive benefits of the Power Plant.

-ဆိုးကျိုးထိခိုက်မှုများကို လျော့ချမည့်စီမံခန့်ခွဲရေး နှင့် ရေသန့်စင်စက်ရုံ၏ ကောင်းကျိုးများ ပိုမိုတိုးပွားစေရန် အစီအစဉ်များရေးဆွဲခြင်း။

This survey forms a part of the socio-economic baseline study. The intention is to better understand the local communities. The ERM/ SEM team will spend time with members of the community to better understand local livelihoods and lifestyles.

ယခုမေးခွန်းကောက်ခံခြင်းသည် လူမှုစီးပွားရေးဆိုင်ရာအခြေခံအချက်အလက်များကောက်ယူခြင်း၏အစိတ်အပိုင်းတစ်ခုဖြစ်ပါသည်။
သက်ဆိုင်ရာဒေသခံများအကြောင်း ပိုမိုနားလည်စေရန် ရည်ရွယ်ပါသည်။ သက်ဆိုင်ရာဒေသခံများ၏ လူနေမှုဘဝ၊
နေထိုင်စားသောက်မှုပုံစံများကို ပိုမိုနားလည်နိုင်ရန်အတွက် ERM/SEM အဖွဲ့များမှ လေ့လာမည်ဖြစ်ပါသည်။ ထို့အပြင် တခြားအဖွဲ့များမှ
ဒေသတွင်းရှိ အခြေခံအချက်များဖြစ်သော အသံဆူညံမှု၊ လေအရည်အသွေး နှင့် ဇီဝမျိုးစုံမျိုးကွဲဆိုင်ရာအချက်အလက်များကို
အသေးစိတ်လေ့လာမည်ဖြစ်ပါသည်။

Participation in this survey is voluntary and you may choose not to answer any of the questions. You may answer the questions in any way you like; there is no right or wrong answer. You may bring up other topics related to the Project.

ဤလေ့လာဆန်းစစ်ခြင်းသည် ဆန္ဒသဘောထားရယူခြင်းသာဖြစ်၍ မဖြေဆိုချင်သောမေးခွန်းများကို ရွေးချယ်နိုင်ပါသည်။
မည်သည့်သဘောထားမျိုးကိုမဆို ဖြေဆိုနိုင်ပြီး အဖြေမှန် (သို့) အဖြေမှား ဟူ၍မရှိပါ။ စီမံကိန်းနှင့် သက်ဆိုင်သည့်
မည်သည့်အကြောင်းအရာကိုမဆို ဖြေဆိုနိုင်ပါသည်။

Please note that your participation in this survey is not linked in any way to determination of entitlements for compensation.

ကျေးဇူးပြု၍ ဤလေ့လာဆန်းစစ်ခြင်းသည် နစ်နာကြေးခံစားခွင့်များနှင့် မသက်ဆိုင်ပါကြောင်း

Enumerator Details:					
Name: အမည်	1) 2) 3) 4) 5)	Contact Phone No: *ဖုန်းနံပါတ်-*	1) 2) 3) 4) 5)	*Signature: လက်မှတ်*	1) 2) 3) 4) 5)
Date: (DD/MM/YY) နေ့စွဲ					
Location Details					
Village: ကျေးရွာအမည်			*Township: မြို့နယ်*		
Village Tract: ကျေးရွာအုပ်စုအမည်			*District: ခရိုင်*		
State/Region/ပြည်နယ်/တိုင်း			*Coordinates: ကိုအော်ဒိနိတ်*		

GENERAL		
1.	How many women are there in the village? ရွာထဲတွင် အမျိုးသမီးအရေအတွက် ဘယ်လောက်ရှိလဲ။	
	What percentage of women's vote in the village? (eg. vote in election process)	
	How many widowed women in the village? ရွာထဲတွင် မုဆိုးမ အရေအတွက် ဘယ်လောက်ရှိလဲ။	
2.	Are there any women headedhouseholds? If yes, how many in the village? အမျိုးသမီး ဦးဆောင်သော အိမ်ထောင်စု ရှိပါသလား။ ရှိလျှင် အရေအတွက်ကို ဖော်ပြပါ။	
3.	What role do women play in: အမျိုးသမီးများ၏ အခန်းကဏ္ဍက ဘာလဲ။ - Their roles in the community? - ရပ်ရွာအဖွဲ့အစည်း - Their roles in the local leadership/politics? - ဒေသအတွင်းဦးဆောင်မှု / နိုင်ငံရေး လှုပ်ရှားမှု	
4.	What is the regular daily schedule? နေ့စဉ်လှုပ်ရှားမှု ပျမ်းမျှ အချိန်ဇယား။ မည်သည့်အချိန်တွင်အလုပ်စတင်၍မည်သည့်အချိန်တွင်အလုပ်ပီးဆုံးသနည်း။ အဓိက လုပ်ငန်းတာဝန်များကို လုပ်ဆောင်ရာတွင် တစ်ရက်လျှင် အချိန်မည်မျှ ကြာသနည်း။ အမျိုးသားများကအိမ်မှုကိစ္စများတွင် ကူညီလုပ်ဆောင်ပေးပါသလား။	

	For a day, how much time do women spend in doing domestic chores?	
	Do men help women with domestic chores?	
Leadership Roles		
5.	How many women are in leadership position in the community? ရပ်ရွာအဖွဲ့အစည်းတွင် အမျိုးသမီးဦးဆောင်မှုအရေအတွက် ဘယ်လောက်ရှိလဲ။	
Ownership		
	What are the ownership patterns in the village? ရွာထဲတွင် ပိုင်ဆိုင်မှုပုံစံကို ဖော်ပြပါ။	
6.	What are the typical assets owned by women in the family (e.g. land, property, jewelry, etc.) မိသားစုအတွင်းအမျိုးသမီးများ ပိုင်ဆိုင်မှုများကို ဖော်ပြပါ။ (မြေ၊ ပစ္စည်းဥစ္စာ၊ ရတနာ..အစရှိသည့်)	
7.	Are the ownership rights for girl child defined? မိန်းကလေးများတွက် သတ်မှတ်ထားသည့် ပိုင်ဆိုင်သည့်အခွင့်အရေး ရှိပါသလား။ လက်ထပ်ပြီးကာစ မိန်းကလေးများအတွက် ပိုင်ဆိုင်မှု ဘာတွေ ရှိပါသလဲ။	
Social Status		
8.	Do you think men and women are given equal opportunities? မိန်းကလေးနှင့် ယောကျ်ားလေး တန်းတူအခွင့်အရေး ရှိသင့်သည်ဟု ထင်ပါသလား။	
9.	What influence do women have in decisions, made within the household? (e.g. marriage, children, other family issues) အိမ်ထောင်စုအတွင်း ဆုံးဖြတ်ရာတွင် အမျိုးသမီးများ၏ အရေးပါမှုကို ဖော်ပြပါ။ (ဥပမာ- လက်ထပ်ပွဲ၊ သားသမီးအရေး၊ အခြားမိသားစုပြဿနာများ)	
10.	If there is a dispute to resolve between a husband and wife? ဇနီးနှင့်ခွန်ပွန်းကြား အငြင်းပွားမှုများကို ပြန်ဖြေရှင်းမှုများရှိလျှင်၊ ဘယ်လိုဖြေရှင်းတာလဲ၊ ဘယ်သူတွေက ကူညီဖြေရှင်းပေးလဲ။	
	How is this resolved?	
	Who helps resolve that dispute?	
	Do girls access formal education? Until what level? မိန်းကလေးများတွင် ပုံမှန်ပညာအရည်အချင်းရှိလား။ ဘယ်အတန်းထိ ရှိလဲ။ ယောကျ်ားလေးများနှင့် ဘယ်လိုနှိုင်းယှဉ်မလဲ။ ကွဲပြားမှုရှိလျှင် ဘာကြောင့်ဖြစ်ရသနည်း၊ ၎င်းနှင့် ပတ်သက်၍ မည်သို့ ထင်သနည်း။	
	How does it compare with boys?	
	If there is a difference, why does it exist and what do you think about it?	

12.	What are the main problems faced by women/girls in general? အမျိုးသမီးများ၏ အဓိက ကြုံတွေ့နေရသော ပြဿနာများကို ဖော်ပြပါ။ အကြောင်းပြချက်က ဘာလို့ထင်ပါသလဲ။	
	What do you think the reason of that problem is?	
13.	How would you rate your quality of life (good, average, bad)? သင်တို့၏ ဘဝ အရည်အသွေးကို သတ်မှတ်ပြပါ။ (ကောင်း၊ သင့်၊ ဆိုး) သင် ရရှိထားသည့် ဘဝကို ကျေနပ်လား/ မကျေနပ်ဘူလား။	
	What do you like/dislike about your quality of life?	
14.	What wishes and hopes do you have for your daughters? သင်တို့၏ သမီးများနှင့် သူတို့၏ဘဝအတွက် မျှော်မှန်းချက်နှင့် ဆန္ဒများ ရှိပါသလား။	
15.	Are there any women's associations / groups? အမျိုးသမီးအဖွဲ့အစည်းများ/ အုပ်စုများ ရှိပါသလား။ ဘာတွေ လုပ်ဆောင်ပါသလဲ။	
	What do they do?	
Access to Services		
16.	What are the main health problems faced by women in the community? (*Ask the group to priorities the top three.)* *ရပ်ရွာအတွင်း အမျိုးသမီးများ ရင်ဆိုင်နေရသော အဓိက ကျန်းမာရေးပြဿနာများက ဘာလဲ။ အဖြစ်များဆုံး ရောဂါသုံးမျိုးကို ဦးစားပေး ဖော်ပြပါ။*	
17.	Have there been any serious disease outbreaks in your community in the past year? လွန်ခဲ့သောနှစ်အတွင်း သင့်ရပ်ရွာတွင် ပြင်းထန်သောရောဂါဖြစ်ပွားမှုများ ရှိပါသလား။	
18.	What are the main causes of death in your village? သင်ကျေးရွာတွင် အဓိက သေဆုံးသည့်အကြောင်းအရင်းက ဘာလဲ။ ဘာကြောင့်လဲ။ ဘယ်သူတွေက အဖြစ်များလဲ။(အမျိုးသား၊အမျိုးသမီး၊ကလေး)	
	Why?	
	What groups?*(men, women, children)*	
19.	Is smoking or drinking alcohol common within your village? ကျေးရွာအတွင်း ဆေးလိပ်သောက်ခြင်း သို့မဟုတ် အရက်သေစာသောက်စာခြင်းများ ရှိလား။ ရှိလျှင် ဘယ်သူတွေလဲ(အမျိုးသား၊အမျိုးသမီး၊ကလေး)။ အသက်အရွယ် ဘယ်လောက်လဲ။ အမျိုးသမီးအပေါ် မည်သို့ သက်ရောက်မှု ရှိသနည်း။	
	If so, among which groups and what ages?	
	How does it affect the women?	
20.	Where do you access your healthcare? Indicate distance and time taken to walk/travel. ကျန်းမာရေးစောင့်ရှောက်မှုများကို ဘယ်နေရာတွင် ရရှိသနည်း။	

	ဘယ်လိုအမျိုးအစားတွေလဲ (ပုဂ္ဂလိက၊ အစိုးရ၊ ဘာသာရေး၊ တိုင်းရင်းဆေး..စသည့်)။ ရွာနှင့်ဘယ်လောက်ဝေးသလဲ (မိုင်နှင့်ဖော်ပြရန်)။ လမ်းလျှောက်/ ယာဉ်လမ်း များ အသုံးပြုပါက ကြာချိန်နှင့်အကွာအဝေးကို ဖော်ပြပါ။	
	What type of facility is it? *(Private, government, religious, traditional etc.)*	
	How far is it from the village (miles)?	
	Indicate distance and time taken to walk/travel.	
21.	Are you satisfied with the levels of healthcare available to you and your family? *သင်နှင့် သင်မိသားစု* ရရှိထားသည့် ကျန်းမာရေးဆိုင်ရာစောင့်ရှောက်မှုများကို ကျေနပ်ပါသလား။ အဓိကပြဿနာများ ရှိပါသလား (ဥပမာ- အကွာအဝေး၊ စောင့်စားချိန်ကြာရှည်ခြင်း၊ ဖွင့်ချိန်များ၊ ဆေးရုံး/ဆေးခန်းအခြေအနေ၊ ဆေးဘတ်ဆိုင်ရာထောက်ပံ့မှုများ၊ ကုန်ကျစရိတ်များ)	
	What are the main problems, if any? *(e.g. distance, long queues, opening hours, condition of hospital or clinic, medical supplies, costs)*	
22.	Do you have to pay for healthcare? ကျန်းမာရေးဆိုင်ရာစောင့်ရှောက်မှုများအတွက် ငွေပေးချေရသလား။ ဘယ်လိုစောင့်ရှောက်မှုအတွက် ပေးရလဲ။ ကုန်ကျစရိတ်ကို ပြောပြပေးနိုင်ပါသလား။	
	Which type of care do you pay for?	
	Can you tell us the price that you have to pay for the diseases or treatment, which you have to afford commonly?	
23.	Are there any health programmes in the area? ဤဒေသတွင် ကျန်းမာရေးဆိုင်ရာ အစီအစဉ်များ ရှိသလား။ ရှိလျှင် ဘာတွေလဲ။	
	If yes, which ones?	
24.	Are Sexually Transmitted Infections (STIs) common? လိင်ဒိုင်ဆိုင်ရာ ကူးစက်ရောဂါတွေ ရှိပါသလား။ အဖြစ်များဆုံးက ဘာတွေလဲ (ဥပမာ- ကာလသားရောဂါ၊ အသဲရောင်အသားဝါရောဂါ၊ HIV)။	
	Which ones are more common *(e.g. syphilis, Hepatitis, HIV)*?	
25.	What sexual health and family planning services are provided to women in the village? ကျေးရွာတွင် အမျိုးသမီးများကို လိင်ဒိုင်ဆိုင်ရာကျန်းမာရေးနှင့် မိသားစုအစီအစဉ် ဝန်ဆောင်မှုများကို ထောက်ပံ့ပေးထားပါသလား။	
26.	How is knowledge regarding sexual health transferred to the younger generation? လူငယ်များကို လိင်ဒိုင်ဆိုင်ရာကျန်းမာရေးနှင့် ပတ်သက်ပြီး အသိပညာပေးနိုင်ရန် ဗဟုသုတ ဘယ်လောက်ရှိလဲ။	
27.	How do you avoid getting pregnant? မည်သည့်သားဆက်ခြားနည်းကို အသုံးပြုသနည်း။ ခေတ်ပေါ်နည်း/ ရှေးရိုးနည်း။	
	What are the modern/traditional ways?	

28.	What is the practice of birth deliverygenerally practiced? (e.g. Home based through traditional nurses or institutional delivery in the hospitals) ကလေးမွေးဖွားသည့်အခါ အိမ်မှာမွေးရင် လက်သည်နှင့်မွေးဖွားသလား။ ဆေးရုံမှာမွေးဖွားခြင်း သို့မဟုတ် အိမ်တွင်	
LIVELIHOOD & INCOME		
	What are the income generating sources for women in the community? Which are the main economicactivities undertaken by women? ရပ်ရွာတွင် အမျိုးသမီးများ၏ ဝင်ငွေရရှိသည့် အရင်းအမြစ်က ဘာလဲ။ အမျိုးသမီးများ၏ အဓိက စီးပွားရေးလှုပ်ရှားမှုများက ဘာတွေလဲ။	Please describe the special roles of women.
29.	On the farm? လယ်ယာလုပ်ငန်း	
	Firewood collection and selling? ထင်းခုတ်/ရောင်း	
	Gathering of non-timber forest products? အခြားသစ်တောထွက်ပစ္စည်းကို စုဆောင်းခြင်း။	
30.	How many women in the community are working in the formal sector? ပုံမှန်ကဏ္ဍများတွင် အလုပ်လုပ်နေသော ရပ်ရွာရှိအမျိုးသမီး အရေအတွက်ကိုဖော်ပြပါ။ အခြားသော စက်ရုံများတွင် အလုပ်လုပ်နေသော အရေအတွက်ကိုဖော်ပြပါ။ အလုပ်အမျိုးအစားကို ဖော်ပြပါ။	
	How many are working in various industries?	
	What are types of their jobs?	
31.	What is approximate women's contribution to family income? အကြမ်းအားဖြင့် မိသားစုဝင်ငွေအတွက် အမျိုးသမီးများ၏ အထောက်အပံ့ ဘာလဲ။ မိသားစုတွင်ငင်းတို့၏ အရေးပါမှု တိုးတက်လာသလား သို့မဟုတ် ဆုံးဖြတ်ချက်ချတဲ့အခါများတွင် သူတို့၏ ပြောစကားများအရေးပါမှု တိုးတက်လာပါသလား။	
	Does it increase their status in the family, or increase their say or influence in the decision-making process?	
32.	Are there households where men or other family members, who migrate seasonally or annually for work? အလုပ်အတွက် နှစ်စဉ် သို့မဟုတ် ရာသီအလိုက် အခြားမိသားစုဝင် သို့မဟုတ် အမျိုးသားများ ပြောင်းရွေ့လုပ်ကိုင်နေသည့် အိမ်ထောင်စုများ ရှိပါသလား။ မိသားစုတွင် ဘယ်လိုသက်ရောက်မှုများ ရှိပါသလဲ။	
	How does this impact on the family?	
33.	What significant changes have taken place in women's role since previous generations? အမျိုးသမီးများ၏ အခန်းကဏ္ဍတွင် ဘာတွေက သိသိသာသာ ပြောင်းလဲစေလဲ။	

	ဘာကြောင့်လဲ။ အနာဂတ်မှာ နောက်ထပ် ပြောင်းလဲမှု ရှိလာနိုင်မလဲ။ ဘာကြောင့်လဲ။	
	Why?	
	Will this change again in the future?	
	Why?	
34.	What is the main problem faced by working women, especially in formal employment or informal employment? အလုပ်လုပ်နေသည့်အမျိုးသမီးများ၏ ရင်ဆိုင်နေသည့်အဓိက ပြဿနာများက ဘာတွေလဲ။ အထူးသဖြင့် တရားဝင်အလုပ် သို့မဟုတ် တရားမဝင်အလုပ်လား။	
FARMING (AGRICULTURE, Livestock) ***(if farming community)***		
35.	How many women in the village are engaged in farming? • % of HHs where women are engaged in farming. • % of HHs where women are engaged as paid farm workers • ကျေးရွာတွင် လယ်ယာလုပ်ငန်းလုပ်ကိုင်နေသော အမျိုးသမီး အရေအတွက် ဘယ်လောက်လဲ။ • လယ်ယာလုပ်ငန်းလုပ်ကိုင်နေသော အမျိုးသမီးပါဝင်သည့် အိမ်ထောင်စုရာခိုင်နှုန်း • လယ်ယာလုပ်ငန်းလုပ်ကိုင်နေသည့်အလုပ်သမားအဖြစ် အမျိုးသမီးပါဝင်သော အိမ်ထောင်စုရာခိုင်နှုန်း •	
36.	Do women have ownership over land? အမျိုးသမီးများ ကိုယ်ပိုင်မြေ ရှိပါသလား ကျေးရွာတွင် ကိုယ်ပိုင်မြေ ပိုင်ဆိုင်သောအမျိုးသမီးအချိုးအစားကို ဖော်ပြပါ။ အမျိုးသမီးများပိုင်ဆိုင်သည့် ကိုယ်ပိုင်မြေသည် သီးသန့်လူတန်းစား/အုပ်စုခွဲများတွင် အတွေ့များလား။	
	What proportions of women in the village have their own lands?	
	Is the women ownership over land is more common in certain caste/sub groups?	

37.	What is the role of women in various agricultural activities? အမျိုးမျိုးသော စိုက်ပျိုးရေး လုပ်ရှားမှုများတွင် အမျိုးသမီးများ၏ အခန်းကဏ္ဍ။ Examples of agricultural activities: • Land preparation • မြေယာပြုပြင်ခြင်း • Buying of seeds and fertilizers • ဓါတ်မြေဩဇာနှင့် မျိုးစေ့များ ဝယ်ယူခြင်း • Sowing • သီးနှံကျဲခြင်း • Weeding • ပေါင်းသတ်ခြင်း • Harvesting • ရိတ်သိမ်းခြင်း • Winnowing and Packaging • အညှံဖယ်ရှားခြင်းနှင့် ထုတ်ပိုးခြင်း • Taking to the market for sale • ရောင်းချရန် ဈေးသို့ပို့ဆောင်ခြင်း • Managing finance • ငွေကြေးစီမံခန့်ခွဲခြင်း	
38.	What are the normal working hours for women working in the field? ကွင်းထဲတွင် လုပ်ကိုင်နေသောအမျိုးသမီးများအတွက် ပုံမှန်အလုပ်လုပ်ချိန် ဘယ်လောက်လဲ • Own farm • ကိုယ်ပိုင်မြေ/ အကျိုးအမြတ်များ • Others' farm • အခြားသောမြေ/ လုပ်ခအကျိုးအမြတ်များ/ ထိုစိုက်ပျိုးရေးအမျိုးသမီးများအတွက် တူညီသော လုပ်ခလစာ ရရှိပါသလား။ မိသားစုအလိုက် သို့မဟုတ် သီးခြား ငွေပေးချေပါသလား။	
	Are the wages equal for female agricultural worker?	
	Are they separately paid or paid as a family?	
39.	Do children support the farming process? လယ်ယာစိုက်ပျိုးရေးလုပ်ငန်းကို ကလေးများက ကူညီပေးပါသလား။ မည်သို့နည်း၊ မည်သည့်အချိန်တွင် (ဥပမာ- ကျောင်းပိတ်ရက်များတွင်)။ ဘယ်လိုလုပ်ရှားမှုများ လုပ်ဆောင်ပေးပါသနည်း။ ပိုးသတ်ဆေး/ပေါင်းသတ်ဆေးများအသုံးပြုခြင်းဖြင့် ကူညီပေးပါသလား။	
	How children support the farming process?	
	When they support? (e.g. during school holidays)	
	What activities do they do?	

	Do they help with the use of pesticides/herbicides?	
40.	What are the main crops grown & in what months? အဓိက မည်သည့် သီးနှံများ ကြီးထွားပြီး မည်သည့်လများတွင် ကြီးထွားသနည်း။	
41.	What are the main livestock reared? What are the roles and responsibility of women in livestock rearing? အဓိကမွေးမြူသော တိရစ္ဆာန်များကို ဖော်ပြပါ။ မွေးမြူရေးတွင် အမျိုးသမီးများ၏ အခန်းကဏ္ဍနှင့် တာဝန်ဝတ္တရားများကို ဖော်ပြပါ။ Examples of roles and/or responsibilities of women in livestock rearing: • Fodder collection • ကျွဲစာ၊ နွားစာ စုဆောင်းခြင်း • Buying and selling of cattle • ကျွဲ၊ နွား ရောင်းဝယ်ရေး • Grazing • စားကျက်မြေ စီမံခန့်ခွဲမှု • Shed management မွေးမြူရေးခြံ စီမံခန့်ခွဲမှု • Dung cakes preparation • မစင်သန့်စင်ခြင်း • Milking • နို့ညှစ်ခြင်း • Selling of milk or taking it to cooperatives နွားနို့ရောင်းခြင်း • Vaccination and veterinary services- health management • ကာကွယ်ဆေး နှင့် တိရစ္ဆာန်ဆရာဝန်များမှ ဝန်ဆောင်မှုများ-ကျန်းမာရေးစီမံခန့်ခွဲမှု	
42.	Is agricultural/farming produce used for self-consumption or selling in the market? စိုက်ပျိုးရေးထုတ်လုပ်မှုများသည် ဈေးကွက်တွင် ရောင်းချရန် (သို့) ကိုယ်တိုင်စားသုံးရန်။ အချိုးအစားကိုဖော်ပြပါ။ သီးနှံတွေကွဲပြားမှုရှိလား။ စိုက်ပျိုးထားသည့် သီးနှံများကို ခွဲခြားပြနိုင်သလား။	
	How many percentage of using for self-consumption or selling in the market? (amount of portion)	
	Does this differ from crop to crop?	
	Can youspecify in terms of the crops that they grow?	
43.	Where are the fields located? • ကွင်း၏တည်နေရာကိုဖော်ပြပါ။ ကျေးရွာမှ အကွာအဝေးနှင့် အချင်းဝက်ကိုဖော်ပြပါ။ အမျိုးသမီးလယ်လုပ်သူများ အလုပ်အတွက်သွားရသည့် အကွာအဝေး။ • တစ်နှစ်ပတ်လုံး လယ်လုပ်သည့်အလုပ်သမားများ ရှိပါသလား။ • သင်သည် ရွှေ့ပြောင်းလုပ်ကိုင်မှုများနှင့် ရင်ဆိုင်နေရပါသလား။	

	Indicate distance and radius from the village:	
	How far women farm workers have to travel for work?	
	Is the farm labour work available throughout the year?	
	Do you face competition with the migrant?	
44.	What are the main challenges faced by women farmers in the village? ကျေးရွာတွင် အမျိုးသမီး လယ်လုပ်သူများရင်ဆိုင်နေရသည့် အဓိကစိန်ခေါ်မှုများ	
G. Project related impacts- perceptions on Industry, expectations and Concerns		
45.	What do you know about the proposed project? အဆိုပြုစီမံကိန်းနှင့် ပက်သတ်ပြီး မည်သည်တို့ကို သိရှိသနည်း။	
46.	Do you anticipate any positive impacts (benefits) from the project? စီမံကိန်းမှ ကောင်းမွန်သောသက်ရောက်မှုများကို မျှော်မှန်းထားပါသလား။ ဖော်ပြပါ။	
	Please describe	
47.	Do you anticipate any negative impacts from the project? စီမံကိန်းမှ ဆိုးကျိုး သက်ရောက်မှုများကို မျှော်မှန်းထားပါသလား။ ဖော်ပြပါ။	
	Please describe	
48.	Do you have any ideas for mitigation / enhancement measures for the issues described above (project impacts / benefits), especially in relation towomen? အထူးသဖြင့် အမျိုးသမီးများနှင့်ဆက်နွယ်နေသော (စီမံကိန်းကြောင့် ထိခိုက်မှုများ/ အကျိုးကျေးဇူးများ) အထက်တွင်ဖော်ပြထားသည့် ပြဿနာများ ကို လျော့ချခြင်း/တိုးချဲ့ခြင်းနည်းလမ်းများနှင့် ပက်သတ်သည့် အကြံဉာဏ်များရှိပါသလား။	
49.	Do you think that there will be any impact on your life owing to the following? (please provide details on the slot given below) အောက်ပါတို့နှင့် ပက်သတ်၍ သင့်၏ဘဝနေထိုင်မှုအပေါ် သက်ရောက်မှုရှိနိုင်သည်ဟု ထင်ပါသလား။	
	a) Forest as a source of resources like medicines, firewood, food, and other income generation sources ဆေး၊ ထင်း၊ အစားအစာကဲ့သို့ ကုန်ကြမ်းများ၏ အရင်းအမြစ်တစ်ခုဖြစ်သည့် သစ်တောနှင့် အခြားဝင်ငွေအရင်းအမြစ်များ	
	b) Traditional Forest	
	c) Religious sites ဘာသာရေးဆိုင်ရာ နေရာများ (The ones you pray including graves, shrines, etc.) (ဘုရားကျောင်း၊ အလေးအနက်ထားသည့်နေရာအစရှိသည်တို့ပါဝင်သော ဆုတောင်းသည့်နေရာ)	
	d) Agricultural land and related food insecurity စိုက်ပျိုးမြေ နှင့် အစားအသောက်များ မလုံခြုံမှုနှင့် သက်ဆိုင်သည့်အရာများ	

	e) Availability of land မြေယာရရှိမှု	
	f) Pollution ညစ်ညမ်းမှု	
	g) Increased crime in the area ထိုနေရာတွင်း ပြစ်မှုများ များပြားလာမှု	
	h) Increased influx of the people in the area ထိုနေရာတွင်း လူဦးရေထူထပ်မှု တိုးပွားလာခြင်း	
	i) Market in the area ဒေသတွင်းရှိဈေးများ	
	j) Increase in the food prices in the area ဒေသတွင်း အစားအစာဈေးနှုန်းများ တိုးပွားလာမှု	
	k) Any other traditional livelihood အခြားသော ရှေးရိုးအသက်မွေးဝမ်းကြောင်းမှုများ	
	m) Any other issue of significant concern for the women အမျိုးသမီးများနှင့် သက်ဆိုင်သော သိသာထင်ရှားသည့် ပြဿနာများ	

INSTRUCTIONS

ညွှန်ကြားချက်

1) The interviewer(s) should first make contact with the village/ward leader/representative who may wish to accompany the Interviewer(s) or to nominate a representative to do so. Stakeholder Engagement will have been done previously but upon arrival in the village, contact should be made with leaders anyway.
2) The HH survey questionnaire is to be used in 7 townships including Dala, Ahlone, Seikgyikanaungto, Thanlyin, Seikkan, Dagon, Lanmadaw.
3) The survey will focus on households located close to the project.
4) If a household is considered vulnerable, it/ they should be prioritized. During meeting with village/Ward leader, question should be asked whether there are more vulnerable households in the village (women headed household, household with handicapped people, chronic diseases etc.)
5) The interviewee may be any adult over 18 years of age. Identity of the respondent should be recorded as well as his link to the head of the household.
6) Throughout this survey, *** in the margin indicates instructions to interviewer. These instructions are not to be read to the interviewee.
7) This survey questionnaire includes six parts: basic household information (Part A), socio-economic information (Part B); housing information (Part C); health profile (Part D); access to infrastructure and energy (Part E); and understanding and perceptions of the project (Part F).
8) Read the following to interviewees.

၁လူတွေ့မေးမြန်းမည့်သူနှင့် (လိုက်ပါဆောင်ရွက်ရန်ဆန္ဒရှိသူ ရွာ/ရပ်ကွက် လူကြီးတာဝန်ခံဖြင့် ပထမဦးစွာ ဆက်သွယ်ဆောင်ရွက်ရန် သို့မဟုတ် လိုက်ပါဆောင်ရွက်မည့် ကိုယ်စားလှယ်ခံထားရန်။

၂ (ဒလ၊ အလုံ၊ ဆိပ်ကြီးခနောင်တို၊ သန်လျင်၊ ဆိပ်ကမ်း၊ ဒဂုံ၊ လမ်းမတော် (၇) မြို့နယ်ကို လူမှုစီးပွားအခြေအနေများနှင့် ပတ်သက်သည့်စစ်တမ်းကို ပြုလုပ်ပါမည်။

၃ (ယခုစစ်တမ်းသည်စီမံကိန်း၏အနီးအနားတွင်ရှိသောအိမ်ထောင်စုများကို အဓိကထား၍ ဆန်းစစ်ပါမည်။

၄ (အိမ်ထောင်စုတစ်စုတွင် ထိခိုက်လွယ်သူများကို ထည့်သွင်းစဉ်းစား၍

၄င်းတို့ကို ဦးစားပေးဆောင်ရွက်သင့်ပါသည်။ ကျေးရွာရပ်ကွက်ခေါင်းဆောင်များနှင့် တွေ့ဆုံစဉ်တွင်လည်း/ ထိုကဲ့သို့ ထိခိုက်လွယ်သူများရှိသည့် အိမ်ထောင်စုများဖြစ်သော (အမျိုးသမီးဦးဆောင်သော အိမ်ထောင်စု၊ အားနည်းသူများကို အားပေးသော အိမ်ထောင်စုနှင့် သက်ကြီးရွယ်အို၊ နာမကျန်းသူများကဦးဆောင်သော အ
°မ်ထောင်စု အစရှိသည်တို့ ကို (ပို၍မေးမြန်းသင့်ပါသည်။

၅ (မေးခွန်းဖြေဆိုမည့်သူသည် အသက် ၁၈နှစ် ပြည့်ပြီးသူဖြစ်ရပါမည်။

၆ (ထိုစစ်တမ်း၏ မျဉ်းအတွင်း ပြထားသောကြယ်များသည် မေးခွန်းဖြေဆိုသူကို ရည်ညွှန်းရေးသားထားပါသည်။ ဤညွှန်ကြားချက်များအား ဖြေကြားသူမမဖတ်ရပါ။

၇ (ဤစစ်တမ်းတွင် အ ပိုင်းခြောက်ပိုင်း ပါဝင်ပါသည်။ အခြေခံအိမ်ထောင်စု သတင်းအချက်အလက်(အပိုင်း က), လူမှုစီးပွားရေးဆိုင်ရာ သ တင်းအချက်အလက်(အပိုင်း ခ), အိမ်အမျိုးအစား(အပိုင်း ဂ), ကျန်းမာရေးဆိုင်ရာသတင်း အချက်အလက်(အပိုင်း ဃ), စွမ်အင်နှင့်အခြေခံအဆောက်အအုံဂှရှိမှု အပိုင်း င)) စီမံကိန်းအပေါ်နားလည်မှုနှင့် သဘောထား(အပိုင်း စ)

၈ (ဖော်ပြပါအချက်လက်များအား လူတွေ့မေးမြန်းခြင်း ဖြေဆိုမည့်သူမှဖတ်ရန်။

As discussed in the Public participation engagement done earlier this week, we are here to conduct a survey on the social and socio-economic environment in the Project area to inform the Impact assessment study for Combine Cycle Power Plant (388 MW CCPP).

The proposed Project site is located Dala, Ahlone, Seikgyikanaungto, Thanlyin, Seikkan, Dagon, Lanmadaw Township

Environmental Resources Management (ERM), with Sustainable Environment Myanmar (SEM), have been asked by TTCL to conduct the independaygent EIA for the coal fired power plant project to satisfy the New EIA Procedure and other relevant requirements.

The purpose of the ESIA process is to assess the potential impacts of the Project activities on the biophysical and socio-economic environments and establish measures to mitigate the impacts.

The ESIA involves:

-Baseline studies, which are undertaken to establish an understanding of the existing environment.

-An impact assessment, which identifies what impacts that are likely to occur as a result of the Project – i.e. how will the baseline change.

-Development of management measures, which are designed to minimise the likely negative impacts and enhance the potential positive benefits of the Power Plant.

This survey forms a part of the socio-economic baseline study. The intention is to better understand the local communities. The ERM/ SEM team will spend time with members of the community to better understand local livelihoods and lifestyles.

Participation in this survey is voluntary and you may choose not to answer any of the questions. You may answer the questions in any way you like; there is no right or wrong answer. You may bring up other topics related to the Project.

Please note that your participation in this survey is not linked in any way to determination of entitlements for compensation.

Thank you for your help.

မကြာသေးခင်က ပြုလုပ်ခဲ့သည့် လူထုနှင့် ညှိနှိုင်းဆွေးနွေးပွဲအရ ထိုကြောင့် ၃၈၈ မဂ္ဂါဝပ်ထွက်ရှိမည့် ပေါင်းစပ်လည်ပတ်စွမ်းအင်စက်ရုံ စီမံကိန်းအတွက် စီမံကိန်းနှင့် သက်ဆိုင်သည့် နေရာများတွင် လူမှုစီးပွားရေးနှင့် ပတ်ဝန်းကျင်ဆိုင်ရာ ထိခိုက်မှု ဆန်းစစ်လေ့ခြင်းများ ပြုလုပ်မည် ဖြစ်ပါသည်။

အဆိုပြုစီမံကိန်း ဇရိယာသည် ဒဂ၊ အလုံ၊ ဆိပ်ကြီးခနောင်တို့၊ သန်လျင်၊ ဆိပ်ကမ်း၊ ဒဂုံ၊ လမ်းမတော် မြို့နယ်များတွင် တည်ရှိပါသည်။

TTCL မှ Environmental Resources Management (ERM) နှင့် Sustainable Environment Myanmar (SEM) တို့ကို ၃၈၈ မဂ္ဂါဝပ်ထွက်ရှိမည့် ပေါင်းစပ်လည်ပတ်စွမ်းအင်စက်ရုံ တည်ဆောက်ရန်အတွက် ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း လုပ်ထုံးလုပ်နည်း နှင့် အခြားဆက်စပ်နေသည့် လိုအပ်ချက်များကို ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းပြုလုပ်ရန် တာဝန်ပေးခဲ့ပါသည်။

လူမှုပတ်ဂန်းကျင်လေ့လာဆန်းစစ်ရခြင်းရည်ရွယ်ချက်မှာ စီမံကိန်းလုပ်ဆောင်ရာတွင် ဇီဂရုပ်ပိုင်းဆိုင်ရာ နှင့် ပတ်ဂန်းကျင်လူမှုစီးပွားရေးဆိုင်ရာ ဖြစ်ပေါ်လာနိုင်သည့် ထိခိုက်မှုများကို လေ့လာဆန်းစစ်ခြင်းနှင့် ထိခိုက်မှုများကို လျော့ချနိုင်မည့်နည်းလမ်းများ ရှာဖွေခြင်း ဖြစ်ပါသည်။

လူမှုပတ်ဂန်းကျင်လေ့လာဆန်းစစ်ခြင်းတွင် အောက်ပါလုပ်ငန်းစဉ်များ ပါဂင်ပါသည်။

အခြေခံအလျက်အလက်များလေ့လာရာတွင် လက်ရှိပတ်ဝန်းကျင်ကို နားလည်ရန် ဆောင်ရွက်ရမည်။

-စီမံကိန်းကြောင့်ဖြစ်လာနိုင်မည့် ထိခိုက်မှုများကို အမျိုးအစားခွဲခြားခြင်း။ (ဥပမာ-မူလပတ်ဂန်းကျင်ဆိုင်ရာ အခြေခံအချက်အလက်များ စီမံကိန်းကြောင့်ပြောင်းလဲသွားမှု ရှိ၊ မရှိ)

-ဆိုးကျိုးထိခိုက်မှုများကို လျော့ချမည့်စီမံခန့်ခွဲရေးနှင့် လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ၏ ကောင်းကျိုးများ ပိုမိုတိုးပွားစေရန် အစီအစဉ်များရေးဆွဲခြင်း။

ယခုမေးခွန်းကောက်ခံခြင်းသည် လူမှုစီးပွားရေးဆိုင်ရာအခြေခံအချက်အလက်များ ကောက်ယူခြင်း၏ အစိတ်အပိုင်းတစ်ခုဖြစ်ပါသည်။ သက်ဆိုင်ရာဒေသခံများအကြောင်း ပိုမိုနားလည်စေရန် ရည်ရွယ်ပါသည်။ သက်ဆိုင်ရာဒေသခံများ၏ လူနေမှုဘဂ၊ နေထိုင်စားသောက်မှုပုံစံများကို ပိုမိုနားလည်နိုင်ရန်အတွက် ERM/SEM အဖွဲ့များမှ လေ့လာမည်ဖြစ်ပါသည်။ ထို့အပြင် တခြားအဖွဲ့များမှ ဒေသတွင်းရှိ အခြေခံအချက်များဖြစ်သော အသံဆူညံမှု၊ လေအရည်အသွေး နှင့် ဇီဂမျိုးစုံမျိုးကွဲဆိုင်ရာအချက်အလက်များကို အသေးစိတ်လေ့လာမည် ဖြစ်ပါသည်။

ဤလေ့လာဆန်းစစ်ခြင်းသည် ဆန္ဒသဘောထားရယူခြင်းသာဖြစ်၍ မဖြေဆိုချင်သောမေးခွန်းများကို ရွေးချယ်နိုင်ပါသည်။ မည်သည့်သဘောထားမျိုးကိုမဆို ဖြေဆိုနိုင်ပြီး အဖြေမှန် (သို့) အဖြေမှား ဟူ၍မရှိပါ။ စီမံကိန်းနှင့် သက်ဆိုင်သည့် မည်သည့်အကြောင်းအရာကိုမဆို ဖြေဆိုနိုင်ပါသည်။

ကျေးဇူးပြု၍ ဤလေ့လာဆန်းစစ်ခြင်းသည် နှစ်နာကြေး၊ခံစားခွင့်များနှင့် မသက်ဆိုင်ပါကြောင်း သတိပြုပေးစေချင်ပါသည်။

ပါဂင်ကူညီပေးသည့်အတွက် ကျေးဇူးတင်ပါသည်။

Environmental and Social Impact Assessment (ESIA) Study for 388 MW Combine Cycle Power Plant, TTCL Power Myanmar Company Limited

Household Survey Questionnaire, 2018

TTCL Power Myanmar Company Limited မှ အကောင်ထည်ဖော်ဆောင်ရွက်မည့် ၃၈၈
မဂ္ဂါဝပ်ထွက်ရှိသည့် ပေါင်းစပ်လည်ပတ်စွမ်းအင်စက်ရုံ၏ ပတ်ဝန်းကျင် ထိခိုက်မှု ဆန်းစစ်ခြင်း
အိမ်ထောင်စုစစ်တမ်းမေးခွန်းလွှာ၊ ၂၀၁၈ခုနှစ်

PART A: *BASIC HOUSEHOLD INFORMATION*

အပိုင်း(က)း အိမ်ထောင်စု၏ အခြေခံအချက်အလက်များ

Q1. *Please record the interviewee information.*
မေးခွန်း(၁) ဖြေဆိုသူ၏ အချက်အလက်များကို မှတ်တမ်းပယူပါ။

Questionnaire Number မေးခွန်းလွှာအမှတ်	
Address လိပ်စာ	_____ State/Division (ပြည်နယ်/တိုင်းဒေသကြီး) _____ District (ခရိုင်) _____ Township (မြို့နယ်) _____ Ward/Village Tract (ရပ်ကွက်/ကျေးရွာအုပ်စု) _____ Village/Community (ကျေးရွာ/အစုအဖွဲ့) _____
Length of time living in this location နေထိုင်ခဲ့သည့်အချိန်	_____ years (နှစ်)
Interviewee Name ဖြေဆိုသူ၏အမည်	
Interviewee Gender ဖြေဆိုသူသည် ကျား/မ	□Male □Female □Decline to state □ကျား □မ □မဖော်ပြချင်ပါ
Telephone Number ဖုန်းနံပါတ်	

Q2. *Please describe the demographic profile of your household members:*
မေးခွန်းနံပါတ်(၂) သင့်အိမ်ထောင်စုဝင်များ၏ အချက်အလက်များကို ဖြေဆိုပေးပါ

Total number of household members: _____ persons;

အိမ်ထောင်စု၏မိသားစုဝင်စုစုပေါင်း : _____ ဦး

No. (စဉ်)	1 (၁)	2(၂)	3(၃)	4(၄)	5(၅)	6(ခြောက်)
Relation to interviewee (1) ဖြေဆိုသူနှင့်တော်စပ်ပုံ(၁)	Interviewee ဖြေဆိုသူ					
Gender (2) ကျား/မ(၂)						
Year of Birth သက္ကရာဇ်						
Age အသက်						
Ethnicity (3) လူမျိုး(၃)						
Highest Educational Attainment (4) ပညာသင်ယူခဲ့သော အမြင့်ဆုံး အဆြေအနေ(၄)						
Marital status (5) အိမ်ထောင်ရေးရှိ/မရှိ(၅)						
Vulnerability (6) အားနည်းချက်(၆)						

(1) Relation to interviewee: 1. Spouse, 2. Son, 3. Daughter, 4. Father, 5. Mother, 6. Other (Specify)

(၁) ဖြေဆိုသူနှင့်တော်စပ်ပ - ၁.ဇနီး/ခင်ပွန်း၊ ၂.သား၊ ၃.သမီး၊ ၄.အဖေ၊ ၅.အမေ

(2) Gender: 1. Male, 2. Female, 3. Decline to state

(၂) ကျား/မ- ၁.ကျား၊ ၂.မ၊ ၃.မဖော်ပြချင်ပါ

(3) Ethnicity includes: (specify)

1. Kachin, 2. Kayah, 3. Kayin, 4. Chin, 5. Buma, 6. Mon, 7. Rakhine, 8. Shan, 9. Other (specify)

(၃) လူမျိုး - ၁.ကချင်၊ ၂.ကယား၊ ၃.ကရင်၊ ၄.ချင်း၊ ၅.ဗမာ၊ ၆.မွန်၊ ၇.ရခိုင်၊ ၈.ရှမ်း၊ ၉ .အခြား(ဖော်ပြပါ)_____

(4) Highest Educational attainment: 1. Kindergarten, 2. Primary school, 3. Junior High School, 4. Senior High school 5. College (Vocational, technical, trade), 6. University, 7. N/A

(၄) ပညာသင်ယူခဲ့သော အမြင့်ဆုံး အဆြေအနေ- ၁.မူကြို၊ ၂.မူလတန်းပညာ၊ ၃.အလယ်တန်းပညာ ၄.အထက်တန်းပညာ၊ ၅.ကောလိပ်(အလုပ်အကိုင်ဆိုင်ရာ၊ နည်းပညာပိုင်းဆိုင်ရာ၊ ကုန်သွယ်မှု ဆိုင်ရာ)၊ ၆.တက္ကသိုလ်၊ ၇. မဖြေပါ။

(5) Marital status 1. Never married, 2. Married, 3. Widowed, 4. Divorced, 5. Separated

(၅) အိမ်ထောင်ရှိ/မရှိ- ၁.အပျို/လူပျို၊ ၂.အိမ်ထောင်ရှိ၊ ၃.မုဆိုးဖို/မ၊ ၄.ကွာရှင်းထားသည်၊ ၅. ခွဲနေရသည်

(6) *Vulnerability includes: 1. Chronic or critical diseases, 2. Mentally disabled, 3.Elderly over 60 years old, without adult working household member, 4. Physically disabled, 5. Female household head with juvenile child, 6. Orphan, 7. Other (specify).*

(၆) အားနည်းချက်- ၁.နာတာရှည်ရောဂါများ (သို့) ဆိုးဝါးသောရောဂါများ၊ ၂.စိတ်ပိုင်းဆိုင်ရာ ချို့.ယွင်းမှု၊ ၃.အရွယ်ရောက်၍အလုပ်လုပ်သောမိသားစုဝင်မရှိသောအသက်၆၀ကျော်သက်ကြီး ရွယ်အို၊ ၄.ရုပ်ပိုင်းဆိုင်ရာချို့.ယွင်းမှု၊ ၅.အသက်ငယ်ရွယ်သောကလေးရှိကာမိန်းမဦးဆောင်သော အိမ်ထောင်စု၊ ၆.မိဘမဲ့ကလေး၊ ၇.အခြား(ဖော်ပြပါ)။

Q3. Please describe the occupation and working experience of each of your family members over 18 years old.

မေးခွန်း၃ အသက်၁၈နှစ်အထက်သင့်မိသားစုဝင်များ၏ အလုပ်အကိုင်နှင့် အတွေ့အကြုံ အသီးသီးကို ဖော်ပြပေးပါ။

No. of family member မိသားစုဝင် အရေအတွက်	Occupation အလုပ်အကိုင်	Skill /Experience ကျွမ်းကျင်မှု/ အတွေ့.အကြုံ	Location of work အလုပ်တည် နေရာ	Working time per year (months) တစ်နှစ် အလုပ်ချိန် (လဖြင့်)	Average monthly income လစဉ်ပျမ်းမျှ ဝင်ငွေ

(1) Occupation incudes: 1. Student, 2.Farmer, 3. Fisherman, 4. Wage employee, 5. Own business, 6.Day labor, 7.Retired, 8. Unemployed, 9. N/A (refers to those above 18 years old but without capacity to work.)

(၁) အလုပ်အကိုင် : ၁. ကျောင်းသူ/သား ၂. တောင်သူ ၃. တံငါသည် ၄. လခစားအလုပ်သမား
၅. ကိုယ်ပိုင်လုပ်ငန်းလုပ်ကိုင်သူ ၆. နေ့စား အလုပ်သမား ၇. အငြိမ်းစား ၈. အလုပ်လက်မဲ့ ၉. N/A (အသက် ၁၈နှင့် ပြည့်ပြီး အလုပ်မလုပ်နိုင်သူများ.)

(2) Skill/experience includes: 1. General construction, 2. Carpentry, 3. Cook, 4. Waiter/waitress in restaurant or supermarket, 5. Teacher, 6. Driver, 7. Vehicle/machinery maintenance, 8. Welding, 9. Electrician, 10. Manual labor, 11. House keeper, 12. O&G industry, 13. Hair dressing, 14. Nurse, 15. Doctor, 16. Government officer, 17. Security guard, 18. Trading/shop keeping, 19. Other (specify).

(၂) ကျွမ်းကျင်မှု/အတွေ့.အကြုံ : ၁. ဆောက်လုပ်ရေးလုပ်ငန်း ၂.လက်သမားလုပ်ငန်း
၃. အချက်အပြုတ်လုပ်ငန်း ၄. စားဆောက်ဆိုင်(သို့)စျေးတွင် စာပွဲထိုးခြင်းလုပ်ငန်း ၅. ကျောင်းဆရာ/မ
၆. ကားမောင်းခြင်း ၇. ယာဉ်ယန္တရားပြုပြင်ခြင်း ၈. ဂရိန်ဆော်ခြင်း ၉. လျှပ်စစ်လုပ်ငန်း ၁၀. ကျပန်း
၁၁. အိမ်သန့်.ရှင်းရေး ၁၂. လောင်စာဆီစက်ရုံ ၁၃. အလုပြင်လုပ်ငန်း ၁၄. သူနာပြု ၁၅. ဆရာဝန်
၁၆. အစိုးရဝန်ထမ်း ၁၇. လုံခြုံရေး ၁၈. ကုန်သည်လုပ်ငန်း ၁၉. အခြားလုပ်ငန်း

(3) Location of work: 1.Within Village Tract/ Ward, 2.Within Township, 3.Within Division, 4.Outside Division

(၃) အလုပ်တည်နေရာ : ၁) ကျေးရွာတွင်း/ရုပ်ကွက် ၂) မြို့နယ်တွင်း ၃) တိုင်းဒေသကြီးတွင်း ၄) အခြားတိုင်းဒေသတွင်း

Q4. Has anyone in the household received any formal vocational training or qualifications?
မေးခွန်း(၄) အိမ်ထောင်စုတွင်း အသက်မွေးဝမ်းကြောင်းဆိုင်ရာ သင်တန်းများ (သို့) တက်ဖူးပါသလား။

No. of Family Member မိသားစုအရေအတွက်						
Training/Qualifications (with certificate) သင်တန်း (အောင်လက်မှတ်ဖြင့်)						

(1) Certification includes: 1. Diver license, 2. Cooker certificate, 3. Accountant certificate, 4. Electrician certificate, 5. Welding certificate, 6. Teacher certificate, 7. Nurse license, 8. Doctor license, 9. Other (specify).
(၁) အောင်လက်မှတ် : ၁) ကားလိုင်စင် ၂) အချက်အပြုတ်သင်တန်းဆင်းလက်မှတ်
၃) စာရင်းကိုင်သင်တန်းဆင်းလက်မှတ် ၄) လျှပ်စစ်ကျွမ်းကျင်လက်မှတ် ၅) ဂရိန်ကျွမ်းကျင်လက်မှတ်
၆) ဆရာအတတ်သင်လက်မှတ် ၇) သူနာပြုလက်မှတ် ၈)ဆမလက်မှတ် ၉) အခြား

Q5. What languages do you speak?
မေးခွန်း(၅) မည်သည့်ဘာသာစကားပြောပါသနည်း။

□Myanmar (မြန်မာ) □ *Others (please specify)* ***အခြား*** _____

Q6. Can you read and write in any language?
မေးခွန်း(၆) အခြားဘာသာစကားကိုရေးတတ်/ဖတ်တတ်ပါသလား။

□Yes (ဖတ်/ရေးတတ်သည်) □No (မဖတ်/ရေးတတ်ပါ)

Please specify language…

Q7. How long have you lived in this village we are in now?
မေးခွန်း(၇) ဤရွာတွင်နေထိုင်သည်မှာဘယ်လောက်ကြာပြီလည်း။

□Less than one year (တစ်နှစ်အောက်) □2 to 5 years (၂ နှစ်မှ ၅ နှစ်အတွင်း)
□Over 5 years (၅နှစ် နှင့်အထက်) □Over 10 years (all life, born here)
၁၀ နှစ်နှင့်အထက် (မွေးစမှစ၍)

□ *Others (please specify)* ***အခြား*** _____

PART B: SOCIO-ECONOMIC INFORMATION

အပိုင်း(ခ) လူမှုစီးပွားရေးဆိုင်ရာအချက်အလက်များကောက်ယူခြင်း

Q8. Please list the land resources owned by the household

မေးခွန်း(၈) မြေယာပိုင်ဆိုင်မှုများကိုစာရင်းပြုစုပါ

	Paddy Field **လယ်မြေ** *(acre)* *(ဧက)*	*Dry land* **ခြောက်သွေ့မြေ** *(acre)* *(ဧက)*	Orchard **သီးစားခြံ** *(acre)* *(ဧက)*	Forest **သစ်တော** *(acre)* *(ဧက)*	Fishpond **ငါးကန်** *(acre)* *(ဧက)*	Others **အခြား (specify)** *(acre)* *(ဧက)*
Land Area *(acre)* *မြေဧရိယာ (ဧက)*						
Does the household have legal title to the land it occupies? မြေပိုင်ဆိုင်မှုတရားဝင်အထောက်အထားများရှိပါသလား။	☐ Yes, we hold title to all the land we occupy ရှိ၊ ပိုင်ဆိုင်သမျှအကုန်လုံး ☐ Yes, partial (please elaborate) _____ ရှိ၊ တစ်စိတ်တစ်ပိုင်း (အကျယ်ချဲ့၍) ☐ No, we are leasing it from another owner မရှိ၊ ပိုင်ရှင်ဆီမှငှားရမ်းထားခြင်း ☐ No, we occupy the land without formal title မရှိ၊ စာချုပ်စာတမ်းမရှိဘဲပိုင်ဆိုင်သည်					
Does the household engage in farming? လယ်ယာစိုက်ပျိုးခြင်းလုပ်ကိုင်ပါသလား။	☐ Yes (လုပ်ကိုင်သည်) ☐ No (မလုပ်ကိုင်ပါ) (If No, please go to Q10 directly). (မလုပ်ကိုင်ပါက မေးခွန်းနံပါတ်-၁၀)					
Is the farmland irrigated? လယ်မြေတွင်ရေသွင်းရန် ရေရရှိပါသလား။	☐ Yes (ရှိ) ☐ No (မရှိ) Specify proportion of irrigated farmland: _____ (ရေသွင်းရန်ရေရရှိသည့်အချိုးအစားဖော်ပြချက်)					

Q9. What are the main cash crops grown in this village? Specify yield/year

မေးခွန်း(၉) ဤရွာတွင်အဓိကအထွက်များသောသီးနှံမှာဘာလည်း။

☐ Paddy (စပါး)

☐ Beans (ပဲအမျိုးအမျိုး)

☐Betel nuts (ကွမ်း)

☐Mangoes (သရက်)

☐ *Others (please specify)* ***အခြား***

_____

Q10. What kind of livestock do household members own?

မေးခွန်း(၁၀) မည်သည့်တိရစ္ဆာန်မွေးမြူသနည်း။

What kind of livestock do household members own? မည်သည့်တိရစ္ဆာန်မွေးမြူထားသနည်း။	☐Pig (ဝက်) ☐Chicken (ကြက်) ☐Goats (ဆိတ်) ☐Cattle (ကျွဲ ၊ နွား) ☐Sheep (သိုး) ☐Others (please specify) **အခြား**_____
How the livestock are used? မွေးမြူရေးကိုမည်သို့ အသုံးပြုသနည်း။	☐Milk (**နို့**) ☐Meat (**အသား**) ☐Others (Specify) **အခြား** :_____
Is livestock used for self-consumption or sale? မွေးမြူရေးကို စားသုံးခြင်း (သို့မဟုတ်) ရောင်းချခြင်းများ ပြုလုပ်ပါသလား။	☐Self-Consumption **ကိုယ်တိုင်စားသုံးခြင်း** ☐Sale **ရောင်းချခြင်း** ☐Both **နှစ်မျိုးစလုံး**
If sale, total income from livestock. ရောင်းချခဲ့လျှင်, စုစုပေါင်းဝင်ငွေ ဘယ်လောက်ရပါသလဲ။	_____

Q11. Does the household engage in fishing?

မေးခွန်း(၁၁) ငါးဖမ်းလုပ်ငန်းလုပ်ကိုင်ပါသလား။

Does the household engage in fishing? ငါးဖမ်းလုပ်ငန်းလုပ်ကိုင်ပါသလား။	☐ *Yes, for household consumption only* လုပ်ကိုင်သည်၊ အိမ်တွင်းစားသုံးရန် ☐ *Yes, for household consumption and for sale* *လုပ်ကိုင်သည်၊ အိမ်တွင်းစားသုံးရန်နှင့် ရောင်းရန်* ☐ *No (If No, please go to Q12 directly).* *မလုပ်ကိုင်ပါ (မလုပ်ကိုင်ပါက မေးခွန်းနံပါတ်-၁၂)*
How regularly do you/they go fishing? ငါးဖမ်းနေ့တိုင်းသွားသလား။	☐ *Daily* (***နေ့စဉ်***) ☐ *Every few days (**ရက်အနည်းငယ်ခြားချီ**)* ☐ *Once a week* (***တစ်ပတ်တစ်ကြိမ်***) ☐ *Others (Specify) **အခြား*** :_____
What method do they use to collect fish? ငါးဖမ်းရာတွင် မည်သည့်နည်းကို အသုံးပြုပါသနည်း။	☐ *Hook and Line (**ငါးမျှားချိတ်**)* ☐ *Drift Netting (**ပိုက်ကွန်**)* ☐ *Fish Trap (**ငါးဖမ်းသောပြွန်**)* ☐ *Potting (**ပုဇွန်ဖမ်းသောပြွန်**)* ☐ *Gillnetting (**ဆွဲပိုက်**)* ☐ *Others (Specify) **အခြား*** :_____
Where is the fishing ground? ငါးဖမ်းခြင်းကိုဘယ်မှာလုပ်လည်း။	☐ Yangon River (**ရန်ကုန်မြစ်**) Bago River (**ပဲခူးမြစ်**) ☐ *Others (Specify) **အခြား*** :_____

Does the household engage in fishing? ငါးဖမ်းလုပ်ငန်းလုပ်ကိုင်ပါသလား။	☐ *Yes, for household consumption only* လုပ်ကိုင်သည်၊ အိမ်တွင်းစားသုံးရန် ☐ *Yes, for household consumption and for sale* *လုပ်ကိုင်သည်၊ အိမ်တွင်းစားသုံးရန်နှင့် ရောင်းရန်* ☐ *No (If No, please go to Q12 directly).* *မလုပ်ကိုင်ပါ (မလုပ်ကိုင်ပါက မေးခွန်းနံပါတ်-၁၂)*
What fish or other species are you/they looking to catch mostly? မည်သည့်အမျိုးအစားကို အများဆုံးတွေ့ရှိရသနည်း။	☐ *Catfish* (***ငါးခူ***) ☐ *Shrimp / Prawn* (***ပုဇွန်အသေး၊ပုစွန်ထုပ်***) ☐ *Eel* (**ငါးရှဉ့်**) ☐ *Others (Specify)* ***အခြား*** :_____
What's the average fish catch per season? တစ်ရာသီကို ပျမ်းမျှ ငါး မည်မျှ ဖမ်းမိပါသလဲ။	_____kgs/year (ကီလိုဂရမ်/ နှစ်)

Q12. Non Timber Forest Product

မေးခွန်း(၁၂) အခြားသစ်တောထွက်ပစ္စည်းများ

Does the household engage in the collection of forest products? သစ်တောထွက်ပစ္စည်းများစုဆောင်းခြင်း ရှိပါသလား။	☐ *Yes, for household consumption only* ရှိ၊ အိမ်တွင်းသုံးစွဲရန် ☐ *Yes, for household consumption and for sale* *ရှိ၊ အိမ်တွင်းသုံးစွဲရန် နှင့် ရောင်းချရန်* ☐ *No (If No, please go to Q13 directly).* *မရှိ (မရှိပါက မေးခွန်းနံပါတ်-၁၃)*
Non-timber Forest Product အခြားသစ်တောထွက်ပစ္စည်းများ	☐Nuts (အခွံမာသီး) ☐Seeds (သစ်စေ့) ☐Mushrooms (မှို) ☐Medicinal plants (ဆေးဖက်ဝင်အပင်) ☐Fuelwood (ထင်း) ☐Others (Specify) အခြား :_____
How regularly do you/they go to the forest? တောထဲသို့ မည်သို့သွားလေ့ရှိသနည်း။	☐Daily (နေ့စဉ်) ☐Every few days (ရက်အနည်းငယ်ခြား၍) ☐Once a week (တစ်ပတ်တစ်ကြိမ်) ☐Others (Specify) အခြား :_____
Where is the forest? သစ်တောကဘယ်နားမှာရှိသနည်း။	☐ Yangon River (ရန်ကုန်မြစ်) Bago River (ပဲခူးမြစ်) ☐Others (Specify) အခြား :_____

Q13. Does the household have private business?

မေးခွန်း(၁၃) ကိုယ်ပိုင်စီးပွားလုပ်ကိုင်ပါသလား။

Do you have private business? ကိုယ်ပိုင်စီးပွားလုပ်ကိုင်ပါသလား။	☐Yes (လုပ်ကိုင်သည်) ☐No (မလုပ်ကိုင်ပါ) If yes, since when? လုပ်ကိုင်ပါက ဘယ်အချိန်မှစလုပ်ကိုင်စားသောက်သနည်း : _____
Where are you doing business? စီးပွားရေးလုပ်ငန်းကို မည်သည့်နေရာတွင် လုပ်ကိုင်သနည်း။	☐Within the village/ ward (ကျေးရွာ/ ရပ်ကွက်အတွင်း) ☐Within the township (မြို့နယ်အတွင်း) ☐Within the District (ခရိုင်အတွင်း) ☐Out of the District (အခြားခရိုင်)
If so, what kind of business you are operating? ထို့အပြင် မည်သည့်စီးပွားရေးလုပ်ကိုင်စားသောက်သနည်း။	☐Livestock raising (မွေးမြူရေးလုပ်ငန်း) ☐Dried fish (ငါးခြောက်လုပ်ငန်း) ☐Farming (လယ်ယာလုပ်ငန်း) ☐Shops/market (ကုန်သွယ်လုပ်ငန်း) ☐Fishing/fish farming (ငါးဖမ်းလုပ်ငန်း) ☐Taxi/Motor bike taxi (မော်တော်ယာဉ်လုပ်ငန်း) ☐Machine maintenance (စက်ပြင်လုပ်ငန်း) ☐Restaurant/Tea House (စားသောက်ကုန်လုပ်ငန်း) ☐Teakwood (သစ်လုပ်ငန်း) ☐Others (Specify) အခြား :_____

Q14. Does the household have informal mining activities?

မေးခွန်း (၁၄) တရားမဝင်သတ္တုတူးဖော်ခြင်းများ လုပ်ဆောင်ပါသလား။

Do you have informal mining activities? ***တရားမဝင်သတ္တုတူးဖော်ခြင်းများ လုပ်ဆောင်ပါသလား။***	☐Yes (တူးဖော်သည်) ☐No (မတူးဖော်ပါ) If yes, since when?: တူးဖော်ပါက မည်သည့်အချိန်မှ စ၍ တူးဖော်ပါသနည်း။ _____
Where are you doing informal mining activities? မည်သည့်နေရာတွင် တရားမဝင်သတ္တုတူးဖော်ခြင်းများ လုပ်ဆောင်ပါသနည်း။	☐ *Within the* village (ကျေးရွာအတွင်း) ☐Within the township (မြို့နယ်အတွင်း) ☐Within the District (ခရိုင်အတွင်း) ☐Out of the District (အခြားခရိုင်)
If so, what kind of informal mining activities you are operating?	☐ *Gold* ☐ *Tin* ☐ *Tantalum* ☐ *Others (Specify)*:_____

Q15. Please describe your household's assets and utilities

မေးခွန်း(၁၅) ပိုင်ဆိုင်မှုနှင့် အသုံးပြုမှုများကို ဖော်ပြပါ။

Item(အမျိုးအစား)	Quantity(အရေအတွက်)	Item(အမျိုးအစား)	Quantity(အရေအတွက်)
Digital TV (တီဗွီ)		*Tractor (ထွန်စက်)*	
		Car (ကား)	
Jewellery (လက်ဝတ်ရတနာများ)		*Other types of Vehicle (e.g. van and truck) အခြားယာဉ်အမျိုးအစား (ဥပမာ-ဗမ်၊ထရက်)*	
Cell phone (ဖုန်း)		*Refrigerator (ရေခဲသေတ္တာ)*	
Landline (အိမ်ဖုန်း)		*Flush Toilet (ယင်လုံအိမ်သာ)*	☐Yes ☐No *(ရှိ) (မရှိ)*
Air Conditioner (လေအေးပေးစက်)		*Tap Water (ဘုံပိုင်ရေ)*	☐Yes ☐No (ရှိ) (မရှိ)
Laundry Machine (အဝတ်လျှော်စက်)		*Electricity (လျှပ်စစ်)*	☐Yes ☐No (ရှိ) (မရှိ)
Sewing Machine (အပ်ချုပ်စက်)		*Gas (ဂက်စ်)*	☐Yes ☐No (ရှိ) (မရှိ)
Gas Cooker (ဂက်စ်မီးဖို)		*Internet (အင်တာနက်)*	☐Yes ☐No (ရှိ) (မရှိ)
Motorbike (ဆိုင်ကယ်)		*Paved road access to home (ကျောက်ခင်းလမ်း)*	☐Yes ☐No (ရှိ) (မရှိ)

Q16. What is your household's income per year from different sources? (Please complete all appropriate)?

မေးခွန်း(၁၆) တစ်နှစ်လျှင် မည်မျှဝင်သနည်း။ (သြဇာရှိစွာဖြည့်စွက်ရန်)

Income Source (ဝင်ငွေရရှိမှု)	Ks/Year (ကျပ်/နှစ်)
Crop farming (သီးနှံစိုက်ပျိုးခြင်း)	
Fishing/ Fish Farming (ငါးဖမ်းလုပ်ငန်း၊ငါးမွေးမြူခြင်း)	
Livestock raising (မွေးမြူရေးလုပ်ငန်း)	
Forestry (သစ်တောလုပ်ငန်း)	
Business (စီးပွားရေးလုပ်ငန်း)	
Local Wage Employment (ဒေသတွင်းနေ့စားလုပ်ငန်း)	
Part time job (အချိန်ပိုင်းလုပ်ငန်း)	
Government Assistance (pension or other government benefits) အစိုးရအထောက်အပံ့ (အငြိမ်းစား သို့ အခြားအခွင့်ရေးများ)	
Other (အခြား)	

Q17. Other income

မေးခွန်း(၁၇) အခြားဝင်ငွေရရှိမှု

Does the household receive any remittances / money from anyone who lives elsewhere? **တခြားတစ်နေရာမှ ငွေလွှဲများလက်ခံရရှိပါသလား။**	☐ *Yes* (ရှိ) ☐ *No* (မရှိ) *If No, please go to Q18.* မရှိပါက မေးခွန်းနံပါတ်-၁၈
Does he/she currently have paid employment in or outside the local area? ***ဒေသအတွင်း နှင့် အပြင်တွင် တာဝန်ထမ်းဆောင်သူရှိပါသလား။***	☐ *In the local area (ဒေသတွင်း)* ☐ *Outside the local area (Please specify):_____* *(ဒေသအပြင်ဘက်)*
Who has employed the member of your household? ***သင့်မိသားစုတွင်းမည်သူ အလုပ်ခန့်.သနည်း။***	☐ *Government (အစိုးရ)* ☐ *Others အခြား* :_____
How much does the household receive any remittances / money from anyone who lives elsewhere? ***တခြားတစ်နေရာမှ ငွေလွှဲများဘယ်လောက် လက်ခံရရှိပါသလား။***	_____Ks/Year (ကျပ်/နှစ်)

Q18. What is your household's expenditure per year?

မေးခွန်း(၁၈) တစ်နှစ်အသုံးစရိတ်ကိုဖော်ပြပါ။

Item* (အမျိုးအစား)	(Ks/Year) (*ကျပ်/နှစ်*)	Item (အမျိုးအစား)	(Ks/Year) (*ကျပ်/နှစ်*)
Expenditure for the household members living in the village/ ward ကျေးရွာ/ ရပ်ကွက်တွင်းရှိအိမ်ထောင်စုများ၏အသုံးစရိတ်		*Transportation* *လမ်းပန်း ဆက်သွယ်ရေး*	
Farming cost (e.g. fertilizer, pesticides, feeds, seeds, irrigation etc.) *မြေယာလုပ်ငန်း(ဥပမာ- မြေဩဇာ၊ပိုးသတ်ဆေး၊ မြေစာ၊ဘိုးစေ့၊ရေရရှိရန်ရေပို့ချခြင်း.အစရှိသဖြင့်)*		*Food* *အစားအသောက်*	
Fishing costs *ငါးဖမ်းလုပ်ငန်း*		*Donations* *အလှူအတန်း*	
Livestock input *တိရစ္ဆာန်မွေးမြူရေး*		*Others, specify* (1) အခြား(၁)	
Forestry production costs *သစ်တောထုတ်လုပ်ခြင်း*			
Business costs *စီးပွားရေး*			

Item* (အမျိုးအစား)	(Ks/Year) (ကျပ်/နှစ်)	Item (အမျိုးအစား)	(Ks/Year) (ကျပ်/နှစ်)
Housing *နေထိုင်မှု*			
Medical care *ကျန်းမာရေး*			
Education *ပညာရေး*			
Family ceremonies (wedding/festivals) *မိသားစု အခမ်းအနား (မင်္ဂလာပွဲ/ ပျော်ပွဲရွှင်ပွဲ)*			

(1) Other expenditure incudes: 1. Soft drink e.g. Ranger etc., 2. Cigarettes, 3. Alcohol (homebrew), 4. Sugar/ Salt, 5. Lollies/sweets, 6. Others

(၁) အခြားအသုံးစရိတ် ၁) အချိုရည် (Ranger) ၂) စီးကရက် ၃) အရက် (ချက်အရက်)
၄) သကြား၊ဆား ၅) ရေခဲချောင်းလုပ်ငန်း ၆) အခြား

Q19. If the annual net income is obviously negative, what are the underlying reasons for this? (Please tick all the appropriate(s))

မေးခွန်း(၁၉) နှစ်စဉ်ဝင်ငွေကို မည်သည့်အကြောင်းတို့ကြောင့်သုံးစွဲပါသနည်း။

☐Medical expenses
ကျန်းမာရေးအသုံးစရိတ်

☐Housing expenses
အိမ်အသုံးစရိတ်

☐Educational expensesပညာရေးအသုံးစရိတ်

☐Others အခြား (please specify)_____

Q20. Do you have a bank account? သင့်တွင်ငွေစုစာအုပ်ရှိပါသလား။

☐Yes ရှိ

☐No မရှိ

Q21. Credit Facility ချေးငွေပံ့ပိုးမှု

Has the household accessed credit/borrowed money in the last 12 months?လွန်ခဲ့သည့်၁၂လအတွင်း ငွေချေးထားသည့်အကြွေးရှိပါသလား။	☐ *Yes* ရှိ ☐ *No* မရှိ *If No, please go to Q22.* မရှိပါက-မေးခွန်းနံပါတ်၂၂
Credit Sources in the village ရွာတွင်းရှိအကြွေးယူသည့်နေရာ	☐ *Bank* ဘဏ် ☐ *Informal credit* တရားမဝင်သောအကြွေး ☐Family မိသားစု ☐Friends/ Neighbours မိတ်ဆွေ/အိမ်နီးချင်း ☐Others (Specify):အခြား :_____
Why people borrow money? အဘယ့်ကြောင့်ငွေချေးရသနည်း။	☐ *For field preparation* လယ်ယာမြေပြင်ဆင်ရန် ☐For Business စီးပွားရေးပြုလုပ်ရန် ☐For marriage လက်ထပ်ပွဲပြုလုပ်ရန် ☐For house construction အိမ်ပြင်ဆောက်ရန် ☐ *Others* *(Specify)*:အခြား :_____
What is the interest rate? အတိုးနှုန်းမည်မျှနည်း။	☐_____%per year တစ်နှစ်လျှင်_____ရာခိုင်နှုန်း ☐No interest အတိုးမပေးရပါ
Have you repaid any loan? ချေးငွေ ပြန်ဆပ်ပြီးပြီလား။	☐Yes, _____% ပြန်ဆပ်ပြီး_____% ☐No ပြန်မဆပ်ရသေးပါ

Q22. Markets ဈေး

Name the markets that you normally go to buy or sell goods ဈေးဟယ် (သို့) ဈေးရောင်း သွားလေ့ ရှိသော ဈေးအမည် ကို ဖော်ပြပါ	☐_____
What do you sell at the market? ဈေးတွင် ဘာရောင်းသနည်း။	☐Fish ငါး ☐Rice ဆန် ☐Others (Specify)အခြား:_____
What do you purchase at the market?ဈေးတွင်ဘာဟယ်သနည်း။	☐ *Fish* ငါး ☐Rice ဆန် ☐Others (Specify)အခြား:_____

Name the markets that you normally go to buy or sell goods ဈေးဝယ် (သို့) ဈေးရောင်း သွားလေ့ ရှိသော ဈေးအမည် ကို ဖော်ပြပါ	□_____
How often do you normally go to these markets to buy or sell goods? ထိုဈေးသို့ ကုန်ပစ္စည်း ဝယ်ခြင်း (သို့ ဧ)ရောင်းခြင်းကို မည်သို့သွားသနည်း။	□Daily နေ့စဉ် □Every few days ရက်အနည်းငယ်ကြာသော် □Once a week တစ်ပတ်လျှင်တစ်ကြိမ် □Others (Specify) အခြား :_____

Q23. Are you a regular member (actively participating on a weekly basis) of any of the following organisations? သင်သည်အောက်ပါအဖွဲ့ အစည်းများ၏ အဖွဲ့ ဝင်ဖြစ်ပါသလား(အပတ်စဉ်လုပ်ရှားမှုများတွင်တက်ကြွစွာပါဝင်ခြင်း)

□ *Monastery* ဘုန်းကြီးကျောင်း

□Fishing Group ရေလုပ်ငန်းအဖွဲ့

□Youth Group လူငယ်အဖွဲ့

□Sports team အားကစားအဖွဲ့

□Women's group အမျိုးသမီးအဖွဲ့

□Others (please specify)အခြား _____

PART C HOUSING INFORMATION အိုးအိမ်အချက်အလက်

Q24. Housing condition အိုးအိမ်အခြေအနေ

No. of Floors အထပ် အရေအတွက်	No. of Rooms အခန်း အရေအတွက်	House Structure အိမ်တည်ဆောက်ပုံ	Year of Construction ဆောက်လုပ်သည့် နှစ်	Year of latest renovation ပြန်ပြင်သည့်နှစ်	Ownership ပိုင်ဆိုင်မှု
		□ Wood သစ် □ Brick-Wood အုတ်-သစ် □ Brick-Concrete အုတ်-ဘိလပ်မြေ □Con Concrete သံကူကွန်ကရစ်			□ Owned အိမ်ပိုင် □ Rented အိမ်ငှား □ Other (specify) အခြား_____

PART D HEALTH PROFILE ကျန်းမာရေးရှုထောင့်

Q25. Please describe the health condition of family members listed in Q1.

ကျေးဇူးပြု၍ မေးခွန်းနံပါတ်၁တွင်ဖြေကြားခဲ့သော သင့်မိသားစုဝင်များ၏ ကျန်းမာရေး အခြေအနေကိုဖော်ပြပါ။

No. of Family Member မိသားစုဝင်အရေအတွက်						
Health Status (1) *ကျန်းမာရေးအခြေအနေ*						
Diseases had in the last 6 month (2) *လွန်ခဲ့သည့်ဖိလအတွင်းရှိခဲ့သည့်ရောဂါများ*						

(1) Health status: *1. Good, 2. neither poor nor good, 3. Poor.*

ကျန်းမာရေးအခြေအနေ : ၁.ကောင်း၊ ၂.သင့်၊ ၃. ညံ့

(2) Diseases: *1. Diarrhoea, 2. Malaria, 3. Skin rash/itches, 4. Respiratory tract infection (cold, cough etc.) 5. Cholera 6. Tuberculosis 7. Sexually transmitted infection 8. HIV/AIDS 9. High blood pressure 10. Common Fever 11. Others (Specify).*

ရောဂါများ : *၁. ဝမ်းလျှောရောဂါ၊ ၂. ငှက်ဖျားရောဂါ၊ ၃.အရေပြားယားယံခြင်း/အင်ပြင်၊ ၄.အသက်ရှူလမ်းကြောင်းပိုးဝင်ခြင်း (အအေးမိ၊ချောင်းဆိုး အစရှိသဖြင့်)၊ ၅.ကာလဝမ်းရောဂါ၊ ၆.အဆုတ်နာရောဂါ၊ ၇.လိင်မှတစ်ဆင့်ကူးစက်သောရောဂါ၊ ၈. HIV/AIDS၊ ၉.သွေးတိုးရောဂါ၊ ၁၀.အဖျားရောဂါ၊ ၁၁.အခြား*

Q26. How many times did you have diarrhoea on average last year?
လွန်ခဲ့သည့်နှစ်များတွင် ဝမ်းလျှောရောဂါ ဘယ်နှစ်ကြိမ်ဖြစ်ပွားခဲ့သနည်း။

☐ *None မရှိ* ☐ *Once တစ်ကြိမ်* ☐ *2-3 times ၂-၃ ကြိမ်* ☐ *4 times or more လေးကြိမ် (သို့) လေးကြိမ်နှင့် အထက်*

Q27. Have you recently consulted a doctor? If Yes, when was it?
မကြာသေးခင်က ဆရာဝန်ထံတွင် ကုသခဲ့ဖူးပါသလား။ ကုသခဲ့ဖူးပါက ဘယ်အချိန်ကနည်း။
☐ *Yes, ကုသခဲ့ဖူးပါက*_____ ☐ *No မကုသခဲ့ဖူးပါ*

Q28. Where does your family usually go to see a doctor when you are sick?
နေထိုင်မကောင်းပါက မည်သည့်နေရာသို့သွားရောက်ကုသလေ့ရှိပါသနည်း။

Types of medical institution	Travelling Method
☐ *Rural/ Sub-rural* Health Center* ဒေသတွင်း ကျန်းမာရေးဌာန	*Distance__km အကွာအဝေး* _____*ကီလိုမီတာ* *Travel:* ☐ *By foot ခြေလျင်* ☐ *By motor bike ဆိုင်ကယ်* ☐ *bus/car ဘတ်စ်/ကား* ☐ *Other အခြား*_____

Types of medical institution	Travelling Method
☐ *Traditional/Private/Mobile* Clinic* တိုင်းရင်းဆေးခန်း/အပြင်ဆေးခန်း	*Distance km အကွာအဝေး* *_____ကီလိုမီတာ* *Travel: ☐By foot ခြေလျင်* *☐By motor bike ဆိုင်ကယ်* *☐bus/car ဘတ်စ်/ကား* *☐ Other အခြား_____*
☐ *Township/Station* Hospital* မြို့နယ်ဆေးရုံ	*Distance km အကွာအဝေး* *_____ကီလိုမီတာ* *Travel: ☐By foot ခြေလျင်* *☐By motor bike ဆိုင်ကယ်* *☐bus/car ဘတ်စ်/ကား* *☐ Other အခြား_____*
☐ *Other (please specify)*_____ အခြား _____	

**Please delete as appropriate*

Q29. Please provide the information for water use
ရေအသုံးပြုမှု

1. Drinking Water
၁. သောက်ရေ

Water Sources ***ရေအရင်းအမြစ်***	☐ *Tap water ဘုံပိုင်ရေ* ☐ *Well (please indicate well depth:__m)* *ရေတွင်း (အနက် _____မီတာ)* ☐ *Spring ရေတွင်း* ☐ *Reservoir ရေလှောင်ကန်* ☐ *Pond ရေကန်* ☐ *Yangon River (ရန်ကုန်မြစ်)* *Bago River (ပဲခူးမြစ်)* ☐ *Others အခြား* :_____
If water is not supplied to the household, how far is the nearest water source? ရေမလာပါက အနီးဆုံးရေအရင်းအမြစ်နှင့် မည်မျှဝေးသနည်း။	*Distance km အကွာအဝေး _____ကီလိုမီတာ* *Travel: ☐By foot ခြေလျင်* *☐By motor bike ဆိုင်ကယ်* *☐bus/car ဘတ်စ်/ကား* *☐ Other အခြား_____*
Availability of water supply ရေပေးဝေမှုအခြေအနေ	☐ *Sufficient လုံလောက်သည်* ☐*Insufficient မလုံလောက်ပါ*

	If insufficient, please state the period of insufficiency *မည်သည့်လများတွင် မလုံလောက်သနည်း။* _____
Water Quality *ရေအရည်အသွေး*	□ *Good ကောင်း* □ *Fair သင့်* □ *Odorous အနံ့ရှိ* □ *Dirty ညစ်ပတ်* □ *Other comments* *အခြားဖော်ပြချက်:*

2. Other Water Use

၂. အခြားရေသုံးစွဲမှု

Does the household use the same source for drinking water and for water for domestic use (e.g. washing, livestock raising) **သောက်ရေနှင့် သုံးရေကို တစ်နေရာထဲမှ သုံးစွဲပါသလား။** (ဥပမာ-အဝတ်လျှော်ခြင်း၊မွေးမြူရေး)	□ *Yes* ရှိ □ *No* မရှိ *If Yes, please go to* ***Q30.*** *သုံးစွဲပါက မေးခွန်းနံပါတ်-၃၀*
Water sources *ရေအရင်းအမြစ်*	□ *Tap water ဘုံပိုင်ရေ* □ *Well (please indicate well depth:__m)* *ရေတွင်း (အနက်_____မီတာ)* □ *Spring စမ်းရေ* □ *Reservoir ရေလှောင်ကန်* □ *Pond ရေကန်* □ *Yangon River (ရန်ကုန်မြစ်)* *Bago River (ပဲခူးမြစ်)* □ *Others အခြား* :_____
Availability of water supply *ရေရရှိမှုအခြေအနေ*	□ *Sufficient* လုံလောက်သည် □Insufficient မလုံလောက်ပါ If insufficient, please state the period of insufficiency မည်သည့်လများတွင် မလုံလောက်သနည်း။ _____ _____
Water Quality *ရေအရည်အသွေး*	□Good ကောင်း □Fair သင့် □Odorous အနံ့ရှိ □Dirty ညစ်ပတ် □Other comments အခြားဖော်ပြချက်:
Type of Latrine, then please specify *အိမ်သာအမျိုးအစား*	□ Dry pit Latrine ယင်လုံအိမ်သာ □ Pour flush latrine(septic tank)ရေလောင်းအိမ်သာ (မိလ္လာကန်) □ Flush latrine (u/g sewer connection) □ Open defecation (တွင်းဖွင့်)

PART E: ACCESS TO INFRASTRUCTURE & ENERGY

Q30. Irrigation Water Availability
ရေသွင်းရန်ရေရရှိမှု

Does your household's farmland get irrigation water **အိမ်ထောင်စု၏စိုက်ပျိုးမြေအတွက် ရေသွင်းရန်ရေရရှိပါသလား။**	☐ *Yes* ရှိ ☐ *No* မရှိ *If No, please go to Q31.* *မရှိပါက မေးခွန်းနံပါတ်-၃၁*
Irrigation Water sources ***ရေသွင်းရန်ရေရရှိနိုင်သည့်အရင်းအမြစ်***	☐Public *Well (please indicate well depth:__m)* *ဘုံပိုင်တွင်း (အနက်_____မီတာ)* ☐Private *Well (please indicate well depth:__m)* *ကိုယ်ပိုင်တွင်း (အနက်_____မီတာ)* ☐ *Spring စမ်းရေ* ☐ *Reservoir ရေလှောင်ကန်* ☐ *Pond ကန်ရေ* ☐ *River မြစ်ရေ* ☐ *Others အခြား* :_____
Irrigation Channels ***ရေသွင်းရန်ရေရရှိသည့်ရေမြောင်း***	☐Private ကိုယ်ပိုင် ☐ *Communal အများပိုင်* ☐ *Open Trench အဖုံးပါသောမြောင်း* ☐ *Covered Trench အဖုံးမပါသောမြောင်း* ☐ *Pipes ပိုက်လိုင်း* ☐ *Others အခြား* :_____
Availability of water supply ***ရေရရှိမှုအခြေအနေ***	☐Sufficient လုံလောက်သည် ☐Insufficient မလုံလောက်ပါ If insufficient, please state the period of insufficiency မည်သည့်လများတွင် မလုံလောက်သနည်း။ _____
Water Quality ***ရေအရည်အသွေး***	☐Good ကောင်း ☐Fair သင့် ☐Odorous အနံ့ရှိ ☐Dirty ညစ်ပတ် ☐Other comments အခြားဖော်ပြချက်:

Q31. Traffic

What is the main mode of transport in the village **ရွာတွင် မည်သည့် သယ်ယူပို့ဆောင်ရေးသည် အဓိကဖြစ်သနည်း။**	☐ *By bike စက်ဘီး* ☐ *By motor bike ဆိုင်ကယ်* ☐ *By foot ခြေလျင်* ☐ *Other (Please specify)* *အခြား* :_____
How do you usually travel to other places from your village? **ရွာမှအခြားသို့ မည်သို့သွားလေ့ရှိသနည်း။**	☐ *By shuttle bus ကြိုး/ပို့ ယာဉ်* ☐ *By motor bike ဆိုင်ကယ်* ☐ *By foot ခြေလျင်* ☐ *By van operated by other villagers*

	အခြားရွာများသို့ပြေးဆွဲသည့်အလုံပိတ်ဝ မ်တော်ယာဉ် *□ Other (Please specify)* *အခြား :_____*
How often do you travel out of the village? **ရွာမှဘယ်နှစ်ကြိမ်သွားလေ့ရှိသနည်း။**	*□ Daily နေ့စဉ်* *□ Every few days ရက်အနည်းငယ်ကြာသော်* *□ Once a week တစ်ပတ်တစ်ကြိမ်* *□ Others (Specify) အခြား :_____*
How long does it take to travel to the nearest market? **အနီးဆုံးဈေးသို့သွားလျှင် ဘယ်လောက်ကြာသနည်း။**	*Distance__km* အကွာအဝေး _____ ကီလိုမီတာ *Travel: □ By foot ခြေလျင် □ By motor bike ဆိုင်ကယ်* *□ bus/car ဘတ်စ်ကား □ Other အခြား_____* How long does it take *(Specify)* *ကြာချိန် :_____*
Road surface **လမ်းအမျိုးအစား**	*□ Dirt မြေသားလမ်း □ Stone ကျောက်ခဲင်းလမ်း* *□ Asphalt ကတ္တရာလမ်း □ Concrete ကွန်ကရစ်လမ်း* *□ Other (Please specify)* *အခြား :_____*
Would people say the overall quality and condition of the area's transportation system is good, fair, or poor? လမ်းပန်းဆက်သွယ်ရေးအခြေအနေသည် ကောင်းမွန်၊ အသင့်အတင့် ၊ ညံ့ ပါသလား။	*□ Good ကောင်းသည် □ Fair အသင့်အတင့် □ Poor မကောင်းပါ* *□ Other comments အခြားဖော်ပြချက် :* _____

Q32. Do you have distributed (grid) electricity access?
မီးရရှိပါသလား။

□ *Yes ရှိ* □ *No မရှိ*

If "Yes", specify daily duration of grid electricity access: _____*hours/day*
ရရှိပါက လျှပ်စစ်မီး နေ့စဉ်သုံးစွဲသည့်အချိန် : တစ်ရက်လျှင်_____နာရီ

Q33. What fuel do you generally use for domestic use?

What type of fuel do you use for cooking? **ဟင်းချက်ရာတွင် မည်သည့်လောင်စာကို အသုံးပြုသနည်း။**	*□ Wood ထင်း □ Charcoal မီးသွေး* *□ Gas, CNG, LPG ဂက်စ် □ Kerosene ရေနံဆီ*

	□ *Other (Please specify) အခြား* _____
What type of fuel do you use for other household activities (e.g. lightening)? **အခြားအိမ်ထောင်စုများအတွက် မည်သည့်လောင်စာကိုအသုံးပြုသနည်း။(ဥပမာ-အလင်းရောင်ပေးခြင်း)**	□Wood ထင်း □Charcoal မီးသွေး □Gas, CNG, LPG ဂက်စ် □Kerosene ရေနံဆီ □Other (Please specify) အခြား _____
Where is the fuel sourced from? **လောင်စာကိုမည်သည့်နေရာမှ ရရှိသနည်း။**	□Within the village/ ward ကျေးရွာ/ရပ်ကွက်အတွင်းမှ □Outside the village/ ward ကျေးရွာ/ရပ်ကွက် ပြင်ပမှ (Please specify) _____

Q34. ***Do you have mobile telephone signal coverage?***
တယ်လီဖုန်းဆက်သွယ်ရေးရှိပါသလား။

□ *Yes ရှိ* □ *No မရှိ*

Q35. ***How and where household waste is disposed?***
အမှိုက်များကို မည်သည့်နေရာတွင် မည်သို့ စွန့်ပစ်သနည်း။

How household waste is disposed? **အမှိုက်များကိုမည်သို့စွန့်ပစ်သနည်း။**	□ *Burn မီးရှို့ခြင်း* □ *Land field မြေမြှုပ်ခြင်း* □ *Other (Please specify) အခြား* _____
Where household waste is disposed? **အမှိုက်များကို မည်သည့်နေရာတွင် စွန့်ပစ်သနည်း။**	□ *Within household အိမ်ခြံဝင်းတွင်း* □ *In the village/ ward ရွာ/ ရပ်ကွက်တွင်း* □ *Other (Please specify) အခြား* _____

PART F: ***UNDERSTANDING AND PERCEPTIONS OF THE PROJECT***

စီမံကိန်းအကြောင်းသိရှိမှု နှင့် အမြင်သဘောထား

Q36. ***Have you heard of the Project?***
စီမံကိန်းအကြောင်းကြားဖူးပါသလား။

□ *Yes ကြားဖူးသည်* □ *No မကြားဖူးပါ*

**** If "No", this is the end of the Survey*
မကြားဖူးပါက မေးမြန်းခြင်းပြီးဆုံးသည်။

Q37. ***What have you heard about the Project?*** *(Record up to three concepts)*
စီမံကိန်းနှင့်ပတ်သက်၍ ဘာများသိထားပါသနည်း။ (ထင်မြင်ချက်သုံးခုနှင့်အထက်)

_____

_____

_____

Q38. ***Where did you hear about the project?*** *(Tick all appropriate)*

စီမံကိန်းအကြောင်းမည်သည့်နေရာမှကြားခဲ့သနည်း။ (အမှန်ခြစ်ပါ)

☐ *Government (အစိုးရ)*

☐ *Village Leaders (လူထုအဖွဲ့ ခေါင်းဆောင်)*

☐ *Friends/ Neighbours* သူငယ်ချင်း။အိမ်နီးချင်းများ

☐ *Newspaper (သတင်းစာ)*

☐ *TV (တီဗွီ)*

☐ *Radio (ရေဒီယို)*

☐ *Internet (အင်တာနက်)*

☐

☐ *Other (Please specify) အခြား*

_____

☐ *NGO (Please Specify):*

_____

Q39. ***What are your views about the Project?***

စီမံကိန်းနှင့်ပက်သက်၍အမြင်သဘောထား

_____

_____

_____

_____

_____

APPENDIX Q FULL AIR QUALITY IMPACT ASSESSMENT (AQIA)

Air Quality Impact Assessment for LNG Power Plant (Ahlone) Project

Technical Report

3 April 2019

Project No.: 0439461

The business of sustainability

ERM

Document details	
Document title	Air Quality Impact Assessment for LNG Power Plant (Ahlone) Project
Document subtitle	Technical Report
Project No.	0439461
Date	3 April 2019
Version	1.0
Author	Edmund Taylor
Client Name	TTCL Power Myanmar Company Limited (TPMC)

Signature Page

3 April 2019

Air Quality Impact Assessment for LNG Power Plant (Ahlone) Project

Technical Report

Edmund Taylor
Senior Consultant

PT. ERM Indonesia
Centennial Tower 40th Floor Suite #B1 | Jl. Jend,
Gatot Subroto Kav. 24-25 Jakarta 12930 | Indonesia |

CONTENTS

List of Tables

List of Figures

Acronyms and Abbreviations

ASR	Air Sensitive Receptor
AQIA	Air Quality Impact Assessment
AQM	Air Quality Monitoring
AQS	Air Quality Standard
BAT	Best Available Techniques
CCGT	Combined Cycle Gas Turbine
CO	Carbon Monoxide
DA	Degraded Air Shed
DEFRA	Department of Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges
EHS	Environment, Health and Safety
EPAS	Haz-Scanner Environmental Perimeter Air Station
EPUK	Environmental Protection United Kingdom
EU	European Union
GIIP	Good International Industry Practice
HGV	Heavy Goods Vehicles
IAQM	Institute of Air Quality Management
IFC	International Finance Corporation
IQR	Interquartile Range
kPa	Kilopascal
LNG	Liquefied Natural Gas
MW_{th}	Megawatt Thermal
NDA	Non Degraded Air Shed
NEQEG	National Environmental Quality (Emission) Guidelines
NO_x	Oxides of Nitrogen
NO_2	Nitrogen Dioxide
NPi	Australian National Pollution Inventory
O_2	Oxygen
PC	Process Contribution
PEC	Predicted Environmental Concentration
PM_{10}	Particulate Matter <10 micrometers
$PM_{2.5}$	Particulate Matter <2.5 micrometers
SO_2	Sulphur Dioxide
SRTM	Shuttle Radar Topographic Mission
TSP	Total Suspended Particulate
UB	Upper Bound
USEPA	United States Environmental Protection Agency
WHO	World Health Organisation

1. INTRODUCTION

1.1 Overview

The Ahlone development (hereafter referred to as 'the Project') involves the construction and operation of a 388 MW liquefied natural gas (LNG) power plant, LNG receiving terminal including a small power generation facility, and a 24.4 km onshore pipeline.

Emissions to air from the Project have the potential for adverse effects on human health, agricultural and sensitive ecology. This air quality impact assessment (AQIA) assesses these potential impacts against relevant air quality standards, objectives and guidelines where relevant.

The assessment of potential air quality impacts associated with the Project considers:

- sources, nature and quantity of emissions to air;
- a qualitative assessment of construction and decommissioning phase impacts;
- a detailed quantitative assessment of process emissions;
- an assessment of potential impacts on relevant sensitive receptors; and
- mitigation measures to reduce the impacts where necessary.

2. LEGAL FRAMEWORK AND BEST PRACTICE

2.1 Overview

The International Finance Corporation (IFC) Environmental, Health and Safety (EHS) guidelines are considered throughout this AQIA. The IFC guidelines provide the overarching guidance and principles for undertaking the assessment. The key documents considered are:

- IFC General EHS Guidelines for Air Emissions and Ambient Air Quality[1];
- IFC General EHS Guidelines for Construction and Decommissioning[2]; and
- IFC EHS Guidelines for Thermal Power Plants[3].

Where necessary, reference is made to other internationally recognised sources of information. These include, but are not necessarily limited to guidelines published by:

- the World Health Organisation (WHO);
- the European Union (EU);
- the United States Environmental Protection Agency (USEPA);
- the Australian National Pollution Inventory (NPi);
- the Department of Environment, Food and Rural Affairs (DEFRA); and
- reputable air quality institutes and working groups such as the Institute of Air Quality Management (IAQM).

2.2 Air Quality Standards and Guidelines

2.2.1 Human Health

The IFC's General EHS guideline for air emissions and ambient air quality states that:

- *Projects with significant sources of air emissions, and potential for significant impacts to ambient air quality, should prevent or minimize impacts by ensuring that:*

  - *emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines, or other internationally recognised source; and*

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

[1] International Finance Corporation (IFC) (2007) Environmental, Health and Safety Guidelines, General EHS Guidelines: Environmental Air Emissions and Ambient Air Quality [Online] Available at: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines [Accessed 13 February 2019]

[2] International Finance Corporation (IFC) (2007) Environmental, Health and Safety Guidelines, General EHS Guidelines: Construction and Decommissioning [Online] Available at: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines [Accessed 13 February 2019]

[3] International Finance Corporation (IFC) (2007) Environmental, Health and Safety Guidelines for Thermal Power Plants [Online] Available at: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines [Accessed 13 February 2019]

Myanmar has established ambient air quality standards (AQS) published in the National Environmental Quality (Emission) Guidelines (NEQEG)[4] for common species related to anthropogenic emissions. The air quality standards are based on reliable scientific evidence and are comparable to other national and international standards and guidelines such as those specified by the WHO[5]. In accordance with the IFC's General EHS guidelines, the NEQEG ambient air quality criteria presented in ***Table 2.1*** should be considered the appropriate standards, and are therefore used for comparison of baseline data and predicted impacts in this AQIA.

A summary of the relevant air quality standards used in this assessment are shown in ***Table 2.1***. This information provides the basis for regulation and control of air emissions from the Project in order to prevent pollution and protect the environment and public health.

Table 2.1: Ambient Air Quality Standards

Parameter	Averaging Period	NEQEG - Air Quality Standard (µg/m^3) [a]
Nitrogen Dioxide (NO_2)	1-hour	200
	Annual	40
Sulphur Dioxide (SO_2)	10-minute	500
	24-hour	20
Particulate Matter (PM_{10})[b]	24-hour	50
	Annual	20
Particulate Matter ($PM_{2.5}$)[c]	24-hour	25
	Annual	10
Ozone	8-hour daily maximum	100

Note: [a] *National Environmental Quality (Emission) Guidelines (NEQEG)*
[b] *PM10 is particulate matter with an aerodynamic diameter no greater than 10 micrometres*
[c] *PM2.5 is particulate matter with an aerodynamic diameter no greater than 2.5 micrometres*

2.2.2 Emission Limits

2.2.2.1 International Finance Corporation: Thermal Power Plants

The IFC EHS guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by using existing technology at reasonable costs. The IFC Performance Standard for 'Resource Efficiency and Pollution Prevention'[6] states that:

- *When host country regulations differ from the levels and measures presented in the World Bank Group EHS Guidelines, projects are required to achieve whichever is the more stringent. If less stringent levels or measures than those provided in the EHS Guidelines are appropriate in view of specific project circumstances, a full and detailed justification must be provided for any proposed alternatives through the environmental and social risks and impacts identification and assessment process. This justification must demonstrate that the choice for any alternate performance levels is consistent with the objectives of this performance standard.*

[4] National Environmental Quality (Emission) Guidelines (NEQEG) (2015) [Online] Available at: http://www.myanmar-responsiblebusiness.org/pdf/2015-12-29-National-Environmental-Quality_Emission_Guidelines_en.pdf [Accessed 13 February 2019]
[5] World Health Organisation (WHO) (2000) Air Quality Guidelines for Europe, 2nd Edition [Online] Available at: http://www.euro.who.int/__data/assets/pdf_file/0005/74732/E71922.pdf [Accessed 13 February 2019]
[6] International Finance Corporation (IFC) (2012) Resource Efficiency and Pollution Prevention [Online] Available at: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/performance-standards/ps3 [Accessed 13 February 2019]

The relevant emission limits applicable to the project for NOx, SO2 and PM as per the IFC EHS Guideline for natural gas fired turbine (>50MW thermal input (MWth)) and gas engine (3-50MWth) are presented in ***Table 2.2*** and ***Table 2.3*** respectively.

Table 2.2: IFC Air Emission Guidelines for Gas Turbine

Combustion Technology / Fuel	Particulate Matter (PM)		Sulphur Dioxide (SO_2)		Nitrogen Oxides (NO_x)		Dry Gas, Excess O_2 content (%)
	mg/Nm^3						
	NDA [a]	DA [b]	NDA [a]	DA [b]	NDA [a]	DA [b]	
Natural Gas (all turbine types of Unit > 50MW$_{th}$) [c]	-	-	-	-	51	51	15%

Note: [a] *Non-Degraded Airshed*
[b] *Degraded Airshed*
[c] *Megawatt thermal input*

Table 2.3: IFC Air Emission Guidelines for Gas Engine

Combustion Technology / Fuel	Particulate Matter (PM)	Sulphur Dioxide (SO_2)	Nitrogen Oxides (NO_x)	Dry Gas, Excess O_2 content (%)
	mg/Nm^3			
Gas Engine (3-50MW$_{th}$) [a]	-	-	200 (Spark Ignition) 400 (Dual Fuel) 1,600 (Compression Ignition)	15%

Note: [a] *Megawatt thermal input*

2.2.2.2 National Environmental Quality (Emission) Guidelines: Thermal Power

Myanmar has established regulation to determine maximum permissible emissions from thermal power plants and small combustion facilities.[7] The relevant emission limit guidelines applicable to the project are presented in ***Table 2.4*** and ***Table 2.5***.

Table 2.4: NEQEG Air Emission Guidelines for Combustion Turbine

Combustion Technology / Fuel	Particulate Matter (PM)	Sulphur Dioxide (SO_2)	Nitrogen Oxides (NO_x)
	mg/Nm^3		
Natural gas (all turbine types; unit > 50 MW)	-	-	100mg/Nm^3

Note: the Nm^3 conditions are not specified in NEQEG, however reference is made to the IFC environmental, health, and safety guidelines for thermal power (2007) that specifies reference conditions at 0°C, 101.3kPa, 6% O_2, dry gas.

[7] National Environmental Quality (Emission) Guidelines (NEQEG) (2015) [Online] Available at: http://www.myanmar-responsiblebusiness.org/pdf/2015-12-29-National-Environmental-Quality_Emission_Guidelines_en.pdf [Accessed 13 February 2019]

Table 2.5: NEQEG Air Emission Guidelines for Small Combustion Facilities

Combustion Technology / Fuel	Particulate Matter (PM)	Sulphur Dioxide (SO_2)	Nitrogen Oxides (NO_x)
	mg/Nm^3		
Gas (3-50MW$_{th}$)	-	-	200 (Spark Ignition) 400 (Dual Fuel) 1,600 (Compression Ignition)
Note: the Nm^3 conditions are not specified in NEQEG, however reference is made to the IFC environmental, health, and safety guidelines for thermal power (2007) that specifies reference conditions at 0°C, 101.3kPa, 15% O_2, dry gas.			

2.2.2.3 Applicable Emission Limits

The emission limits applicable to the Project are provided in ***Table 2.6***.

Table 2.6: Applicable Emission Limits

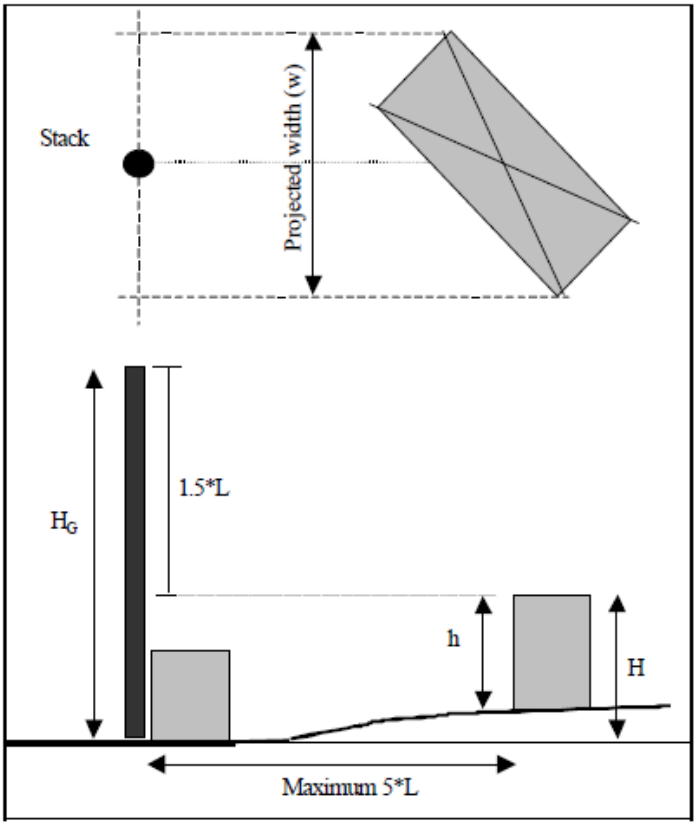
Combustion Technology / Fuel	Particulate Matter (PM)	Sulphur Dioxide (SO_2)	Nitrogen Oxides (NO_x)	Dry Gas, Excess O_2 content (%)
	mg/Nm^3			
Natural gas (all turbine types; unit > 50 MW)	-	-	51	15
Gas Engine (3-50MW$_{th}$)	-	-	200	15

2.2.3 Stack Height

The IFC EHS guideline for ambient air quality and air emissions set out the Good International Industry Practice (GIIP) general approach for determining the required stack height using the following calculation:

- $H_G = H + 1.5L$; where
  - HG = GEP stack height measured from the ground level elevation at the base of the stack
  - H = Height of nearby structure(s) above the base of the stack
  - L = Lesser dimension, height (h) or width (w), of nearby structures
  - "Nearby structures" = Structures within/touching a radius of 5L but less than 800 m.

Figure 2.1: Good International Industry Practice (GIIP)



Note: Stack Height (Based on United States 40 CFR, part 51.100 (ii)).

The IFC guidance specifically states that:

- *The stack height for all point sources of emissions, whether 'significant' or not, should be designed according to GIIP to avoid excessive ground level concentrations due to downwash, wakes, and eddy effects, and to ensure reasonable diffusion to minimize impacts.*

The main nearby structures and their dimensions are presented in ***Table 2.7***. The data indicates that a stack height of 28.4 m is necessary to comply with GIIP. The Project design includes 2 x 40 m stacks and is thus compliant with the GIIP requirements.

Table 2.7: Approximate Building Dimensions

Building	Height (m)	Width (m)	Length (m)	GIIP Stack Height Requirement (m)
Demin Water Treatment Buiding	8.5	10	24.3	23.5
Workshop Building	8	10	24	23.0
Admin Building	5	10	30	20.0
ECB Building	10.4	45	12	28.4
Filter Press Building	9.7	7	10.2	20.2
Guardhouse Building	5	2.8	4	9.20
Rack Room Building	5.45	9.2	5	19.3

3. PRELIMINARY SCREENING ASSESSMENT

3.1 Overview

This section presents the findings of a preliminary qualitative/semi-quantitative screening assessment undertaken to identify Project activities, processes and emissions that require consideration within the scope of the detailed AQIA presented in ***Section 5***.

3.2 Screening Assessment

A preliminary screening assessment has been undertaken using a combination of quantitative and semi quantitative techniques, project specific information, international guidelines and methodologies, and professional experience and opinion (refer to ***Table 3.1***). The assessment identifies the processes and emissions that have the potential to adversely affect ambient air quality and require detailed assessment to inform the level of mitigation necessary to reduce impacts, if any, to an acceptable level throughout the lifetime of the Project.

The processes and activities that will result in emission to air during the construction, operation and decommissioning phase include:

- Shipping;
- The use of diesel powered vehicles and equipment;
- Vehicles travelling over unpaved access roads;
- On site earthworks, clearing of land, material handling, stockpiling, vehicle use on unpaved surfaces, and construction of the main infrastructure;
- The operation of the LNG power plant;
- The operation of the gas receiving terminal;
- The use of diesel generators for back-up power; and
- Decommissioning related activities.

Table 3.1: Preliminary Air Quality Screening Assessment

Project Activity, Process or Emission Source	Project Phase	Potential Impact to Air Quality	Preliminary Impact Assessment
Shipping	Construction, Operation	Elevated ambient concentrations of NO_x, NO_2, SO_2, PM_{10} and $PM_{2.5}$ from ship exhausts.	The UK technical guidance document (TG16)[a] recommends that a detailed air quality assessment is only required for large ports, defined as: ■ More than 5,000 movements per year and where there is relevant public exposure within 250m of berthing and manoeuvring; or ■ More than 15,000 movements per year and where there is relevant public exposure within 1km of berthing and manoeuvring. The exact number of ships necessary for the construction of the Project is unknown. However, the exhaust emissions from ships will be intermittent, short term and transient in nature, and no receptors exist within 250m of the indicative jetty location and power plant site, thus a detailed assessment is not considered necessary. During the operation phase, the Project predicts that approximately six 8,500 tonne ships will arrive every month (i.e. 72 ships per year) to deliver 440,000 tonnes of LNG per year to the Project. This is less than the TG16 screening criteria, thus impacts to ambient air quality and not likely and a detailed assessment has not been considered in this AQIA.
Diesel Powered Vehicles and Equipment (onsite & offsite)	Construction, Operation	Elevated ambient concentrations of NO_x, NO_2, SO_2, PM_{10} and $PM_{2.5}$ from vehicle and heavy equipment exhaust emissions.	The Institute of Air Quality Management (IAQM)[b] states that: ■ Exhaust emissions from on-site plant (also known as non-road mobile machinery or NRMM) and site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed. For site plant and on-site traffic, consideration should be given to the number of plant/vehicles and their operating hours and locations to assess whether a significant effect is likely to occur. For site traffic on the public highway, if it cannot be scoped out (for example by using the EPUK's criteria), then it should be assessed using the same methodology and significance criteria as operational traffic impacts. The Environmental Protection UK (EPUK)[c] indicative criterion to proceed with a detailed air quality impact assessment is as follows:

Project Activity, Process or Emission Source	Project Phase	Potential Impact to Air Quality	Preliminary Impact Assessment
			■ Daily traffic flows increase by more than 500 vehicles/day; and/or ■ Heavy goods vehicles (HGV) flows increase by more than 100 vehicles/day. The Design Manual for Roads and Bridges (DMRB)[d] states that: ■ Only properties and Designated Sites within 200m of roads affected by the project need be considered. The detailed construction schedule including locations of individual sources in any given period of time is not known. Emissions to air from onsite mobile and non-mobile plant will be intermittent and spatially variable throughout the construction phase period as different activities take precedence. The impacts to air quality will be highly dependable on the operating time of individual mobile and non-mobile plant, meteorological conditions and the relative distance to sensitive receptors. On this basis, it is recognised that a representative and accurate dispersion model is difficult to define. Instead, whilst it is acknowledged that exhaust emissions will have some impact on air quality, the assumption is that with the implementation of internationally recognised good practice air quality management measures (refer to ***Table 5.10***) the impacts to ambient air quality at relevant sensitive receptors in the study area will be negligible and are not considered further.
Vehicles travelling over unpaved access roads	Construction and Operation	Elevated ambient concentrations of dust, PM_{10} and $PM_{2.5}$ from vehicles operating on unpaved access roads. Dust deposition and/or visible dust plumes can cause nuisance[e] affecting local amenities and quality of life	The main access roads to the Project and all internal roads will be paved. Impacts to ambient air quality from dust rising from unpaved access roads during the construction and operation of the Project are not expected and are not considered further in this AQIA.
On site earthworks, clearing of land, material handling,	Construction	Elevated ambient concentrations of dust and particulate matter (PM_{10}	Elevated ambient concentrations of TSP and PM_{10} from earthwork activities, construction of the Project infrastructure, and trackout of dusty materials onto the public road network has the potential to cause impacts on sensitive receptors in the vicinity of the named activities if

Project Activity, Process or Emission Source	Project Phase	Potential Impact to Air Quality	Preliminary Impact Assessment
stockpiling, vehicle use on unpaved surfaces, construction of the main infrastructure.		and $PM_{2.5}$) from construction related activities. Dust deposition and/or visible dust plumes can cause nuisance affecting local amenities and quality of life.	not managed accordingly. Dust deposition and/or visible dust plumes arising from construction sites can also cause nuisance[e] affecting local amenities and quality of life. Dust emissions can vary substantially from day to day and will depend on the level of activity, the specific operations being undertaken and the meteorological conditions at the time of release. Given the complexity and specific nature of fugitive dust emissions, the potential impacts to air quality from construction related activities could lead to significant adverse impacts on air quality and have therefore been given further consideration in ***Section 5*** of this AQIA.
Power Generation at Power Plant	Operation	Elevated ambient concentrations of NO_x and NO_2 resulting from the combustion of gas.	The Project will be equipped with 2 x 117MW natural gas fired turbines. The combustion of natural gas to generate power has the potential to impact air quality at sensitive receptors across a wide area depending on operating and meteorological conditions. The European Commission Best Available Techniques (BAT) Reference Document for Large Combustion Plants[f] specifies that the emissions from the combustion of natural gas are principally NO_x and CO with mostly negligible dust and SO_2 emissions. The document further states that dust and SO_2 emissions are not an environmental concern under normal and controlled combustion conditions. Myanmar does not specify an ambient air quality standard for CO, and experience suggests that impacts to ambient air quality because of CO emissions from natural gas fired power plants are negligible. An evaluation of the expected impacts to ambient air quality is presented in ***Section 5*** of this AQIA.
Continuous power generation at the LNG terminal	Operation	Elevated ambient concentrations of NO_x and NO_2 resulting from the combustion of gas.	The LNG receiving terminal will be equipped with four Cummins C1160 N5C 1160kW natural gas fired generators required for continuous power generation during the operation phase. An evaluation of the expected impacts to ambient air quality is presented in ***Section 5*** of this AQIA.
Intermittent power generation including	Start-up / emergency	Elevated ambient concentrations of NO_x, NO_2, SO_2, CO, PM_{10} and	The use of the auxiliary boiler and diesel engine generators for power plant start-up and emergency power is expected to be infrequent, short term and mostly unplanned thus

Project Activity, Process or Emission Source	Project Phase	Potential Impact to Air Quality	Preliminary Impact Assessment
auxiliary boiler and emergency generators		$PM_{2.5}$, from the combustion of fuel oil.	defining a representative dispersion model and quantifying the impact on ambient air quality is challenging. Given the relatively low release heights typically associated with these source types, an assumption of continuous operation would in most cases result in unacceptable impacts to ambient air quality and result in them becoming the controlling emissions scenario for demonstrating compliance against the short-term air quality standards. On this, the USEPA[g h] states: ■ "*the intermittent nature of the actual emissions associated with emergency generators and startup/shutdown in many cases, when coupled with the probabilistic form of the standard, could result in modelled impacts being significantly higher than actual impacts would realistically be expected to be for these emission scenarios. The potential overestimation in these cases results from the implicit assumption that worst-case emissions will coincide with worst-case meteorological conditions based on the specific hours on specific days of each of the years associated with the modelled design value based on the form of the hourly standard*" and ■ "*compliance demonstrations for the 1-hour NO_2 and SO_2 NAAQS be based on emission scenarios that can logically be assumed to be relatively continuous or which occur frequently enough to contribute significantly to the annual distribution of daily maximum 1-hour concentrations*". Emissions to air from the auxiliary boiler and generators are short-term, intermittent and infrequent in nature and are unlikely to contribute significantly to the annual distribution of daily maximum 1-hour concentrations. No further consideration of these emissions sources is therefore provided in this AQIA.
Decommissioning	Decommissioning	The decommissioning of the proposed Project will likely include deconstruction of structures and buildings and include similar activities and impacts as during the construction phase.	The decommissioning of the proposed Project will likely include deconstruction of structures and buildings and include similar activities and impacts as during the construction phase. It is assumed that mitigation and management implemented during construction will be similarly applied during decommissioning; therefore, decommissioning impacts are not assessed further.

Note: [a] *Department for Environment Food and Rural Affairs (DEFRA) Local Air Quality Management Technical Guidance (TG16) (2016) [Online] Available at: https://laqm.defra.gov.uk/documents/LAQM-TG16-April-16-v1.pdf [Accessed 04 January 2019]*
[b] *Institute of Air Quality Management (IAQM) (2014) Guidance on the Assessment of Dust from Demolition and Construction [Online] Available at: http://iaqm.co.uk/guidance/ [Accessed 04 January 2019]*
[c] *Guidance from the Environmental Protection UK and Institute of Air Quality Management (IAQM) (2017) Land-Use Planning & Development Control: Planning for Air Quality [Online] Available at: http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf [Accessed 04 January 2019]*
[d] *The Design Manual for Roads and Bridges (2007) [Online] Available at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/index.htm [Accessed 04 January 2019]*
[e] *Nuisance shall be used as a general term to describe annoyance to local communities from dust deposition and visible dust plumes from construction activities affecting local amenities and quality of life.*
[f] *European Commission (2017) Best Available Techniques (BAT) Reference Document for Large Combustion Plants [Online] Available at: http://eippcb.jrc.ec.europa.eu/reference/BREF/LCP/JRC107769_LCP_bref2017.pdf [Accessed 13 February 2019]*
[g] *The United States Environmental Protection Agency (USEPA) (2011) Additional Clarification Regarding Application of Appendix W Modelling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard [Online] Available at: https://www.epa.gov/sites/production/files/2015-07/documents/appwno2_2.pdf [Accessed 13 February 2019]*
[h] *The United States Environmental Protection Agency (USEPA) (2016) SO_2 NAAQS Designations Modelling Technical Assistance Document [Online] Available at: https://www.epa.gov/sites/production/files/2016-06/documents/so2modelingtad.pdf [Accessed 13 February 2019]*

4. RECEIVING ENVIRONMENT

4.1 Overview

A critical part of the AQIA is to establish the state of the existing environment, also referred to as the baseline. This section defines the study area and existing air quality.

4.2 Study Area

The study area is spatially different for the construction and operation phase and is defined based on:

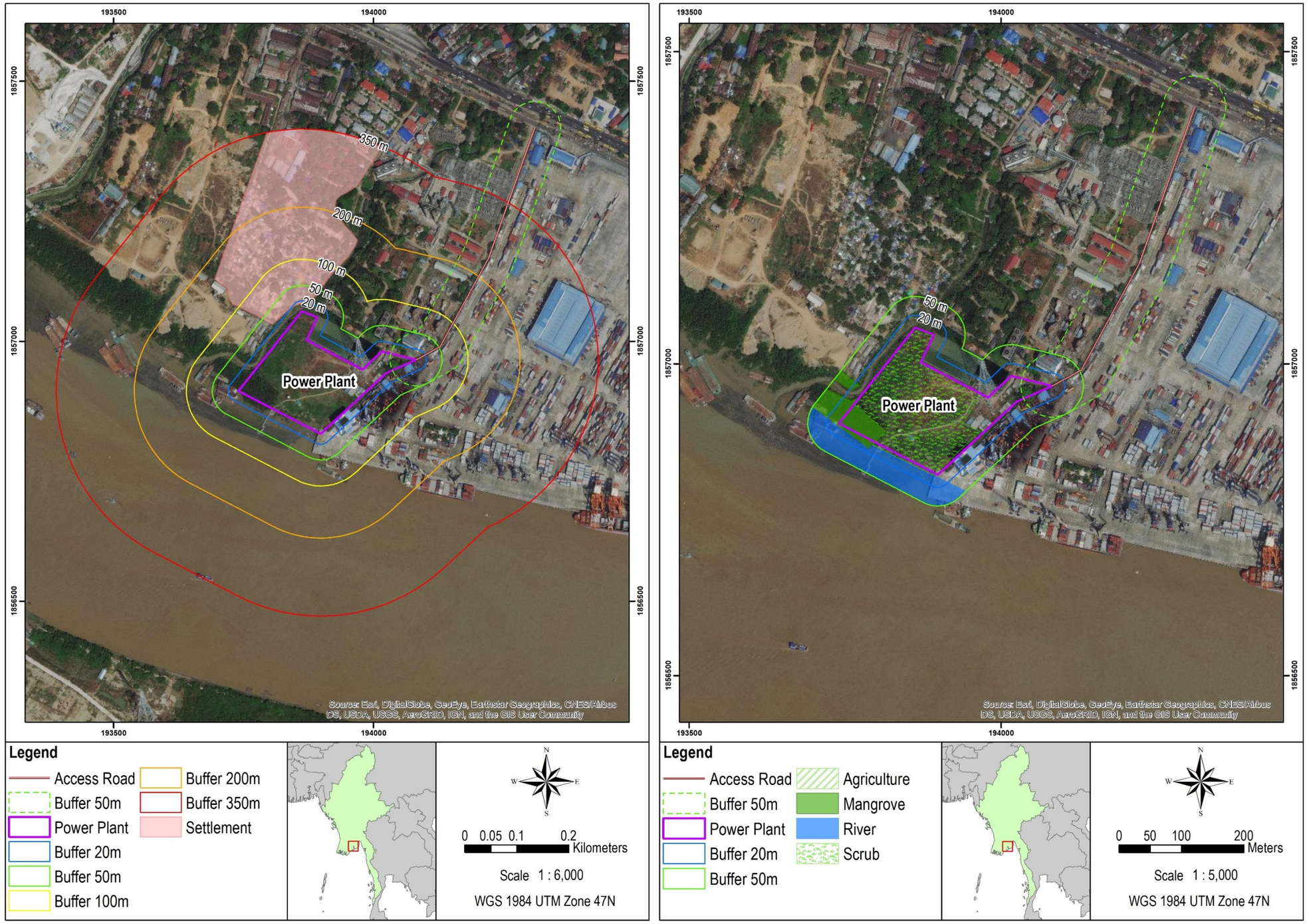
- available guidance documents;
- the nature of activities;
- the relative locations of sensitive receptors; and
- professional experience.

4.2.1 Construction Phase

The study area, for the construction phase, is defined using the IAQM guidance on the assessment of dust from demolition and construction[8]. The guidance states than a risk assessment is normally required when there is a human receptor within 350m and 50m of the construction site boundary and access road respectively; and an ecological receptor within 50m of the boundary or access road. The study area for the power plant, gas receiving terminal and onshore pipeline based on the IAQM guidance is presented in ***Figure 4.1***, ***Figure 4.2***, and ***Figure 4.3*** for human and ecological receptors respectively.

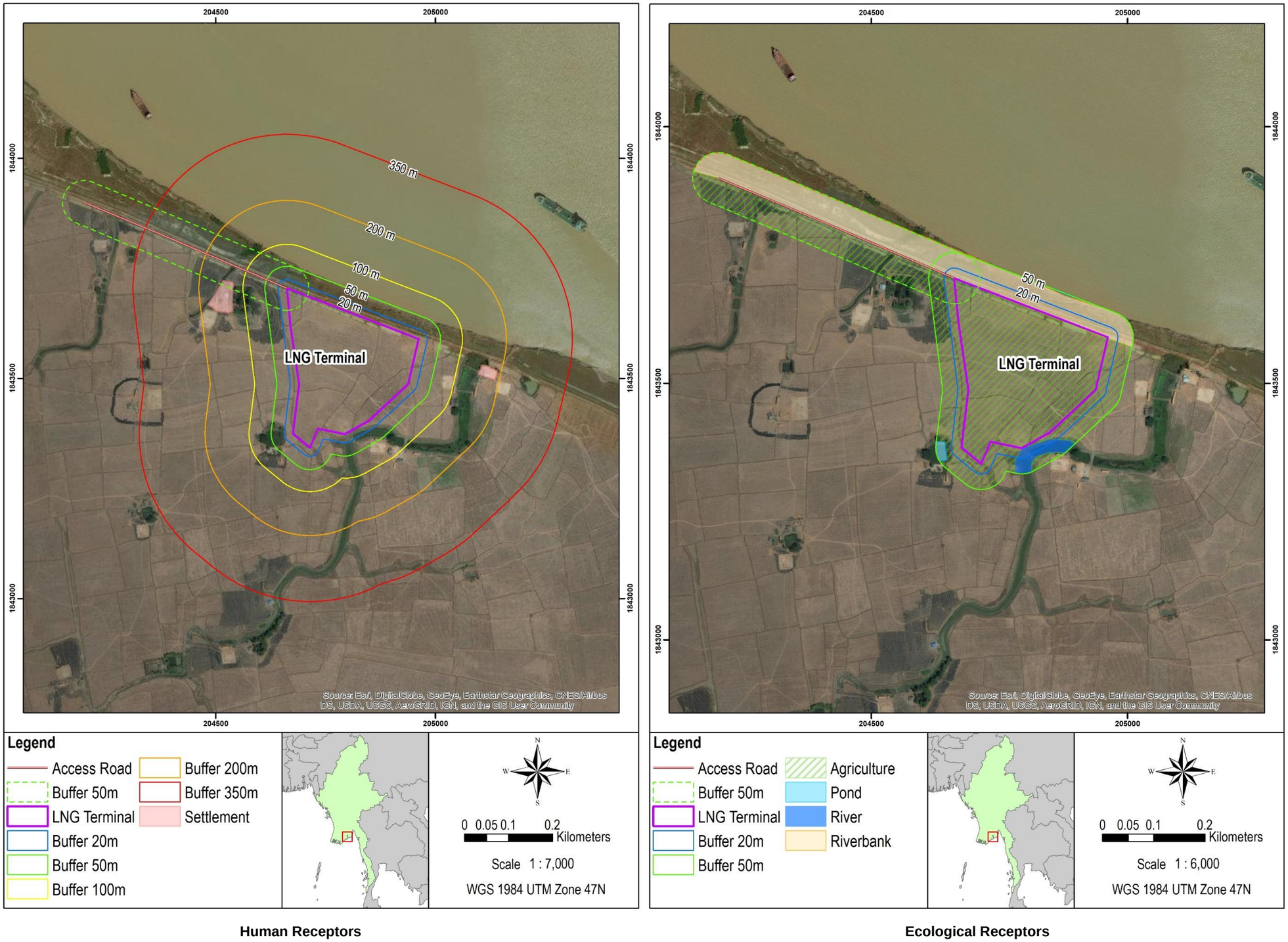
[8] Institute of Air Quality Management (IAQM) (2014) Guidance on the Assessment of Dust from Demolition and Construction [online] Available at: http://iaqm.co.uk/text/guidance/construction-dust-2014.pdf [Accessed 13 February 2019]

Figure 4.1: CCGT Site Sensitivity



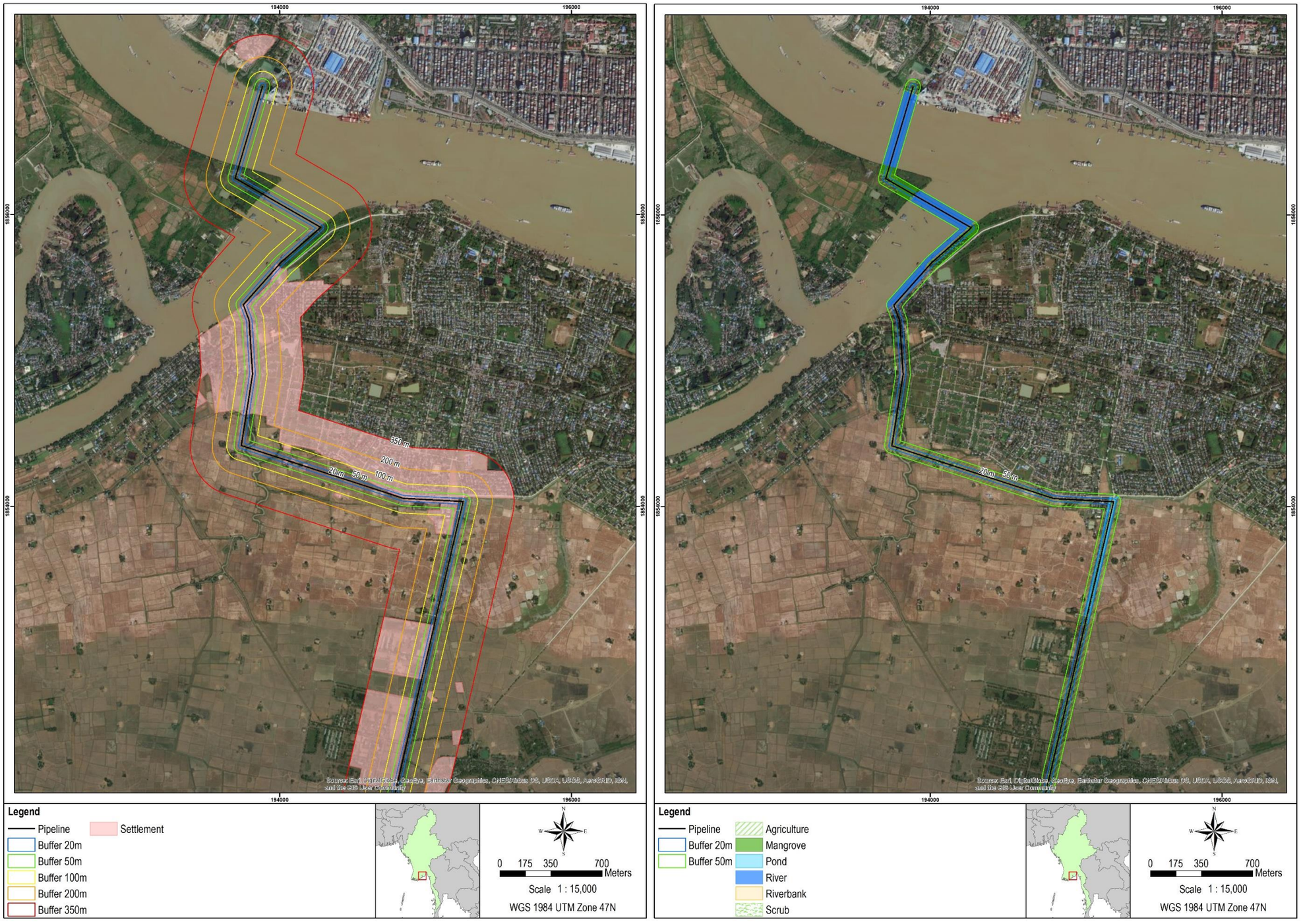
Human Receptors **Ecological Receptors**

Figure 4.2: LNG Terminal Site Sensitivity

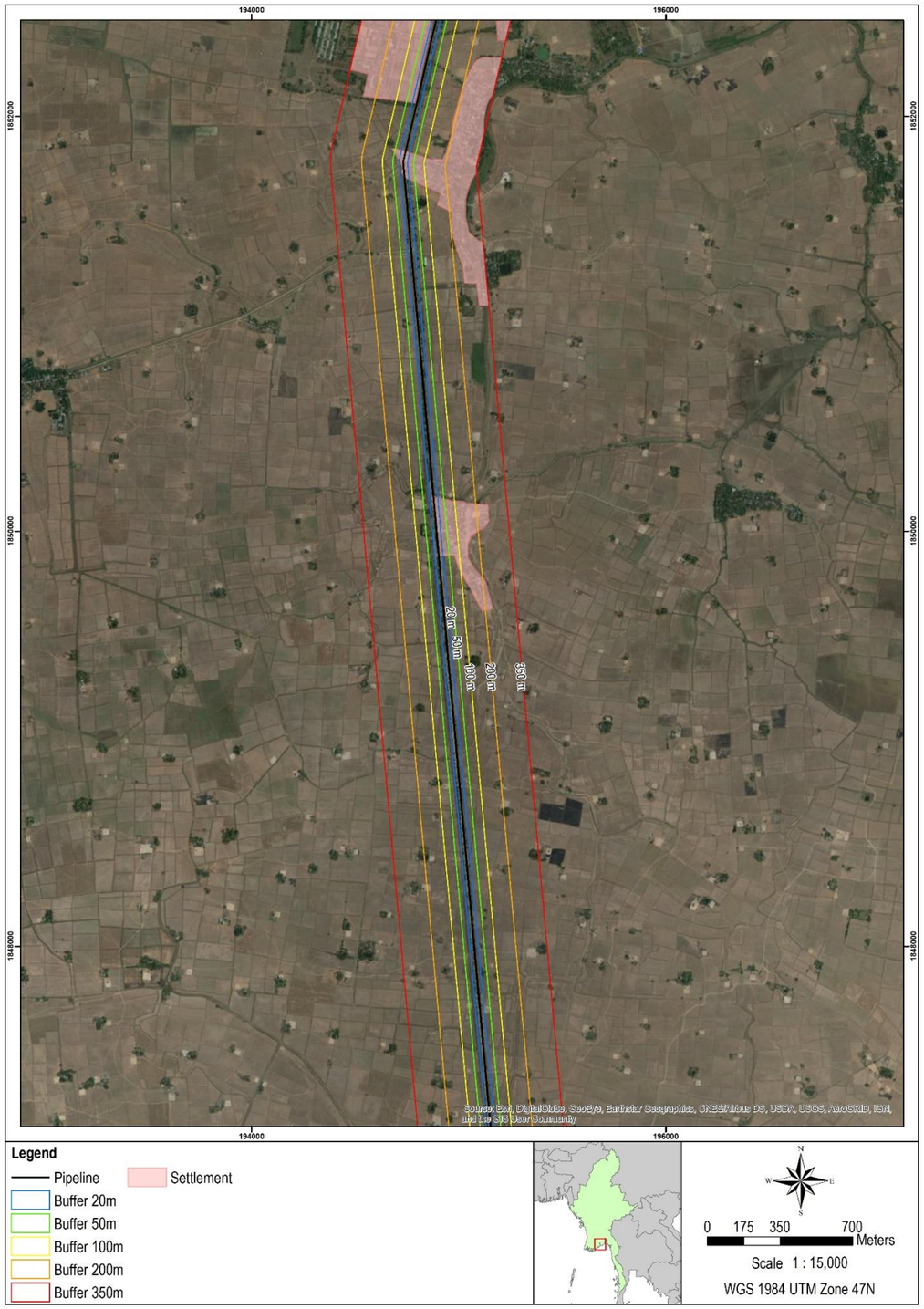


Human Receptors **Ecological Receptors**

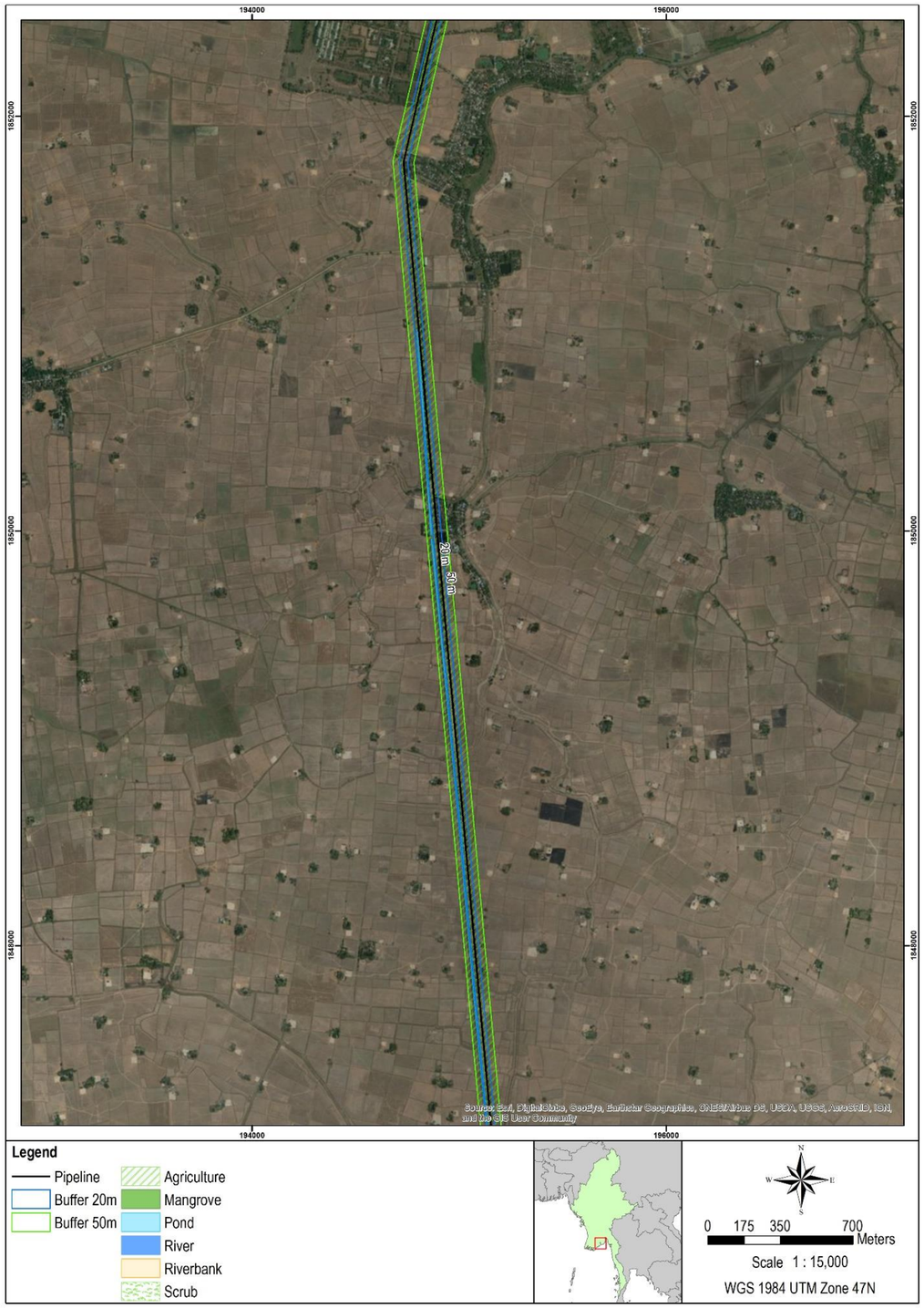
Figure 4.3: Pipeline Route Sensitivities



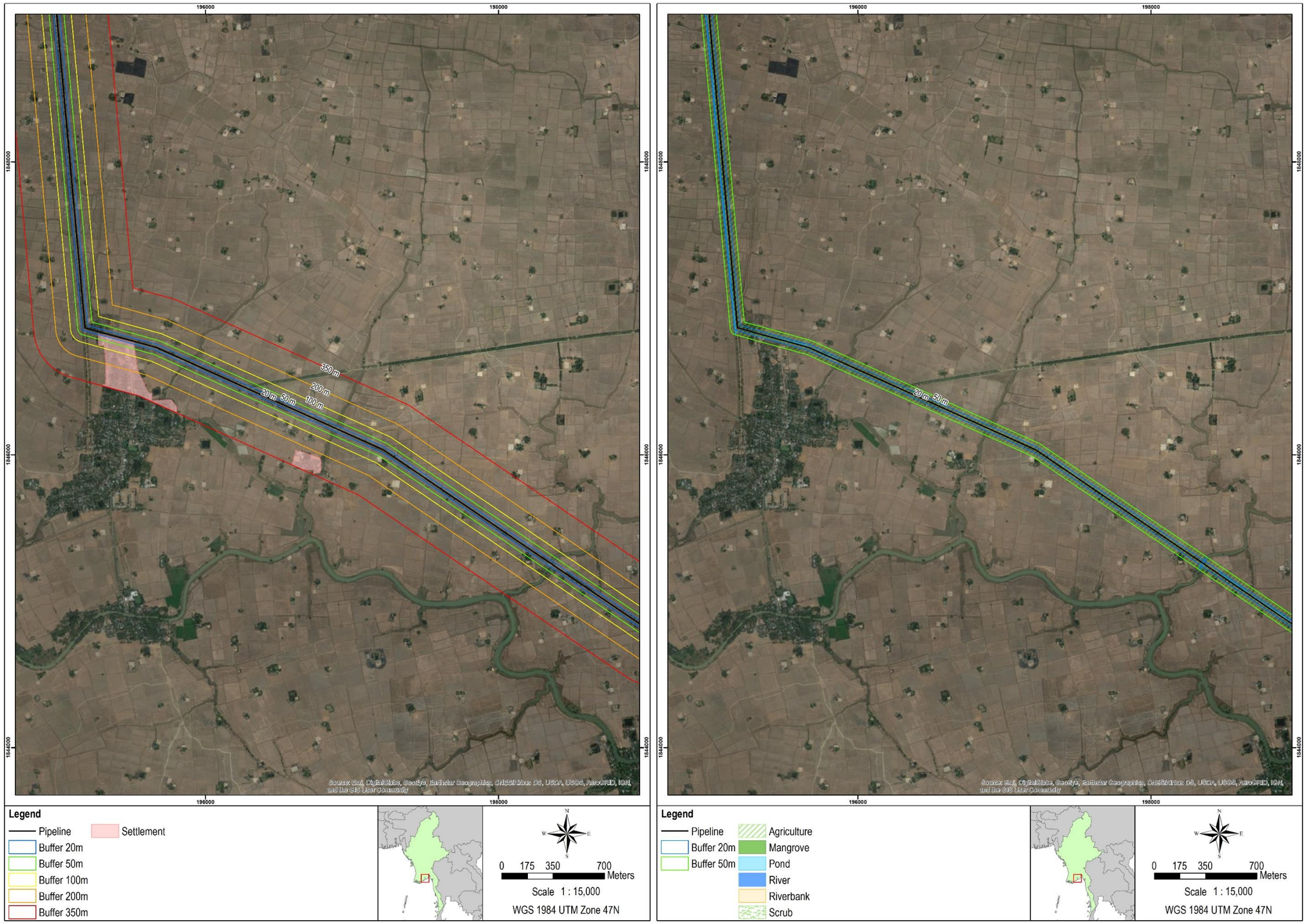
Human Receptors **Ecological Receptors**



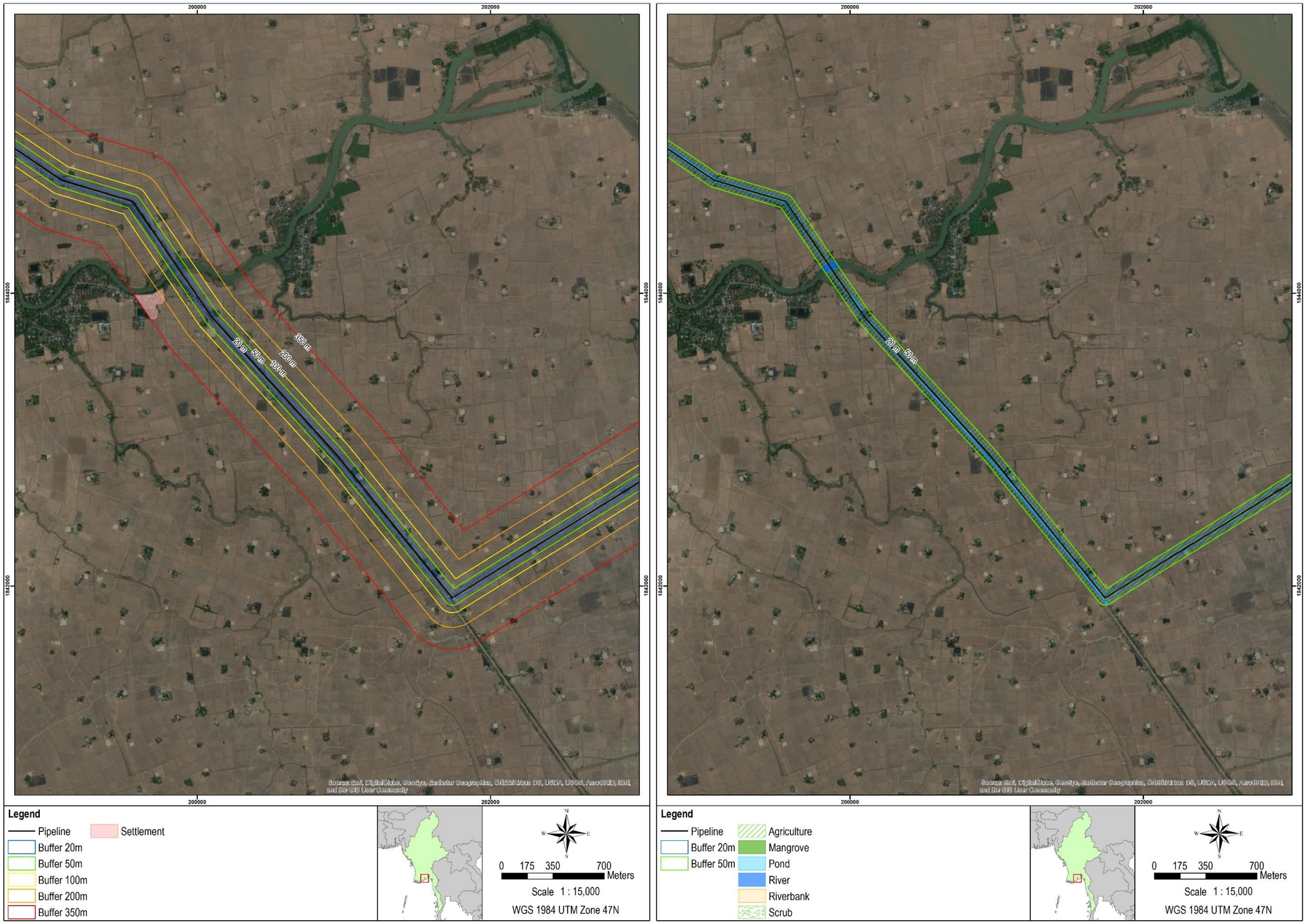
Human Receptors



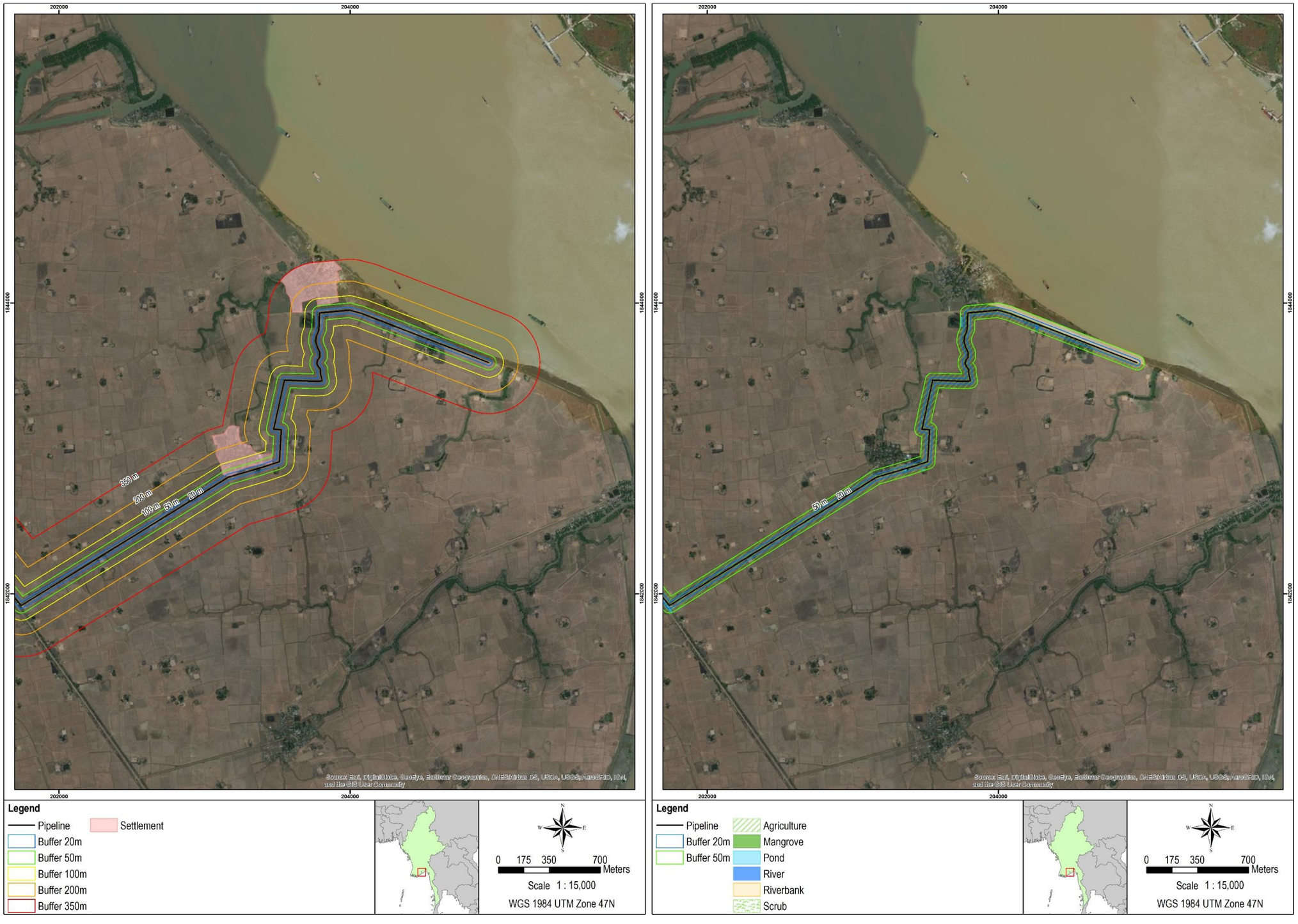
Ecological Receptors



Human Receptors **Ecological Receptors**



Human Receptors **Ecological Receptors**



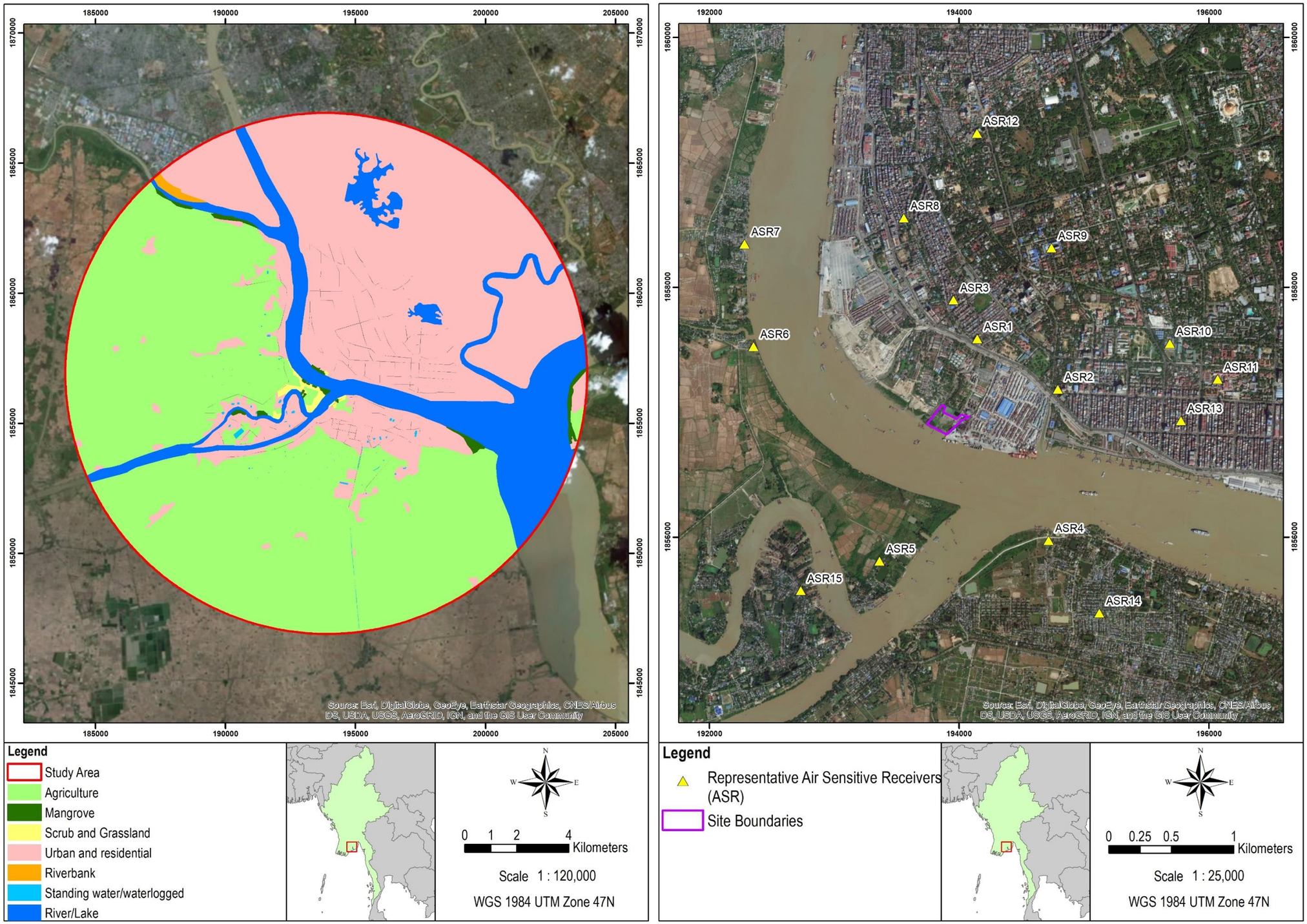
Human Receptors **Ecological Receptors**

4.2.2 Operation Phase

4.2.2.1 Power Plant

Discharge emission to air will occur continuously from the 2x117MWth power plant. A study area of 10km x 10km is used in this AQIA to ensure the spatial extent of the plume and the resulting worst-case ground level concentrations are suitably considered. The study area and a select number of representative air sensitive receptors (ASR) is presented in ***Figure 4.4***.

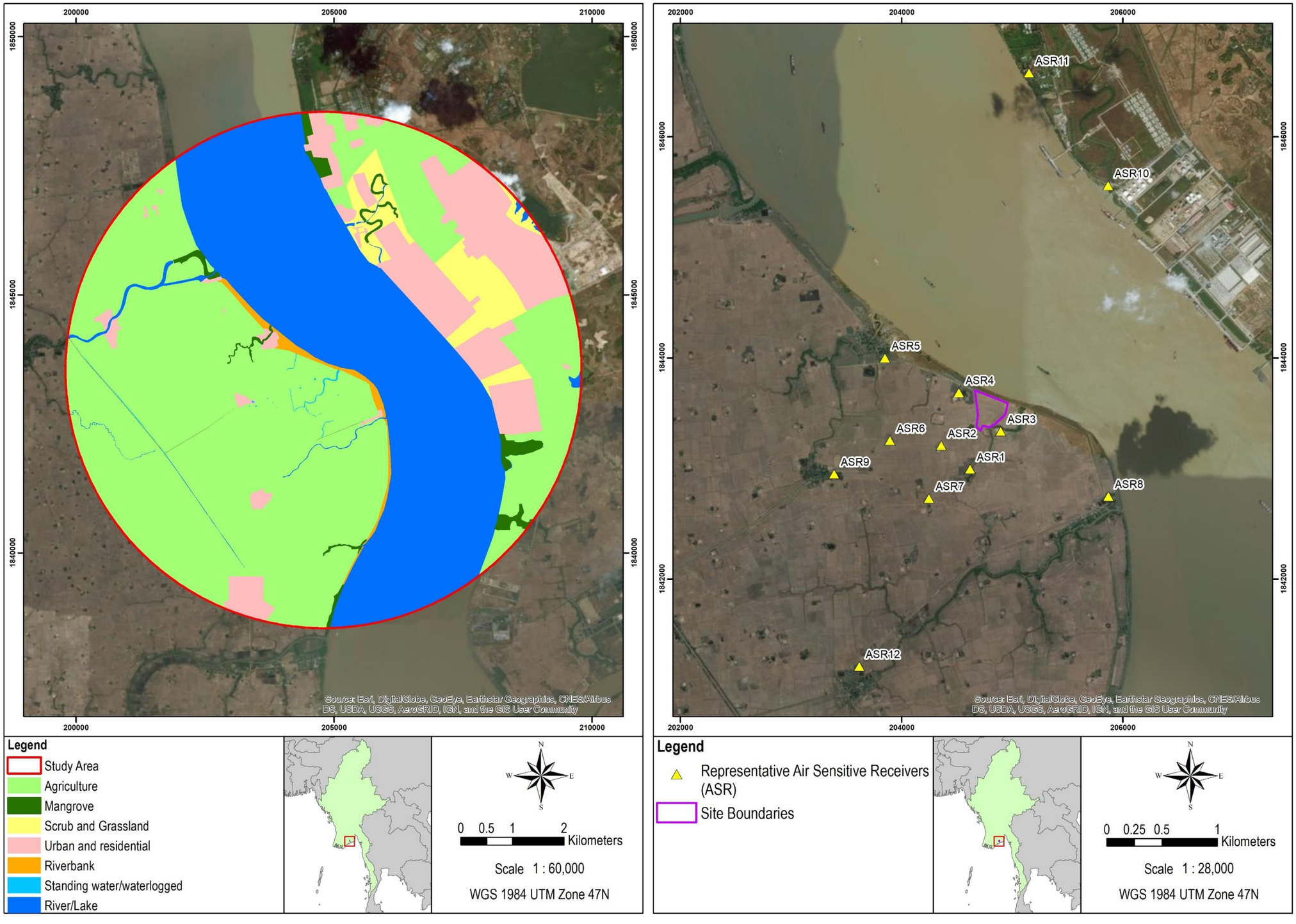
Figure 4.4: Study Area, Land-Use Type and Representative Air Sensitive Receptor Locations at Power Plant Site



4.2.2.2 Liquefied Natural Gas Receiving Terminal

Discharge emission to air will occur continuously from four 1160 kW gas fired generators. A study area of 5 km x 5 km is used in this AQIA to ensure the spatial extent of the plume and the resulting worst-case ground level concentrations are suitably considered. The study area and a select number of representative ASRs is presented in ***Figure 4.5***.

Figure 4.5: Study Area, Land-Use Type and Representative Air Sensitive Receptor Locations at LNG Receiving Terminal Site



4.3 Air Quality Baseline

4.3.1 Overview

In accordance with IFC guidelines, measurement of existing air quality is required for emissions associated with the Project processes over time that have potential to impact the surrounding land use. The IFC EHS guideline for Thermal Power Plants requires seasonal manual sampling for mid-sized projects (i.e. <1,200 MWth).

As discussed in ***Section 3***, the primary focus of this AQIA relates to NO_x emissions from natural gas combustion. On this basis, a project specific monitoring survey was commissioned to provide an indication of ambient concentrations of NO_2 in the study area and to inform the AQIA presented in ***Section 5.3***.

4.3.2 Monitoring Methodology

4.3.2.1 Haz-Scanner Environmental Perimeter Air Station (EPAS)

Ten air quality-monitoring (AQM) sites were established in the study area to determine general background concentrations of NO_2. Monitoring locations were initially selected using aerial photography, local available knowledge about villages, accessibility and security to determine the location of operations and nearby sensitive receptors. The final monitoring locations were decided in the field so that the most suitable and representative locations for monitoring equipment could be identified.

At each of the air quality monitoring locations, the Haz-Scanner Environmental Perimeter Air Station (EPAS) was deployed for a continuous 72-hour period in both the wet and dry season. Information regarding the monitoring locations and duration of monitoring are presented in ***Table 4.1*** and aerial mapping showing the location of the monitoring sites relative to the Project site is presented in ***Figure 4.6***.

Table 4.1: Haz-Scanner Environmental Perimeter Air Station Monitoring Summary

Site	Land-use	Location		Start Date	End Date	Season
		Latitude	Longitude			
AQM1	Inside Project boundary	16° 77'51.92"N	96°12'80.86"E	02/05/2015	05/05/2018	Dry
				27/06/2018	30/06/2018	Wet
AQM2	Inside Project boundary	16° 77'75.91"N	96°13'04.98"E	02/05/2015	05/05/2018	Dry
				27/06/2018	30/06/2018	Wet
AQM3	Monastery grounds	16° 78'19.91"N	96°12'90.84"E	02/05/2015	05/05/2018	Dry
				27/06/2018	30/06/2018	Wet
AQM4	Church grounds	16° 78'22.22"N	96°13'61.11"E	12/05/2018	15/05/2018	Dry
				06/07/2018	09/07/2018	Wet
AQM5	School	16° 76'29.65"N	96°13'58.25"E	06/05/2015	09/05/2018	Dry
				30/06/2018	03/07/2018	Wet
AQM6	Monastery	16° 75'33.31"N	96°13'51.29"E	06/05/2015	09/05/2018	Dry
				30/06/2018	03/07/2018	Wet
AQM7	Village	16° 72'39.16"N	96°13'84.45"E	06/05/2015	09/05/2018	Dry
				30/06/2018	03/07/2018	Wet
AQM8	Monastery	16° 68'31.90"N	96°14'40.02"E	09/05/2018	12/05/2018	Dry
				03/06/2018	06/06/2018	Wet
AQM9	Monastery	16° 66'00.00"N	96°22'37.00"E	09/05/2018	12/05/2018	Dry
				03/06/2018	06/06/2018	Wet
AQM10	Village	16° 64'80.66"N	96°24'23.56"E	09/05/2018	12/05/2018	Dry
				03/06/2018	06/06/2018	Wet

4.3.2.2 Diffusion Tubes

Palmes diffusion tubes were deployed in triplicate to monitor ambient concentrations of NO2 at three locations within and adjacent to the power plant site boundary. The diffusion tubes were exposed between the 27 February 2018 and the 2 May 2018, and again from the 12 June 2018 to the 26 June 2018. Diffusion tubes are passive samplers that consist of small plastic tubes that contain a chemical reagent to absorb the pollutant to be measured directly from the air. The preparation and analysis of the diffusion tubes is undertaken to British Standard BS EN 13528. The technique is widely recognised internationally, including by the USEPA[9] and the UK Department for the Environment, Food and Rural Affairs (DEFRA).[10] The analysis of the exposed tubes is completed through Ion Chromatography (United Kingdom Accreditation Service (UKAS) Accredited Method ISO/IEC 17025:2005). Diffusion tubes were selected for the following reasons:

- Tubes are inexpensive, lightweight, robust, easy to deploy and non-intrusive;
- No power source is required making them ideal in remote project locations; and
- Can be located at several sites around the project location increasing the spatial variability of the assessment.

Information regarding the monitoring locations and duration of monitoring are presented in ***Table 4.2*** and aerial mapping showing the location of the monitoring sites relative to the Project site is presented in ***Figure 4.6***.

It should be noted that due to unforeseen circumstances the first round of diffusion tubes were deployed beyond the recommended exposure period. The results may therefore be compromised however; they were still used to inform the assessment.

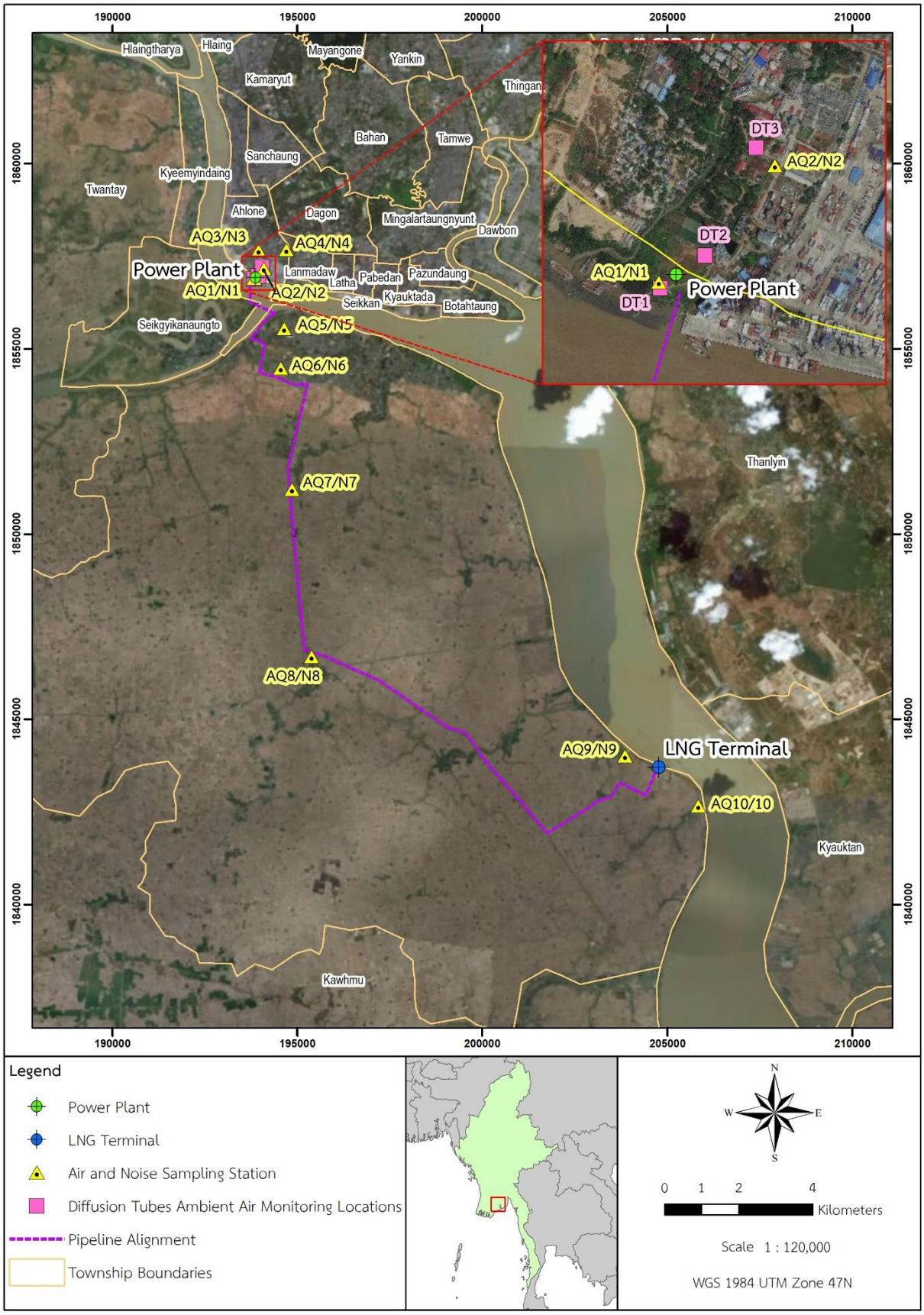
Table 4.2: Diffusion Tube Monitoring Summary

Site Name	Location		Period 1		Period 2	
	Latitude	Longitude	Start Date	End Date	Start Date	End Date
DT1	16 º 46’ 30.253” N	96º 07’ 41.228” E	27/02/18	02/05/18	12/06/18	26/06/18
DT2	16 º 46’ 32.700” N	96 º 07’ 44.600” E	27/02/18	02/05/18	12/06/18	26/06/18
DT3	16 º 46’ 40.636” N	96 º 07’ 48.370” E	27/02/18	02/05/18	12/06/18	26/06/18

[9] United States Environmental Protection Agency (USEPA) Air Monitoring Methods - Passive Monitoring [Online] Available at: https://www3.epa.gov/ttn/amtic/passive.html [Accessed 13 February 2019]

[10] Department for Environment, Food and Rural Affairs (Defra) Diffusion Tubes [Online] Available at: https://laqm.defra.gov.uk/diffusion-tubes/diffusion-tubes.html [Accessed 13 February 2019]

Figure 4.6: Ambient Air Quality Monitoring Locations



4.3.3 Nitrogen Dioxide Monitoring Results

4.3.3.1 Haz-Scanner Environmental Perimeter Air Station (EPAS)

Dry Season

The NO2 1-hour average monitoring results at each monitoring location are presented below as a series of line graphs (refer to ***Figure 4.7*** to ***Figure 4.16***). The upper bound (UB) has been calculated for each data set by multiplying the interquartile range (IQR) by 1.5 and adding the result to Quartile 3 (Q3). Monitoring results above the UB are considered outliers and are not considered in the AQIA. The monitoring results including the upper bound and the resulting maximum monitored 1-hour average at each monitoring location are presented in ***Table 4.3***.

Figure 4.7: Site AQ1 NO_2 1-hour Average (Dry Season)

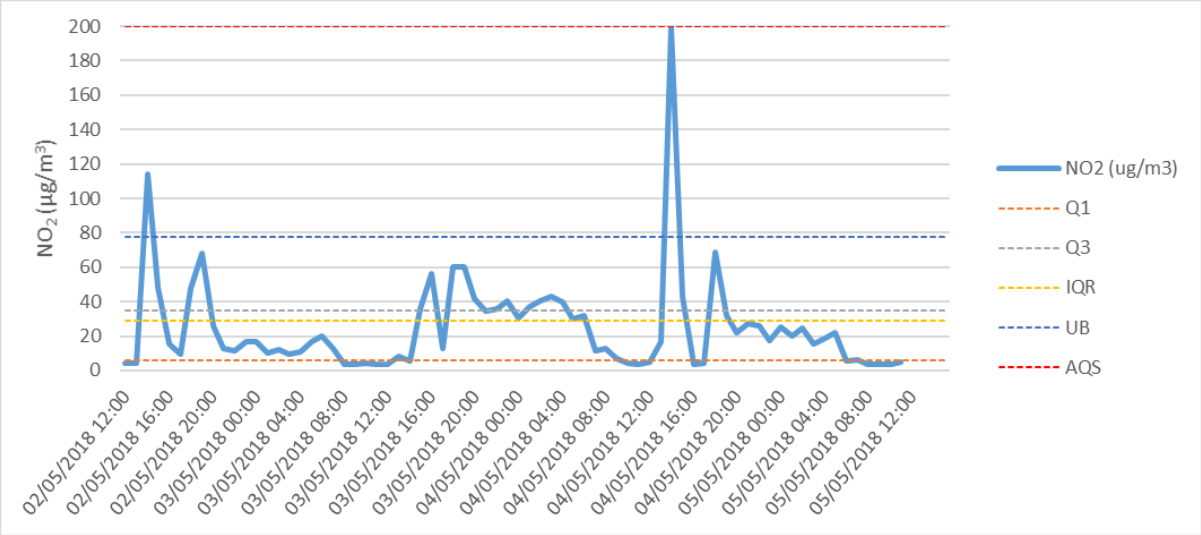


Figure 4.8: Site AQ2 NO_2 1-hour Average (Dry Season)

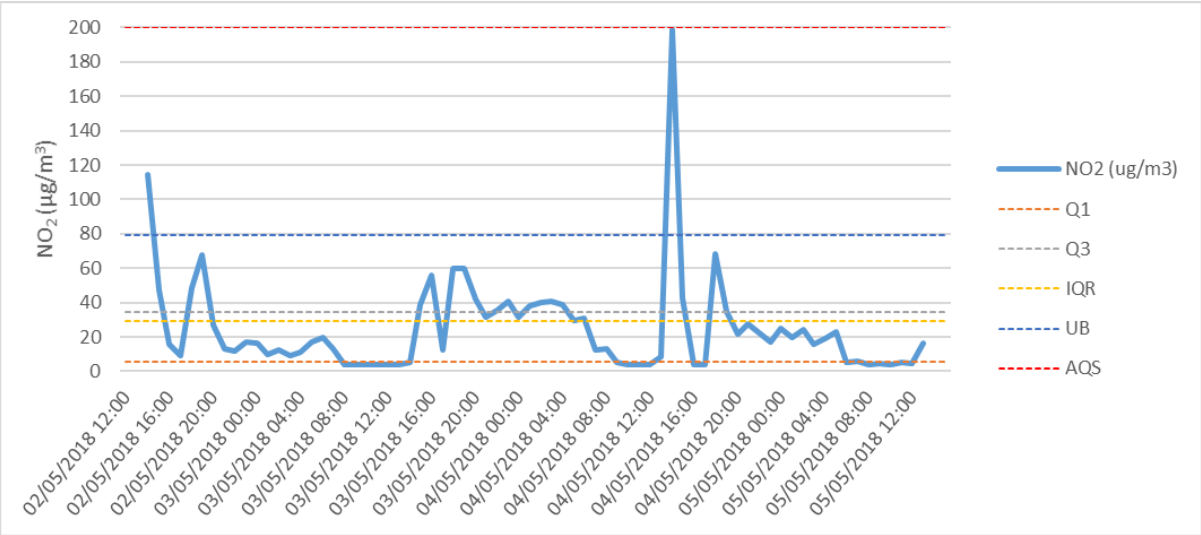


Figure 4.9: Site AQ3 NO_2 1-hour Average (Dry Season)

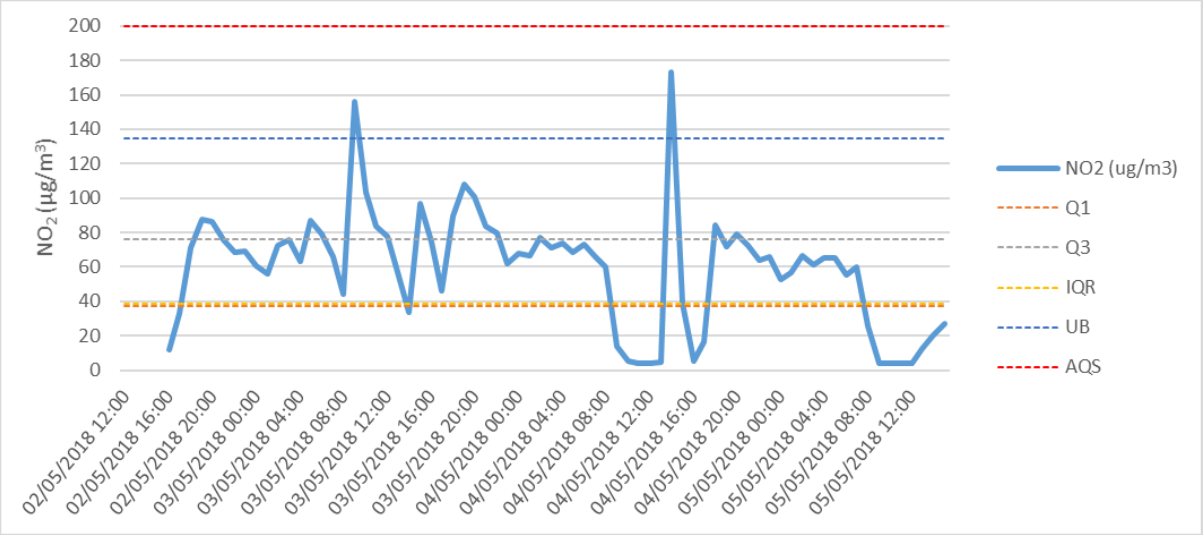


Figure 4.10: Site AQ4 NO_2 1-hour Average (Dry Season)

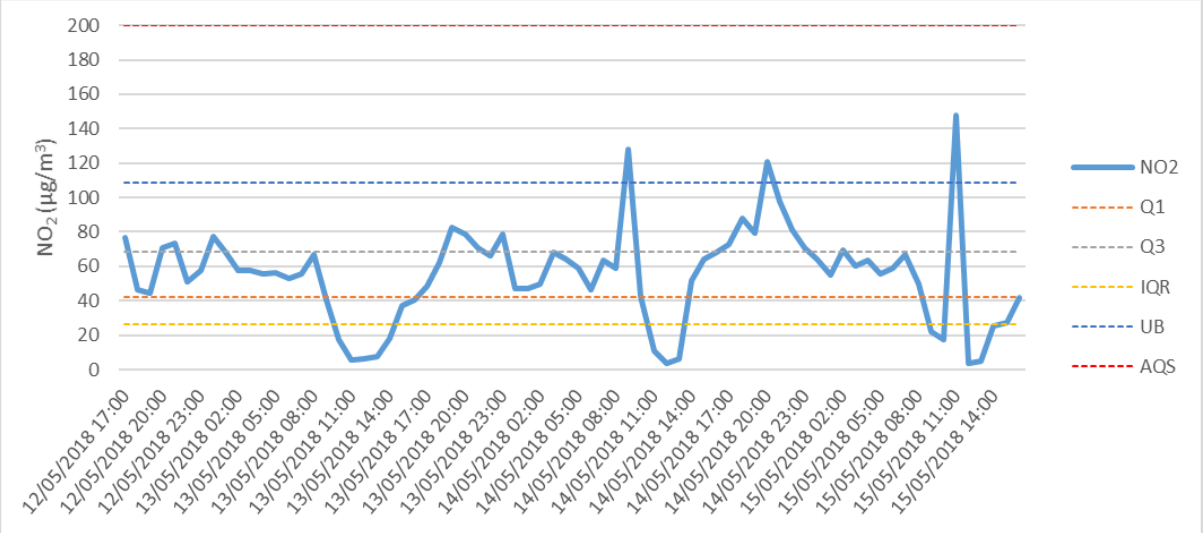


Figure 4.11: Site AQ5 NO_2 1-hour Average (Dry Season)

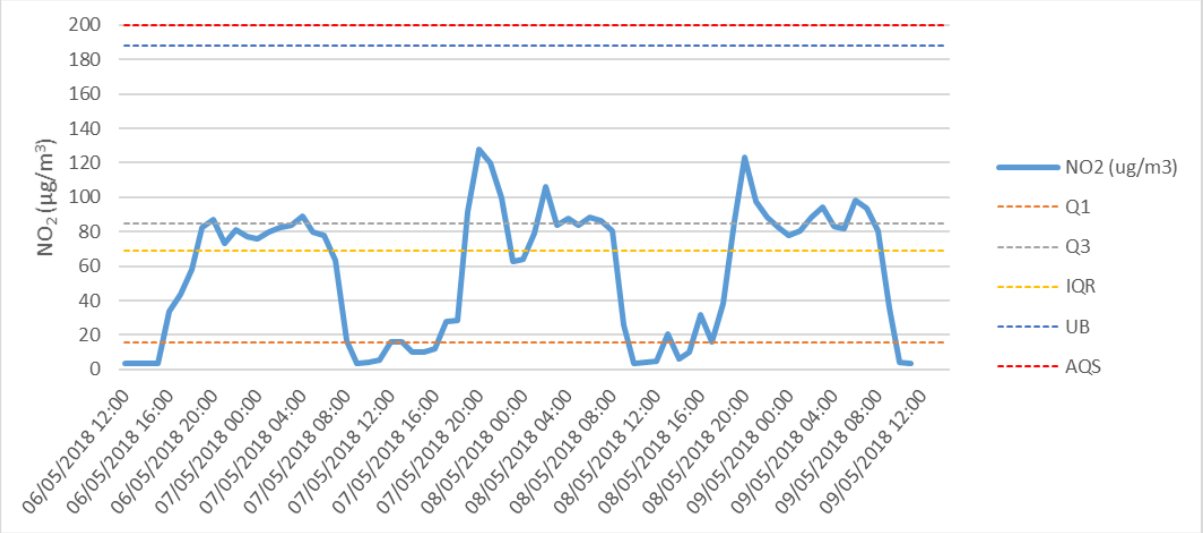


Figure 4.12: Site AQ6 NO_2 1-hour Average (Dry Season)

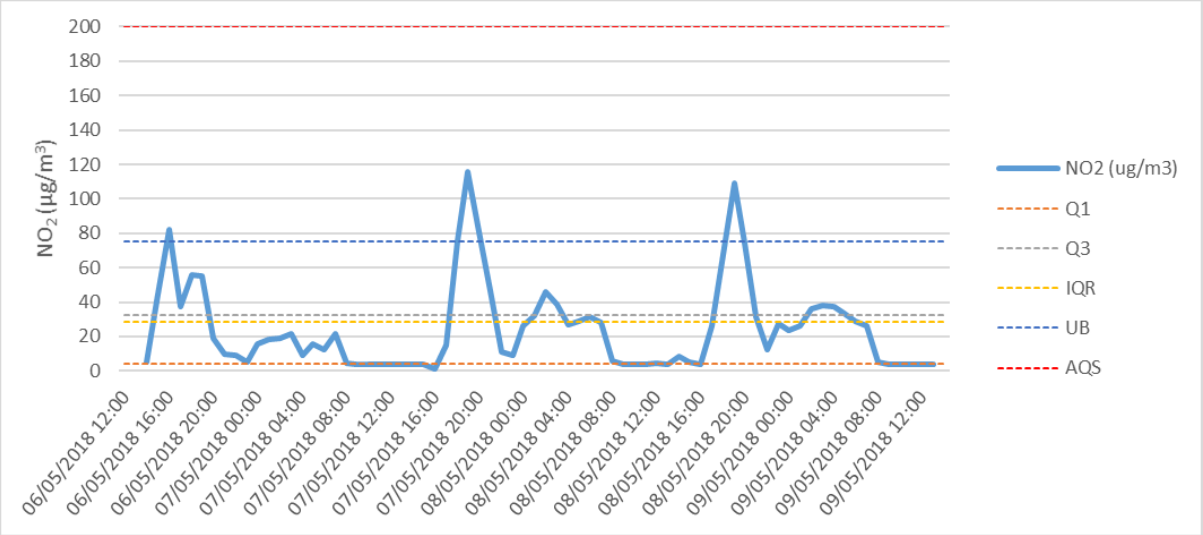


Figure 4.13: Site AQ7 NO_2 1-hour Average (Dry Season)

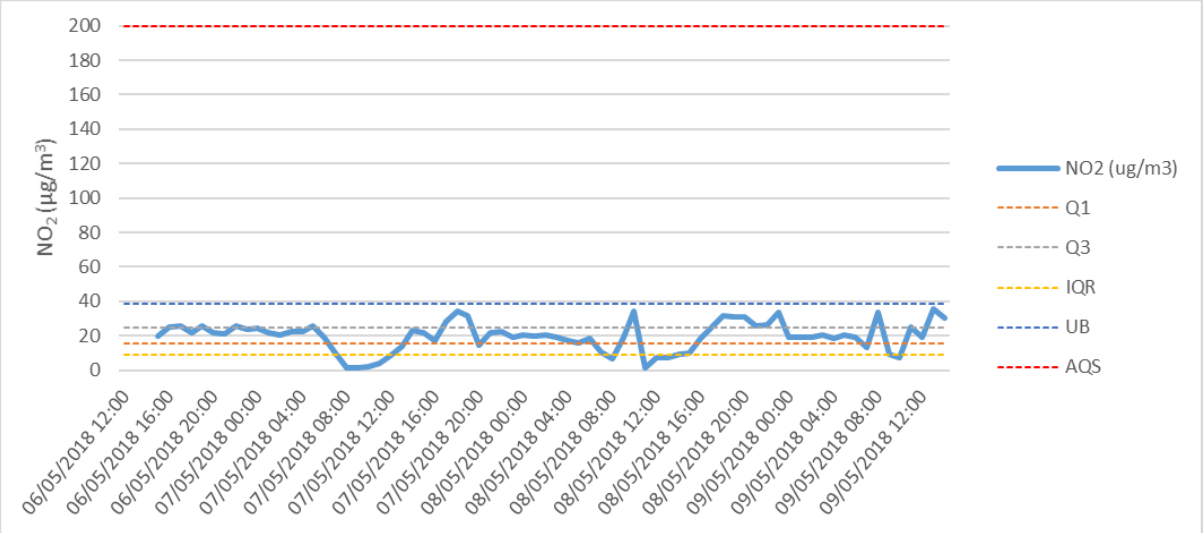


Figure 4.14: Site AQ8 NO_2 1-hour Average (Dry Season)

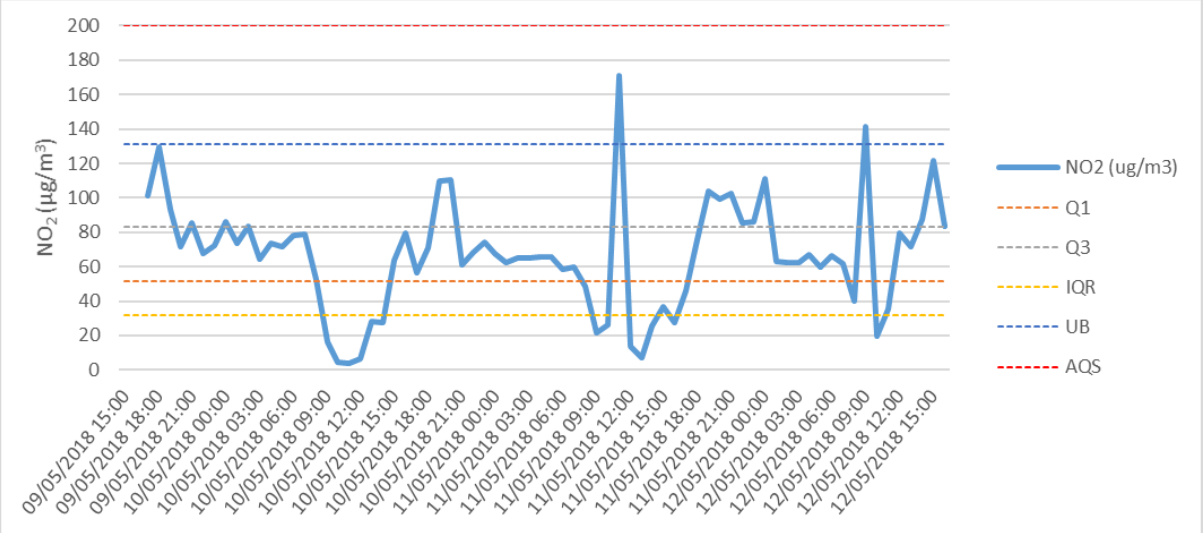


Figure 4.15: Site AQ9 NO_2 1-hour Average (Dry Season)

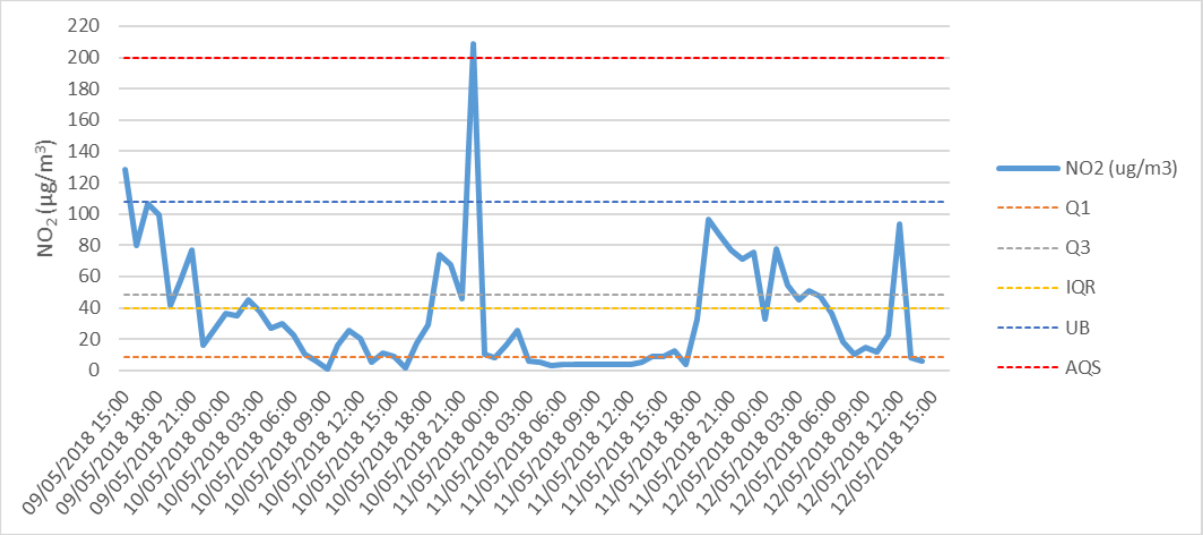


Figure 4.16: Site AQ10 NO_2 1-hour Average (Dry Season)

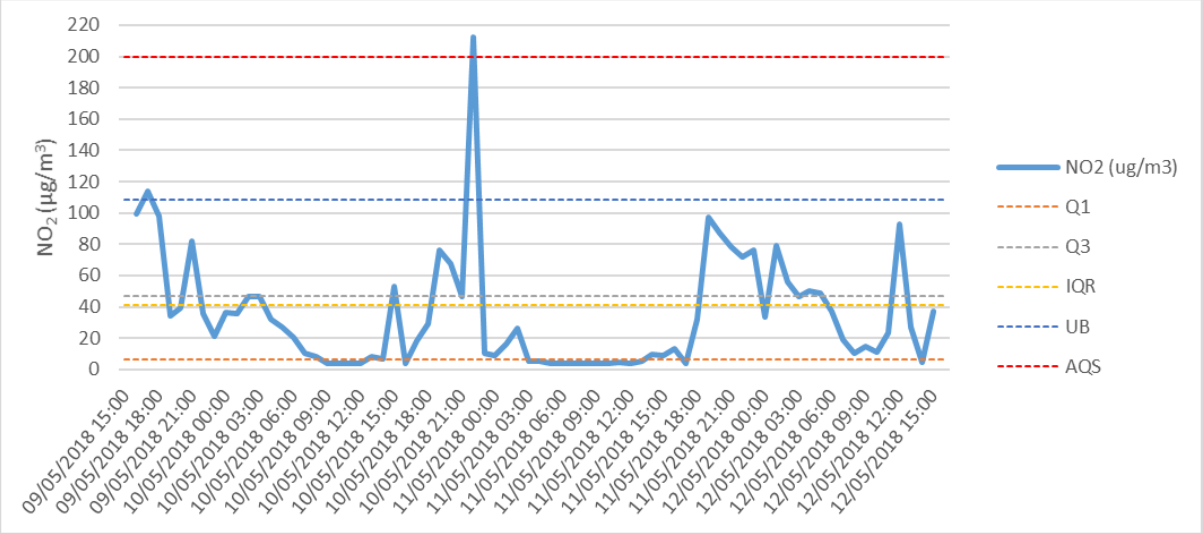


Table 4.3: Dry Season NO_2 Monitoring Result Summary

Site	NO_2 Upper Bound ($\mu g/m^3$)	NO_2 1-hour Average Maximum ($\mu g/m^3$)	1-hour Mean Air Quality Standard (AQS) ($\mu g/m^3$)	% of AQS
AQ1	77.7	68.5	200	34%
AQ2	79.0	68.6	200	34%
AQ3	135	108	200	54%
AQ4	108	97.9	200	49%
AQ5	188	128	200	64%
AQ6	74.9	74.3	200	37%
AQ7	38.7	35.9	200	18%
AQ8	131	129	200	65%
AQ9	108	106	200	53%
AQ10	108	100	200	50%

Wet Season

The NO2 1-hour average monitoring results at each monitoring location are presented below as a series of line graphs (refer to ***Figure 4.17*** to ***Figure 4.26***). The upper bound (UB) has been calculated for each data set by multiplying the interquartile range (IQR) by 1.5 and adding the result to Quartile 3 (Q3). Monitoring results above the UB are considered outliers and are not considered in the AQIA. The monitoring results including the upper bound and the resulting maximum monitored 1-hour average at each monitoring location are presented in ***Table 4.4***.

Figure 4.17: Site AQ1 NO_2 1-hour Average (Wet Season)

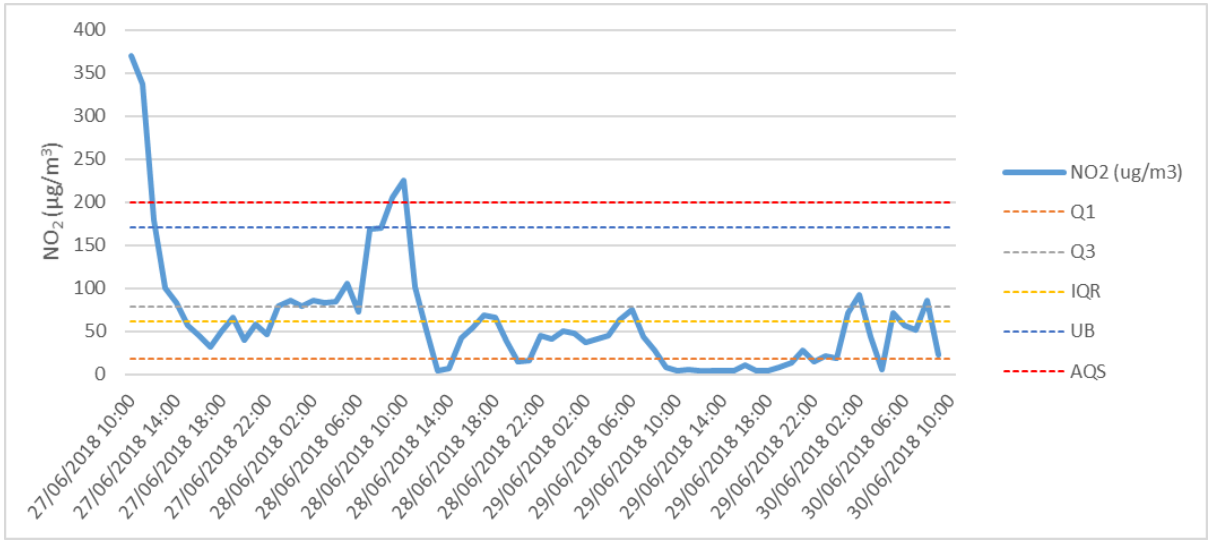


Figure 4.18: Site AQ2 NO_2 1-hour Average (Wet Season)

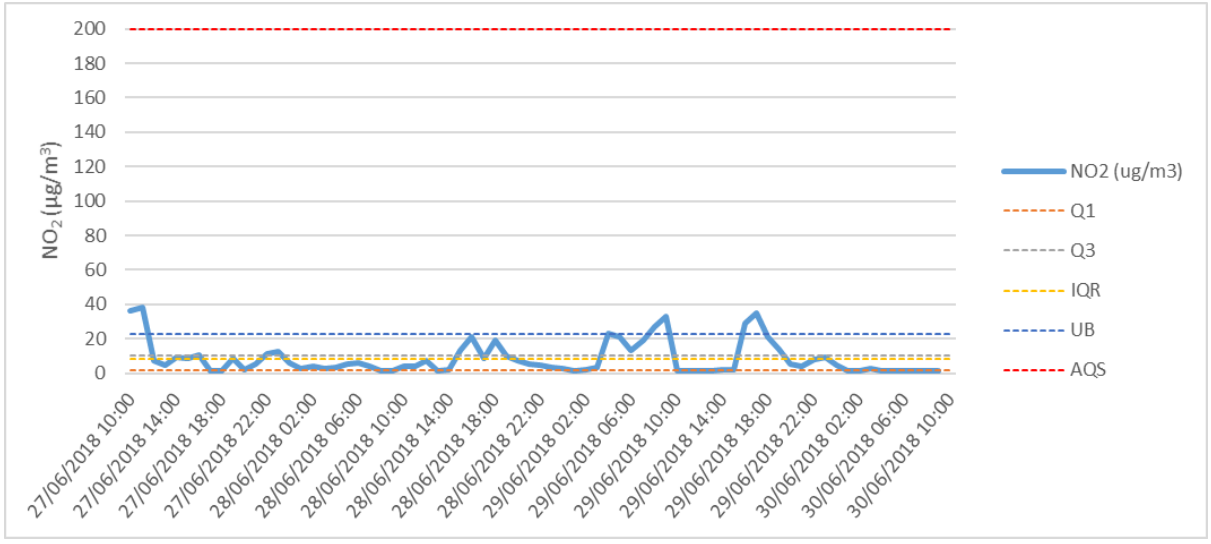


Figure 4.19: Site AQ3 NO_2 1-hour Average (Wet Season)

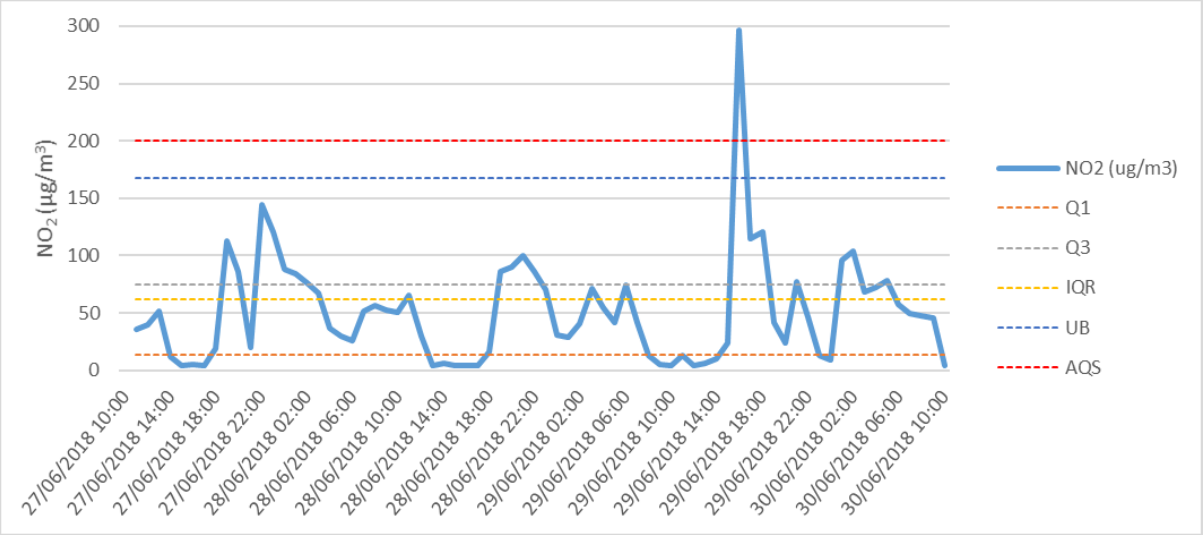


Figure 4.20: Site AQ4 NO_2 1-hour Average (Wet Season)

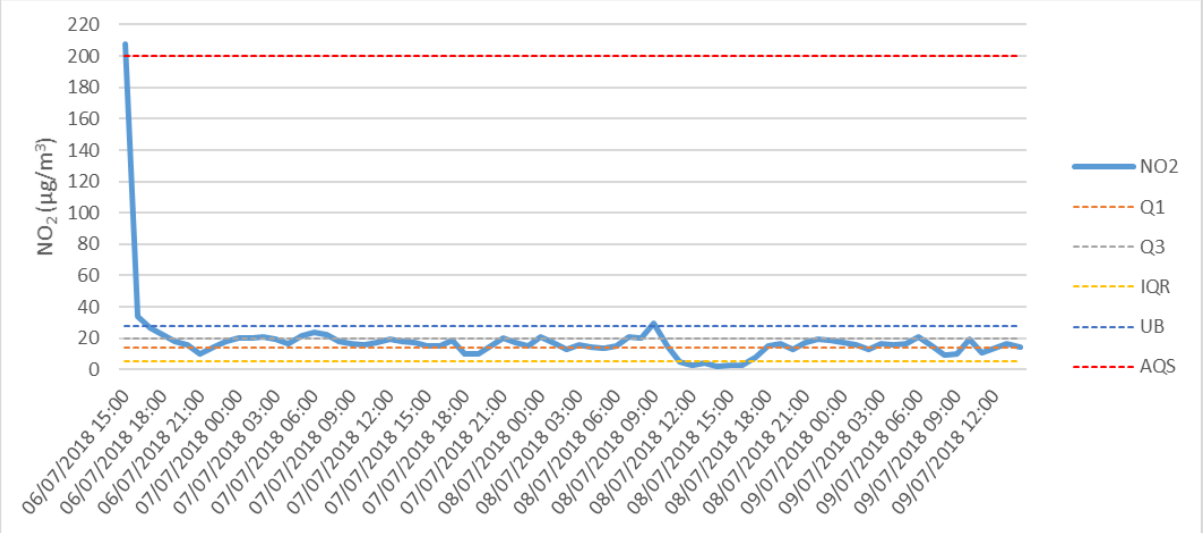


Figure 4.21: Site AQ5 NO_2 1-hour Average (Wet Season)

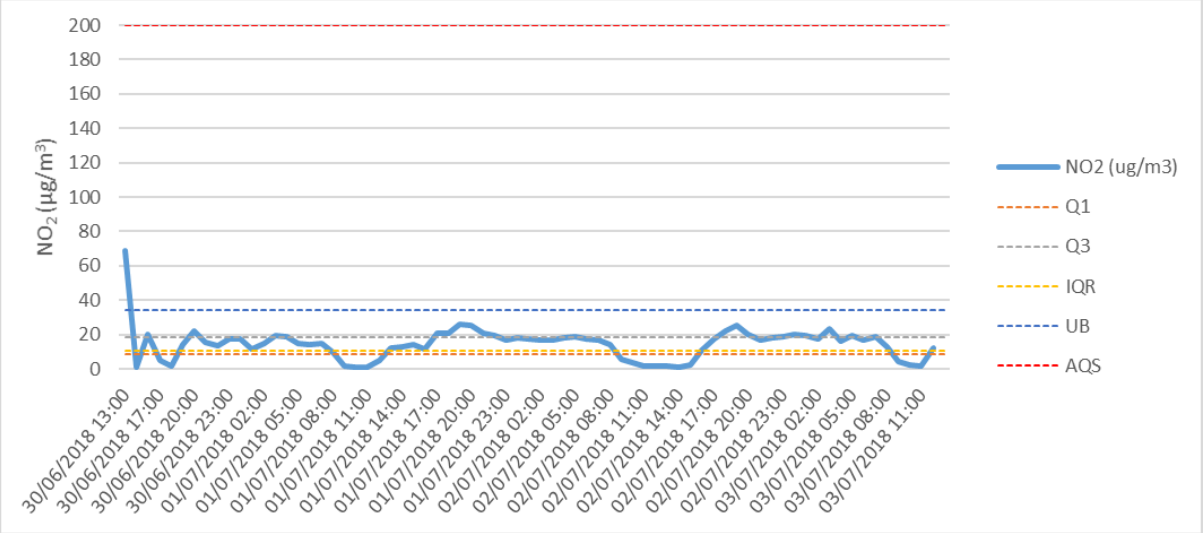


Figure 4.22: Site AQ6 NO_2 1-hour Average (Wet Season)

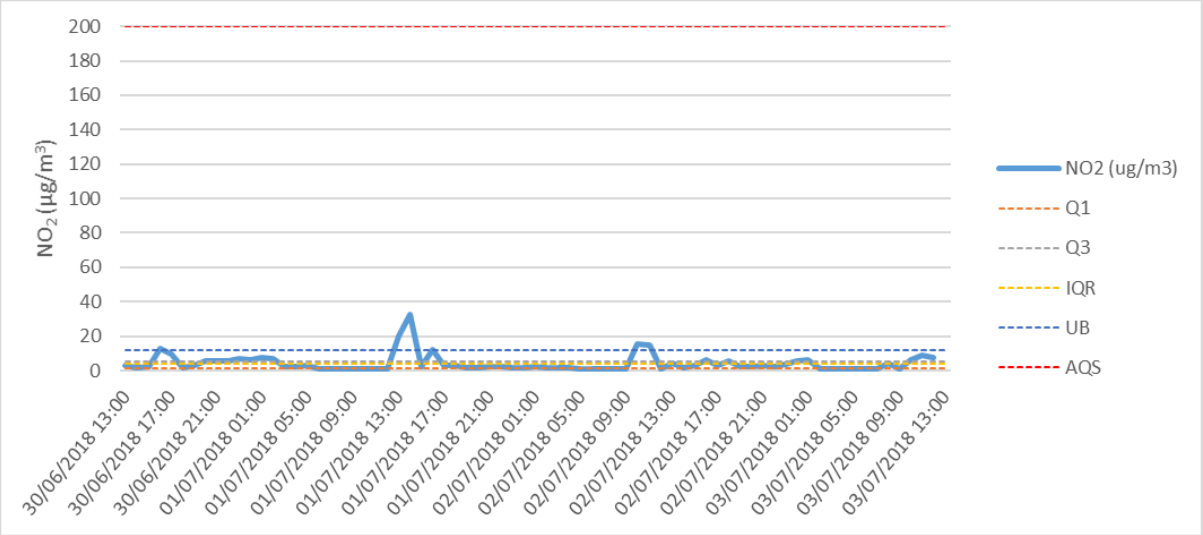


Figure 4.23: Site AQ7 NO_2 1-hour Average (Wet Season)

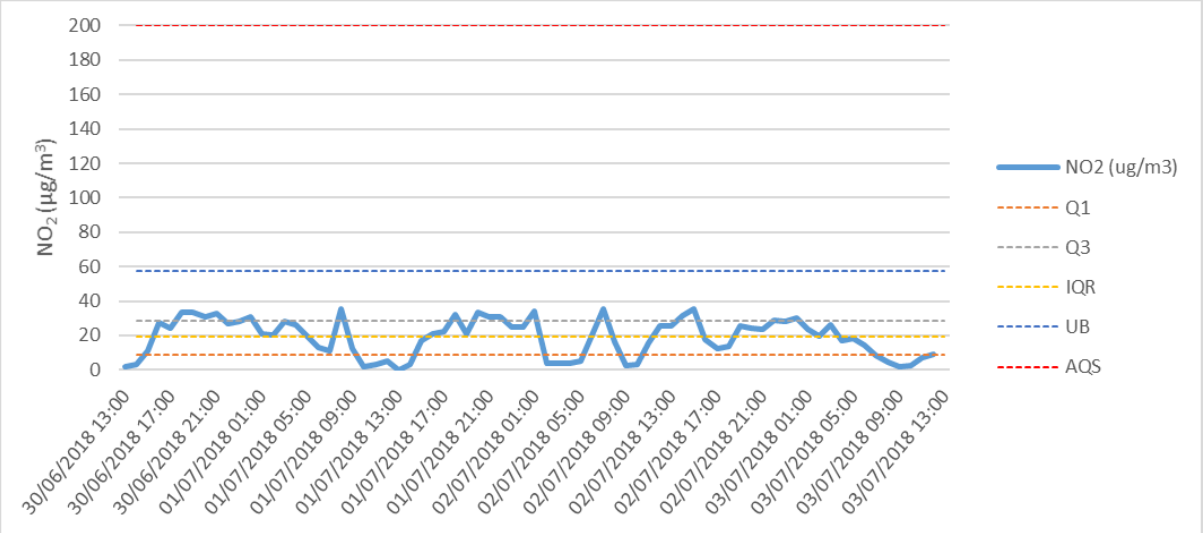


Figure 4.24: Site AQ8 NO_2 1-hour Average (Wet Season)

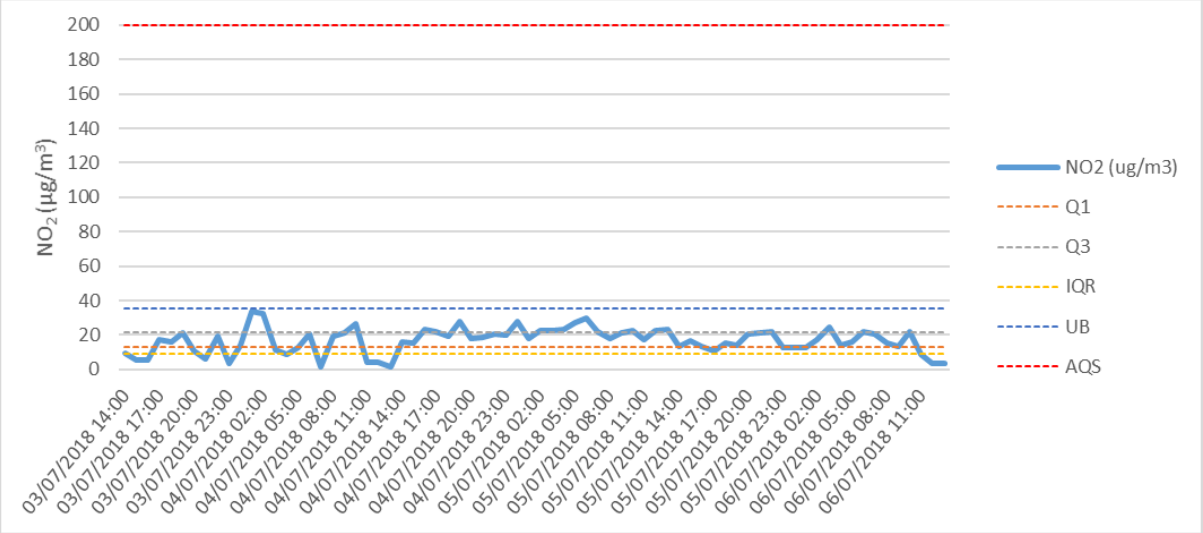


Figure 4.25: Site AQ9 NO_2 1-hour Average (Wet Season)

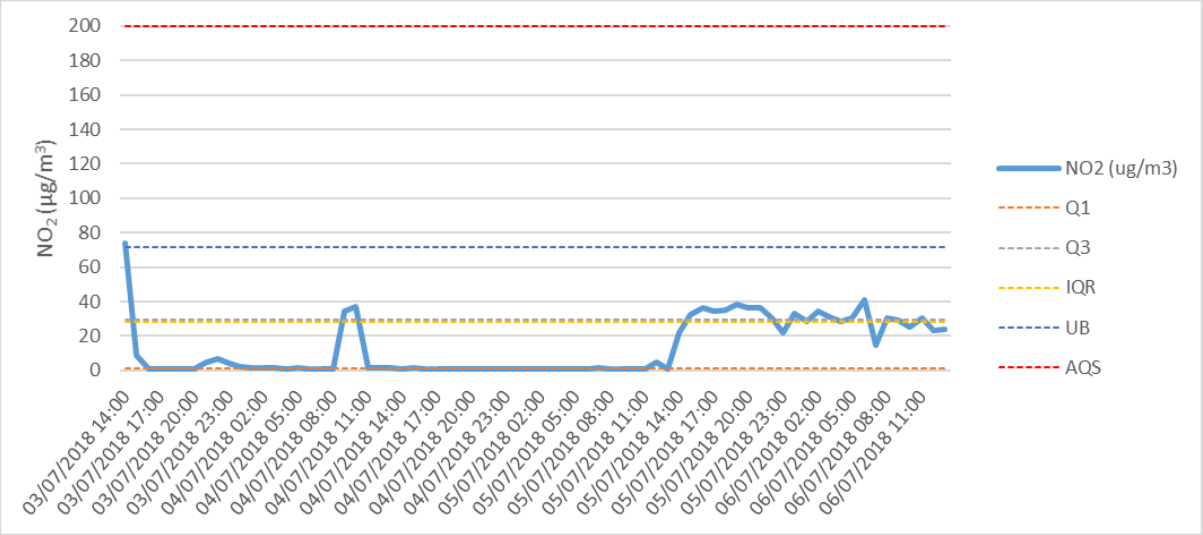


Figure 4.26: Site AQ10 NO_2 1-hour Average (Wet Season)

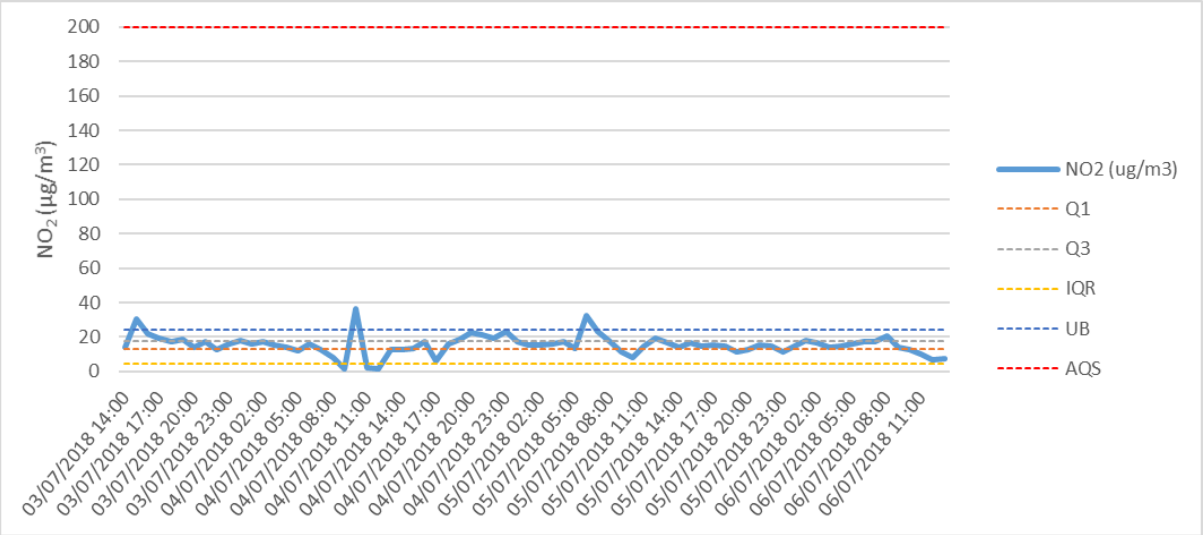


Table 4.4: Wet Season NO_2 Monitoring Result Summary

Site	NO_2 Upper Bound (µg/m³)	NO_2 1-hour Average Maximum (µg/m³)	1-hour Mean Air Quality Standard (AQS) (µg/m³)	% of AQS
AQ1	171	170	200	85%
AQ2	23.1	22.8	200	11%
AQ3	167	144	200	72%
AQ4	27.5	26.4	200	13%
AQ5	34.1	25.9	200	13%
AQ6	12.0	9.30	200	4.6%
AQ7	57.5	35.5	200	18%
AQ8	35.4	33.5	200	17%
AQ9	71.4	41.2	200	21%
AQ10	24.1	23.3	200	12%

4.3.3.2 Diffusion Tubes

The diffusion tube monitoring results sampled in the dry and wet season are presented in ***Table 4.5*** and ***Table 4.6*** respectively.

Table 4.5: Diffusion Tube Monitoring Dry Season

Location	Tube Number	Date on	Date off	NO_2 (µg/m^3)	Annual Mean AQS [a]	% of AQS
DT1	1	27/02/2018	02/05/2018	19.0	40	48%
	2	27/02/2018	02/05/2018	18.9	40	47%
	3	27/02/2018	02/05/2018	17.6	40	44%
DT2	1	27/02/2018	02/05/2018	24.6	40	61%
	2	27/02/2018	02/05/2018	21.6	40	54%
	3	27/02/2018	02/05/2018	22.4	40	56%
DT3	1	27/02/2018	02/05/2018	19.8	40	50%
	2	27/02/2018	02/05/2018	15.3	40	38%
	3	27/02/2018	02/05/2018	15.7	40	39%

Note: [a] *National Environmental Quality (Emission) Guidelines (NEQEG) (2015)*
Due to unforeseen circumstances, the diffusion tubes were deployed beyond the recommended exposure period. The results may be compromised and should be treated with caution.

Table 4.6: Diffusion Tube Monitoring Wet Season

Location	Tube Number	Date on	Date off	NO_2 (µg/m^3) [a]	Annual Mean AQS [b]	% of AQS
DT1	1	12/06/2018	26/06/2018	3.02	40	7.6%
	2	12/06/2018	26/06/2018	0.853	40	2.1%
	3[c]	12/06/2018	26/06/2018	-	40	-
DT2	1	12/06/2018	26/06/2018	2.48	40	6.2%
	2	12/06/2018	26/06/2018	2.27	40	5.7%
	3	12/06/2018	26/06/2018	3.24	40	-
DT3	1	12/06/2018	26/06/2018	0.960	40	8.1%
	2	12/06/2018	26/06/2018	1.54	40	2.4%
	3[c]	12/06/2018	26/06/2018	-		-

Note: [a] *The monitoring results are considered low given the urban environment in which they were located. The results have been treated with caution.*
[b] *National Environmental Quality (Emission) Guidelines (NEQEG) (2015)*
[c] *Tubes 1177604 & 1177610 could not be analysed as they did not contain any grids upon arrival in the laboratory.*

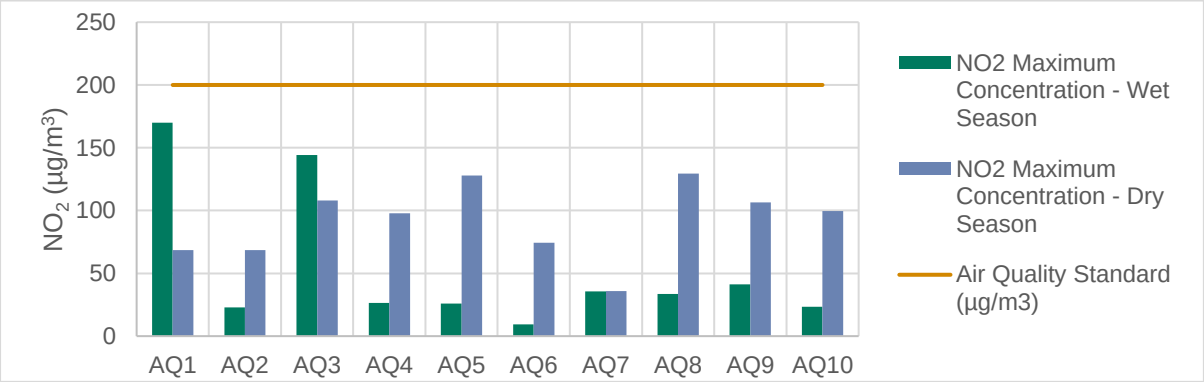
4.3.4 Nitrogen Dioxide (NO_2) Monitoring Final Summary

The maximum 1-hour average baseline concentration recorded at each monitoring site is compared to the NEQEG 1-hour air quality standard and the findings are presented in ***Figure 4.27***.

The data indicates that the maximum 1-hour average concentration at any monitoring location is below the NEQEG air quality standard. On this basis, the air shed is considered non-degraded.

The diffusion tube data is considered indicative of long-term NO_2 concentration at the monitoring locations. The diffusion tube results presented in ***Table 4.5*** and ***Table 4.6*** are below the annual mean air quality standard and suggest that the air shed is non-degraded.

Figure 4.27: NO_2 1-Hour Maximum Baseline Concentration Summary



5. IMPACT ASSESSMENT AND MITIGATION

5.1 Overview

The AQIA approach utilises qualitative and quantitative methods, including detailed air dispersion modelling, to assess potential impacts to sensitive receptors from the key processes identified in ***Section 3***. Where appropriate, the assessment considers existing ambient air quality baseline and assesses predicted impacts at sensitive receptors by comparing them to the relevant air quality standards and guidelines presented in ***Section 2***.

The main sources of emissions associated with the Project that require further more detailed assessment have been identified as follows:

- Construction activities: These activities are specifically associated with demolition, earthworks, the construction of the Project infrastructure, and track-out (carrying and contamination) of materials onto public roads leading to increased ambient concentrations of TSP and PM_{10};
- Power Plant Operation: The continuous operation of the 388 MW gas turbines used for power generation during the normal operation of the Project resulting in elevated ambient concentrations of NO_2; and
- Gas Receiving Terminal Operation: The continuous operation of four-1160 kW natural gas fired generators required during the normal operation of the Project resulting in elevated ambient concentrations of NO_2.

5.2 Impacts to Air Quality from Construction Related Activities

5.2.1 Overview

The activities associated with the construction phase of the Project have the potential to generate TSP and PM_{10} that can result in adverse impacts on sensitive receptors if not managed accordingly. Activities include ground excavation, site levelling, material transfer, material stockpiling, construction of the main infrastructure and track out of dusty materials and dirt onto the public road network.

The following section qualitatively assesses the potential impacts on human health and ecology as well as potential nuisance concerns from dust emissions associated with construction phase activities.

5.2.2 Assessment Methodology

The IAQM[11] provide specific guidance for defining the dust impact risk from construction sites based on the dust emissions magnitude and the sensitivity of the receiving area. The IAQM guidance is used as the main reference document for determining the potential risk of impact from the anticipated construction works in order to determine the level of site-specific mitigation that should be applied. The premise of the guidance is that with the implementation of effective site-specific mitigation and management measures, the environmental effect will not be significant in most cases.

The potential dust impact risk from the different project components and activities and the specific mitigation measures that are required are considered. Professional judgement is used where necessary to estimate the impact magnitude from the different project components and activities.

5.2.2.1 Determining the Magnitude of the Impact

The IAQM defines the dust emission magnitude based on the scale of the anticipated works. The criteria for estimating the magnitude of dust impacts from demolition, earthworks, construction and track-out as per the IAQM guidance note is presented in ***Table 5.1*** and is used to inform this impact assessment.

[11] Institute of Air Quality Management (IAQM) (2014) Guidance on the Assessment of Dust from Demolition and Construction [Online] Available at: http://iaqm.co.uk/guidance/ [Accessed 13 February 2019]

5.2.2.2 Determining the Sensitivity of the Area

The IAQM define the sensitivity of the area based on receptor type and the number of receptors within a certain distance from the source. Residential properties, schools, and hospitals are classified as high sensitivity to dust soiling and health effects. Locations where there are particularly important plant species (i.e. rice paddy) are classified as medium sensitivity. The criteria for estimating the sensitivity of the area as per the IAQM guidance is presented in ***Table 5.2***, ***Table 5.3*** and ***Table 5.4***. The guidance provides a screening criterion of 350 m and 50 m from the construction site and access road respectively beyond which impacts are not considered likely.

5.2.2.3 Determining the Risk of Impact

The impact magnitude is combined with the sensitivity of the area to determine the risk of the impact with no mitigation. The matrices in ***Table 5.5***, ***Table 5.6***, ***Table 5.7*** and ***Table 5.8*** provide the approach for defining the impact risk due to demolition, earthworks, construction and track-out respectively. The findings from this risk assessment inform the level of mitigation that is necessary to reduce impacts to an acceptable level.

Table 5.1: Dust Emission Magnitude

Activity	Impact Magnitude		
	Small	Medium	Large
Demolition	Total building volume <20,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10 m above ground, demolition during wetter months.	Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level; and	Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20 m above ground level
Earthworks	Total site area <2 ,500 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4m in height, total material moved <20,000 tonnes, earthworks during wetter months	Total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m – 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes	Total site area >10,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes
Construction	Total building volume <25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).	Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), on site concrete batching;	Total building volume >100,000 m^3, on site concrete batching, sandblasting
Trackout	<10 HDV (>3.5 t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m.	10-50 HDV (>3.5 t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m	>50 HDV (>3.5 t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m

Table 5.2: Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Note: For trackout the distances should be measured from the side of the roads used by construction traffic. Without site specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

Table 5.3: Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} concentration	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m^3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low

Receptor Sensitivity	Annual Mean PM_{10} concentration	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
		1-10	Low	Low	Low	Low	Low
Medium	>32 µg/m^3	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg/m^3	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>=1	Low	Low	Low	Low	Low

Note: For trackout the distances should be measured from the side of the roads used by construction traffic. Without site specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

Table 5.4: Sensitivity of the Area to Ecological Impacts

Sensitivity of the Area	Distance from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Table 5.5: Risk of Dust Impacts – Demolition

Sensitivity of the Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table 5.6: Risk of Dust Impacts – Earthworks

Sensitivity of the Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 5.7: Risk of Dust Impacts – Construction

Sensitivity of the Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 5.8: Risk of Dust Impacts – Trackout

Sensitivity of the Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

5.2.3 Construction Phase Impacts from the Combined Cycle Gas Turbine Power Plant (pre mitigation)

Information regarding demolition, earthworks, construction, and trackout associated with the Project is summarised in ***Table 5.9***. The magnitude of the impact and the sensitivity of the area is defined based on the IAQM approach outlined in ***Section 5.2.2***.

Table 5.9: Construction Dust Risk Assessment of Combined Cycle Gas Turbine Power Plant

Activity	Magnitude of Impact	Site Sensitivity (Human)	Site Sensitivity (Ecology)
Demolition	■ Buildings require demolition include one x wooden building (1,140 m^3) and one x concrete building (350 m^3). Total building volume demolished is 1,490 m^3. ■ The dust emission magnitude from demolition during construction will be **small** (refer to ***Table 5.1***).	■ A review of aerial imagery indicates that to the north of the site there are approximately 10-100 human receptors <100 m from the site boundary and between 1-10 human receptors <50 m from the site boundary (refer to ***Table 4.1***). ■ The sensitivity of the area to dust soiling and human health impacts will be **low** as a worst case (refer to ***Table 5.2*** and ***Table 5.3***).	■ Mangroves exist within 20 m from the site boundary (refer to ***Table 4.1***). ■ The sensitivity of the mangroves to dust soiling from earthwork activities will be **medium** (refer to ***Table 5.4***).
Earthworks	■ Development of the Project will occur on approximately 36,300 m^2 of existing land. ■ 84,560 tons of soil required for landscaping ■ Clay/silt soil type ■ The dust emission magnitude from earthworks will be **large** (refer to ***Table 5.1***).	■ A review of aerial imagery indicates that to the north of the site there are approximately 10-100 human receptors <100 m from the site boundary and between 1-10 human receptors <50m from the site boundary (refer to ***Table 4.1***). ■ The sensitivity of the area to dust soiling and human health impacts will be **low** as a worst case (refer to ***Table 5.2*** and ***Table 5.3***).	■ Mangroves exist within 20 m from the site boundary (refer to ***Table 4.1***). ■ The sensitivity of the mangroves to dust soiling from earthwork activities will be **medium** (refer to ***Table 5.4***).
Construction	■ Total expected building volume is 12,100 m^3. ■ Construction materials will primarily consist of concrete and steel. ■ On-site concrete batching. ■ The dust emission magnitude from construction of infrastructure will be **medium** (refer to ***Table 5.1***).	■ A review of aerial imagery indicates that to the north of the site there are approximately 10-100 human receptors <100 m from the site boundary and between 1-10 human receptors <50 m from the site boundary (refer to ***Table 4.1***). ■ The sensitivity of the area to dust soiling and human health impacts will be **low** as a worst case (refer to ***Table 5.2*** and ***Table 5.3***).	■ Mangroves exist within 20 m from the site boundary (refer to ***Table 4.1***). ■ The sensitivity of the mangroves to dust soiling from construction activities will be **medium** (refer to ***Table 5.4***).
Track-out	■ While the exact number of vehicles exiting the site per day is unknown, this assessment assumes between 10-50 HDV	■ A review of the aerial imagery indicates that there are no sensitive receptors adjacent to the	■ A review of the aerial imagery indicates that there is no sensitive ecology adjacent to the

Activity	Magnitude of Impact	Site Sensitivity (Human)	Site Sensitivity (Ecology)
	resulting in a **medium** dust emission magnitude.	access road (refer to ***Table 4.1***). ■ The sensitivity of the area to track-out is therefore not applicable.	access road (refer to ***Table 4.1***). ■ The sensitivity of the area to track-out is therefore not applicable.

5.2.4 Construction Phase Impacts from the LNG Terminal (pre mitigation)

Information regarding demolition, earthworks, construction, and track out associated with the Project is summarised in ***Table 5.10***. The magnitude of the impact and the sensitivity of the area is defined based on the IAQM approach outlined in ***Section 5.2.2***.

Table 5.10: Construction Dust Risk Assessment of Liquefied Natural Gas Receiving Terminal

Activity	Magnitude of Impact	Site Sensitivity (Human)	Site Sensitivity (Ecology)
Demolition	■ No demolition is necessary.	■ Not applicable.	■ Not Applicable.
Earthworks	■ Development of the Project will occur on approximately 64,414 m^2 of existing land. ■ 126,702 tons of soil required for landscaping. ■ Clay/silt soil type. ■ The dust emission magnitude from earthworks will be **large** (refer to ***Table 5.1***).	■ A review of aerial imagery indicates that there are 1-10 human receptors <350 m from the site boundary (refer to ***Table 4.2***). ■ The sensitivity of the area to dust soiling and human health impacts will be **low** (refer to ***Table 5.2*** and ***Table 5.3***).	■ Agriculture exist within 20 m from the site boundary (refer to ***Table 4.2***). ■ The sensitivity of the agriculture to dust soiling from earthwork activities will be **medium** (refer to ***Table 5.4***).
Construction	■ Total expected building volume is 12,100 m^3. ■ Construction materials will primarily consist of concrete and steel. ■ On-site concrete batching. ■ The dust emission magnitude from construction of infrastructure will be **medium** (refer to ***Table 5.1***).	■ A review of aerial imagery indicates that there are 1-10 human receptors <350 m from the site boundary (refer to ***Table 4.2***). ■ The sensitivity of the area to dust soiling and human health impacts will be **low** (refer to ***Table 5.2*** and ***Table 5.3***).	■ Agriculture exist within 20 m from the site boundary (refer to ***Table 4.2***). ■ The sensitivity of the agriculture to dust soiling from construction activities will be **medium** (refer to ***Table 5.4***).
Track-out	■ While the exact number of vehicles exiting the site per day is unknown, this assessment assumes between 10-50 HDV resulting in a **medium** dust emission magnitude.	■ A review of aerial imagery indicates that there is one human receptors <50 m from the road (refer to ***Table 4.2***). ■ The sensitivity of the area to dust soiling and human health impacts will be low (refer to ***Table 5.2*** and ***Table 5.3***).	■ A review of aerial imagery indicates that there are no ecological receptors <50 m from the road (refer to ***Table 4.2***). ■ The sensitivity of the area to dust soiling is not applicable.

5.2.5 Construction Phase Impacts from the Onshore Pipeline (pre mitigation)

Information regarding demolition, earthworks, construction, and trackout associated with the onshore pipeline is summarised in ***Table 5.11***. The magnitude of the impact and the sensitivity of the area is defined based on the IAQM approach outlined in ***Section 5.2.2***.

Table 5.11: Onshore Pipeline Dust Risk Assessment

Activity	Magnitude of Impact	Site Sensitivity (Human)	Site Sensitivity (Ecology)
Demolition	■ No demolition required	■ Not applicable	■ Not applicable
Earthworks	■ The installation of the pipeline is expected to require >10,000 m^2 of land ■ More than 10 heavy earth moving vehicles are expected to be active at any one time ■ The dust emission magnitude from earthworks will be **large** (refer to ***Table 5.1***).	■ A review of aerial imagery indicates that there are potentially 10-100 human receptors <20 m from the site boundary (refer to ***Table 4.3***). ■ The sensitivity of the area to dust soiling and human health impacts will be **large** (refer to ***Table 5.2*** and ***Table 5.3***).	■ Agriculture exists <20 m from the pipeline route (refer to ***Table 4.3***). ■ The sensitivity of the agriculture to dust soiling from construction activities will be **medium** (refer to ***Table 5.4***).
Construction	■ No physical construction is required.	■ Not applicable	■ Not applicable
Track-out	■ The exact number of outward movements is unknown, however it is assumed >50 HDV as a worst case ■ The dust emission magnitude from earthworks will be **large** (refer to ***Table 5.1***).	■ The access roads to the pipeline construction area are not known. This impact assessment assumes the site sensitivity will be high as a worst case (refer to ***Table 5.2*** and ***Table 5.3***).	■ The access roads to the pipeline construction area are not known however it is assumed that agriculture will exist within 20 m of the road. This impact assessment therefore classifies the site sensitivity as medium (refer to ***Table 5.4***).

5.2.5.1 Summary of Dust Risk

The summary of the dust risk associated with the construction of the Project pre-mitigation is presented in ***Table 5.12***.

Table 5.12: Summary of Dust Risk

Project Component	Activity	Impact	Impact Magnitude	Sensitivity of the Area	Impact Significance
CCGT Power Plant	Demolition	Dust Soiling	Small	Low	Negligible
		Human Health	Small	Low	Negligible
		Ecological	Small	Medium	Low
	Earthworks	Dust Soiling	Large	Low	Low
		Human Health	Large	Low	Low
		Ecological	Large	Medium	Medium
	Construction	Dust Soiling	Medium	Low	Low
		Human Health	Medium	Low	Low
		Ecological	Medium	Medium	Medium
	Trackout	Dust Soiling	Medium	*n/a*	*n/a*
		Human Health	Medium	*n/a*	*n/a*
		Ecological	Medium	*n/a*	*n/a*
LNG Terminal	Demolition	Dust Soiling	*n/a*	*n/a*	*n/a*
		Human Health	*n/a*	*n/a*	*n/a*
		Ecological	*n/a*	*n/a*	*n/a*
	Earthworks	Dust Soiling	Large	Low	Low
		Human Health	Large	Low	Low
		Ecological	Large	Medium	Medium
	Construction	Dust Soiling	Medium	Low	Low
		Human Health	Medium	Low	Low
		Ecological	Medium	Medium	Medium
	Trackout	Dust Soiling	Medium	Low	Low
		Human Health	Medium	Low	Low
		Ecological	*n/a*	*n/a*	*n/a*
Onshore Pipeline	Demolition	Dust Soiling	*n/a*	*n/a*	*n/a*
		Human Health	*n/a*	*n/a*	*n/a*
		Ecological	*n/a*	*n/a*	*n/a*
	Earthworks	Dust Soiling	Large	Large	Large
		Human Health	Large	Large	Large
		Ecological	Large	Medium	Medium
	Construction	Dust Soiling	*n/a*	*n/a*	*n/a*
		Human Health	*n/a*	*n/a*	*n/a*
		Ecological	*n/a*	*n/a*	*n/a*
	Trackout	Dust Soiling	Large	Large	Large
		Human Health	Large	Large	Large
		Ecological	Large	Medium	Medium

5.2.6 Recommended Mitigation, Management and / or Monitoring Measures

A series of project specific mitigation measures for demolition, earthworks, construction and trackout are suggested based on the outcome of the dust risk assessment summarised in ***Table 5.13***. Where the assessment predicts negligible impacts, no site-specific mitigation measures are proposed.

Table 5.13: Proposed Construction Phase Mitigation and Management Measures

Activity	Mitigation
General Construction	■ Develop and Implement a Dust Management Plan (DMP). The DMP will contain the measures outlined in this document and a plan for implementation. ■ Regular site inspections will be performed to monitor compliance with the DMP. All inspection results will be recorded and corrective actions taken where mitigation and management measures are not being implemented effectively (i.e. to reduce dust emissions). ■ Daily onsite and offsite inspections will be undertaken to visually assess the dust emissions from earthwork and construction activities, and from vehicles exiting the construction sites. Results from the inspection will be recorded and appropriate measures such as those presented in this table will be taken to reduce emissions where necessary. ■ All dust and air quality complaints will be recorded, the cause identified and appropriate measures such as those presented in this table will be implemented or intensified to reduce dust emissions in a timely manner. ■ The frequency of site inspections will be increased when activities with a high potential to produce dust are being carried out and during prolonged dry and windy conditions. ■ Watering will be used to suppress wind and physical disturbance dust generation. ■ Ensure an adequate water supply on site for effective dust suppression and mitigation. ■ The site layout will be planned so that dust causing activities are located away from receptors as far as is possible. ■ Screens or barriers will be erected around dusty activities or the site boundary that are at least the height of any stockpile on site. ■ All stockpiles will be covered or fenced off to prevent wind whipping. ■ Only cutting, grinding, or sawing equipment fitted with suitable dust suppression techniques such as water sprays will be used. ■ All chutes, conveyors and skips will be covered at all times. ■ Drop heights from conveyors, loading shovels and hoppers will be minimised. ■ No waste will be burned on site.
Demolition	■ Ensure effective water suppression is used during demolition operations. ■ Avoid explosive blasting, using appropriate manual or mechanical alternatives. ■ Bag and remove any biological debris or damp down such material before demolition.
Earthworks	■ Re-vegetate earthwork and exposed areas as soon as is practicable. ■ Use hessian, mulches or trackifiers where it is not possible to revegetate, or cover with top soil as soon as is practicable.
Construction	■ Sand and other aggregates will be stored in bunded areas and will not be allowed to dry out unless this is required for a particular process, in which case additional control measures such as those discussed in ‘General Construction’ will be applied.
Track out	■ Ensure that all vehicles entering and leaving the site are covered to avoid fugitive emissions during transport. ■ Inspect on-site haul roads for integrity and instigate the necessary repairs to the surfaces as soon as reasonable practicable. ■ Implement a wheel washing system. ■ Regularly dampen/clean the site access and local roads to remove any materials tracked out of the site. ■ All site access gates will be located at least 10m away from air sensitive receptors where possible.

Activity	Mitigation
Operation of Vehicles/Machinery	■ The site layout will be planned so that machinery is located away from receptors as far as is possible. ■ All vehicles will switch off engines when stationary. ■ A regular vehicle and machinery maintenance and repair programme will be implemented. ■ Mains electricity or battery powered equipment will be used instead of diesel/petrol generators where practicable.

5.2.7 Residual Impact (post mitigation)

The IAQM guidance suggest that when correctly applying and actively managing the mitigating controls outlined in ***Table 5.13***, the impacts to receptors located within 350m downwind of any construction activity are not likely to be significant for the large majority of the time. However, due to the nature of construction activities, the scale and duration of the construction phase, and the possibility of extreme weather conditions, it is possible that communities will experience occasional, short-term dust annoyance. The IAQM states, "*the likely scale of this would not normally be considered sufficient to change the conclusion that with mitigation the effects will be 'not significant'*. On this basis, it can be concluded that construction phase activities are likely to result in a negligible impact at worst post mitigation.

5.3 Impacts to Ambient Air Quality during Operations

5.3.1 Overview

The operation of the Project will generate emissions to air that can result in adverse health impacts at sensitive receptors in the study area. The following section quantitatively assesses the potential impacts at sensitive receptors using detailed dispersion modelling.

5.3.2 Assessment Methodology

5.3.2.1 Magnitude and Significance of Impacts

There is no Project specific approach for determining the magnitude and the significance of impacts during the operation phase of the Project. This AQIA, therefore, makes specific consideration to the guidance set out by the IFC when defining the magnitude and significance of impacts to air quality.

The magnitudes of impacts during the operation phase were quantified using detailed dispersion modelling. The magnitude of the impact was ascertained by means of comparison to the Myanmar air quality standards. Magnitude is based on both the 'Project Contribution (PC)'; this is the impact arising solely from project related emissions, and the Predicted Environmental Concentration (PEC); this is the PC added to the existing baseline.

In order to determine the significance of those impacts, consideration is then required to the sensitivity of the area in question, based on sensitivity of human health and ecology within the study area. Examples of receptor type and sensitivity for the purpose of this AQIA are presented in ***Table 5.14***.

In general, the approach assumes that sensitivity within the general study area is 'Medium' for human health. There are a small number of specific cases where the sensitivity may be defined as 'High'; these include hospitals, for example, where there are intensive care units or high dependency wards. Under no circumstances is the sensitivity for human health described as 'Low'.

Table 5.14: Receptor Sensitivity

Receptor Sensitivity	Human Health	Ecology
High	■ Hospitals; and ■ Schools	■ Internationally Designated Sites
Medium	■ General Population	■ Nationally Designated Site
Low	■ n/a	■ Locally Designated Sites (Areas of specific ecological interest not subject to statutory protection)

The IFC make a differentiation in the significance of impacts, based upon the existing baseline. Essentially, this is whether air quality guidelines or standards are exceeded or not due to baseline concentrations.

The IFC General EHS Guideline states:

- *Projects with significant sources of air emissions, and potential for significant impacts to ambient air quality, should prevent or minimise impacts by ensuring that:*
  - *Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines, or other internationally recognised sources.*
  - *Emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards. As a general rule, this Guideline suggests 25 percent of the applicable air quality standards to allow additional, future sustainable development in the same airshed [i.e. in an undegraded airshed].*
- *An airshed should be considered as having poor air quality [degraded] if nationally legislated air quality standards or WHO Air Quality Guidelines are exceeded significantly.*
- *Facilities or projects located within poor quality airsheds, and within or next to areas established as ecologically sensitive (e.g. national parks), should ensure that any increase in pollution levels is as small as feasible, and amounts to a fraction of the applicable short-term and annual average air quality guidelines or standards as established in the project-specific environmental assessment.*

The significance of impacts are therefore defined in terms of the sensitivity of the receptors (refer to ***Table 5.14***), the impact magnitude (i.e. the PC) (refer to ***Table 5.15***), and whether the baseline pollution concentrations are above or below the air quality standards (i.e. degraded or non-degarded). This approach has been used to define the AQIA significance criteria for a non-degraded and degraded airshed (refer to ***Table 5.16***).

Table 5.15: Impact Magnitude

Magnitude of Impact	Non-degraded airshed (i.e. baseline < AQS)	Degraded airshed (i.e. baseline > AQS)
Negligible	■ PC <25% of AQS	■ PC <10% of AQS
Small	■ PC between 25% and 50% of AQS and PEC <100% of AQS	■ PC between 10% and 30% of AQS
Medium	■ PC between 50% and 100% of AQS, and PEC <100% AQS; or ■ PC between 25% and 50% of AQS, and PEC >100% of AQS	■ PC between 30% and 50% of AQS
Large	■ PC > 100% of AQS; or ■ PC > 50% of AQS, and PEC >100% of AQS	■ PC > 50% of AQS

Note: PC: Process Contribution; PEC: Predicted Environmental Concentration; AQS: Air Quality Standard/Guideline

Table 5.16: Determination of Significance

Impact Magnitude	Receptor Sensitivity		
	Low	Medium	High
Negligible	Negligible	Negligible	Negligible
Small	Negligible	Minor	Moderate
Medium	Minor	Moderate	Major
Large	Moderate	Major	Major

5.3.2.2 Dispersion Model

The AQIA approach uses air dispersion modelling to assess potential impacts to sensitive receptors from the stack emissions from the CCGT power plant.

The dispersion model used in the assessment was the latest USEPA AERMOD dispersion model version 18081 released in April 2018. AERMOD is a state of the art detailed dispersion model that can represent complex multiple emission sources and predict air quality at receptor locations taking into account meteorology. The model is widely recognised for use in this type of application, including by the IFC, USEPA, UK Environment Agency and state based EPA's throughout Australia.

5.3.2.3 Modelling Scenarios

The assessment on air quality during normal operation considers emissions to air from gas turbines at the power plant and gas generators at the LNG receiving terminal. The power plant and the terminal area are approximately 17km apart and cumulative impacts are unlikely given the design of the Project. On this basis, two separate modelling scenarios were considered as follows:

- Scenario A: The modelling scenario considers the continuous operation of the 388 MW natural gas fired turbines. The emissions from the turbines are derived from the manufactures guaranteed NO_x emission concentration of 51 mg/Nm^3. The modelling scenario assumes continuous emissions throughout one entire year comprising of 365 days. In practice, the power plant will operate below the guaranteed emission level, thus the modelling scenario is an absolute worst-case representation of the potential impact on ambient air quality; and
- Scenario B: The modelling scenario considers the continuous operation of four-1160 kW natural gas fired engines at the gas-receiving terminal. The modelling scenario assumes continuous emissions for 365 days per year. The emissions from the generators are based on the Cummins C1160 N5C natural gas fired generator at 100% rated load.

5.3.2.4 Modelling Methodology

Detailed dispersion modelling was used to predict concentrations of emitted substances at ground level locations. Three years of hourly sequential meteorological data was used so that inter annual variability was incorporated into the model. The modelling methodology including receptor grid spacing, meteorological data information, NO_x to NO_2 conversion and the treatment of buildings, land use and terrain is discussed in the following Section. The stack design parameters and emission data for the Project are presented in ***Table 5.17*** and ***Table 5.18***.

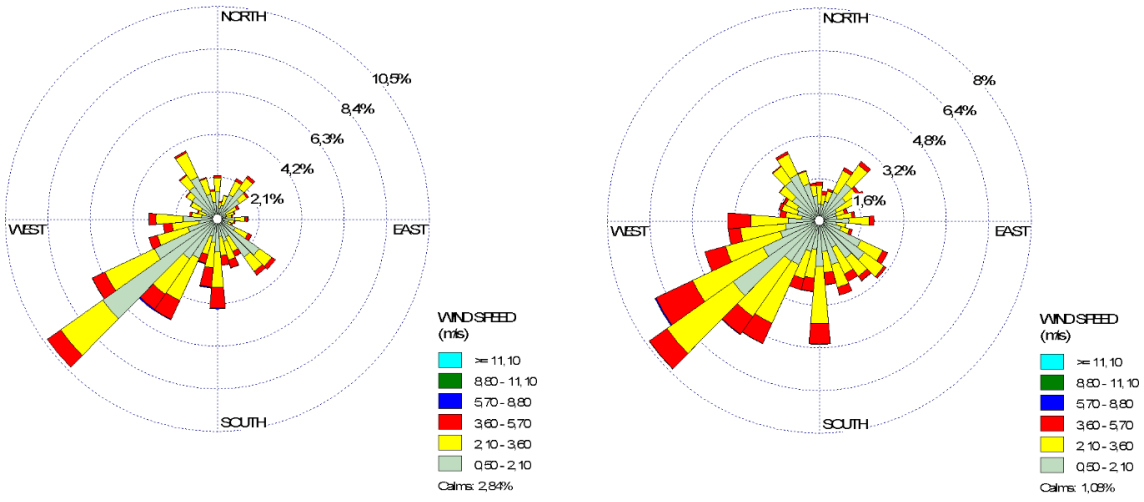
Meteorological Data

Meteorological data representative of the study area is crucial for supporting the detailed dispersion modelling assessment. Following IFC recommendations, three to five years of data is necessary in order to capture year on year variability. Hourly sequential meteorological data is required for wind speed; wind direction; precipitation; relative humidity; temperature; and cloud cover.

A meteorological station at Yangon Airport, approximately 15 km north-northwest of the power plant location, was identified as having sufficient data availability for all parameters. Three years (2015-2017) of meteorological data was sourced from the site and used to inform the dispersion model.

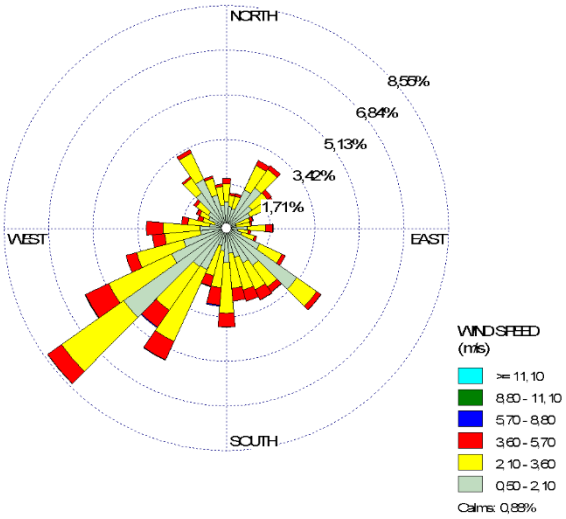
The wind roses for each year are presented in ***Table 5.1***. The data shows that the prevailing wind in the study area is predominantly from the southwest.

Figure 5.1: Wind Rose Yangon Airport 2015-2017



2015

2016



2017

Percentiles

Modelling guidelines in a number of jurisdictions around the world including Victoria in Australia[12], Alberta in Canada[13], and the New Zealand Ministry[14] for the Environment recognise that the 100th percentile 1-hour average concentration has the potential to be highly skewed. Research indicates that indicates that the absolute worst hour (100th percentile) may have a concentration twice that of the second-worst hour, and 10 times that of the ninth-highest hour; however, the ninth-highest hour may only be fractionally above the tenth-highest hour. Consequently, a modelling result taken as a peak value (100th percentile) in comparison to ambient air quality criteria is greatly sensitive to 'modelling uncertainty' as a result of extreme, rare and transient meteorological conditions. To mitigate modelling uncertainty and provide a more accurate representation of the likely impact on ambient air quality, the use of the ninth highest or 99.9th percentile is considered. Use of the ninth highest 1-hour average value means that from the model predictions, results for 8751 hours of the year are equal to or lower than the value presented.

For averaging periods longer than an hour, the modelling uncertainty is reduced as the averaging process over multiple hours reduces the peak 1-hour values, and longer averaging periods are therefore not subject to the same modelling uncertainty. Consequently, for criteria with averaging periods of greater than 1-hour, the highest (100th percentile) value has also been reported.

NO_x to NO_2 Conversion

The stack emissions from the Project contain oxides of nitrogen, occurring as both nitric oxide (NO) and NO2. The ratio of these two gases in the exhaust gases from combustion processes varies, but is typically in the ratio of 90-95% NO to 5–10% NO_2. With regard to the assessment of impact on human health NO2 is the pollutant of interest as NO has little effect on human health at concentrations typically encountered in ambient air.

Within the atmosphere, various processes oxidise NO to create NO_2. This process is largely dependent on the amount of oxidant in the atmosphere at the time of release. It is, therefore, overly pessimistic to assume 100% conversion from NO to NO_2, and it is necessary to use a factor to estimate ground level concentrations of NO_2 based upon total NO_x emitted.

Based on the UK Environment Agency[15] suggested worst-case scenario for NO_x to NO_2 conversion, a 35% conversion rate for short term and a 70% conversion rate for long term concentrations was used.

Receptor Grid

A meteorological grid extending 10 km from the power plant and 5 km from the LNG terminal was used to ensure that all impacts from the Project were captured in the model. The receptor spacing varies with distance from the point source locations in order to provide sufficiently dense receptors close to the site, and suitable spatial coverage further afield (refer to ***Figure 5.2***). Furthermore, specific receptor points

[12] Environmental Protection Agency Victoria (2013) Guidance notes for using the regulatory air pollution model AERMOD in Victoria [Online] Available at: https://www.epa.vic.gov.au/~/media/Publications/1551.pdfhttp://www.mfe.govt.nz/sites/default/files/atmospheric-dispersion-modelling-jun04.pdf [Accessed 13 February 2019]

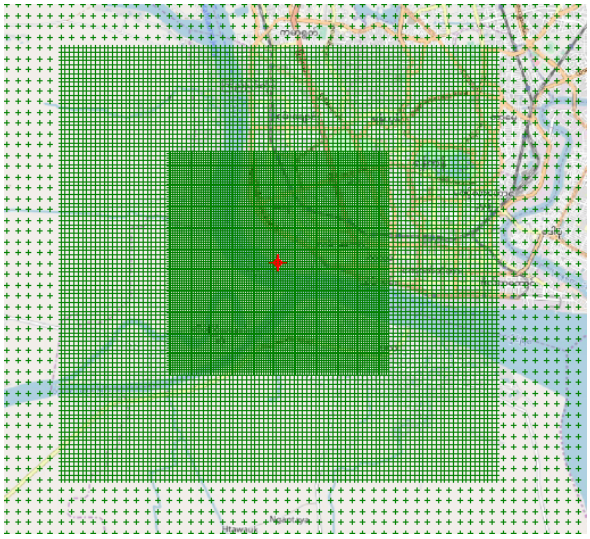
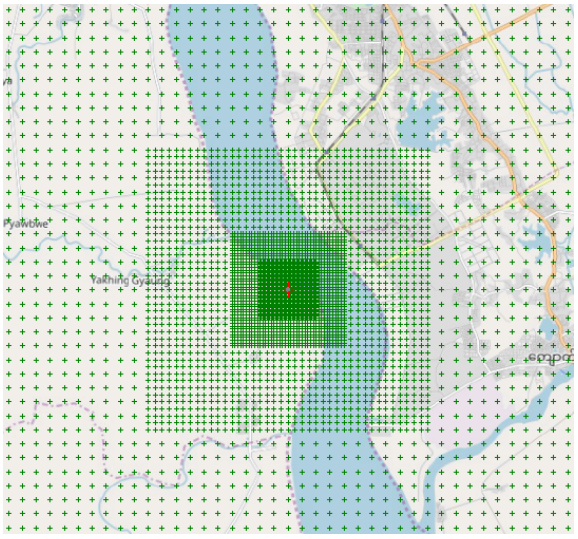
[13] Alberta Government (2013) Air Quality Model Guideline [Online] Available at: https://open.alberta.ca/dataset/e796eeb3-4e88-456c-9dcb-79808c4f926a/resource/3f30ef73-eb06-4deb-a033-5a018d42d24a/download/2013-airqualitymodelguideline-oct1.pdf [Accessed 13 February 2019]

[14] New Zealand Ministry for the Environment (2004) Good Practice Guide for Atmospheric Dispersion Modelling [Online] Available at: http://www.mfe.govt.nz/sites/default/files/atmospheric-dispersion-modelling-jun04.pdf [Accessed 13 February 2019]

[15] Environment Agency (EA) Air Quality Modelling and Assessment Unit (AQMAU) Conversion ratios for NOx and NO2 [Online] Available at: http://webarchive.nationalarchives.gov.uk/20140328232919/http://www.environment-agency.gov.uk/static/documents/Conversion_ratios_for__NOx_and_NO2_.pdf [Accessed 13 February 2019]

were included in the model to reflect the locations of representative human sensitive receptors (refer to ***Figure 4.4*** and ***Figure 4.5***).

Figure 5.2: Receptor Grid

Power Plant	LNG Receiving Terminal
	
Grid spacing as follows: ■ 50 meter grid spacing from 0 to 2,500 meters; ■ 100 meter grid spacing from 2,500 to 5,000 meters; and ■ 250 meter grid spacing from 5,000 to 10,000 meters.	Grid spacing as follows: ■ 50 meter grid spacing from 0 to 1,000 meters; ■ 100 meter grid spacing from 1,000 to 2,000 meters; ■ 250 meter grid spacing from 2,500 to 5,000 meters; and ■ 500 meter grid spacing from 5,000 to 10,000 meters.

Terrain

Hills, mountains and valleys can affect dispersion by directing the plume. The terrain pre-processor AERMAP using the Shuttle Radar Topographic Mission (SRTM) 30 x 30 m imagery was run to provide information on a) the base elevation of each receptor and source defined in the model; and b) the terrain height that has the greatest influence on dispersion for each individual receptor, otherwise known as the hill height scale. Both the base elevation and hill height scale were incorporated into AERMOD.

Buildings

When airflow passes over buildings, a phenomenon known as building downwash occurs where the air is entrained in the lee of the building and drawn down to ground level. This effect can bring the plume from the stack down to ground level quicker than would otherwise be the case, and therefore increase the ground level concentration relative to a case where there are no buildings. The USEPA[16] suggest that emissions from stacks greater than 2.5 times the height of the highest nearby structure would escape building influences on dispersion. A review of the power plant design indicates that the highest building is 10.4m (refer to ***Table 2.6***) therefore building downwash is not expected and buildings were considered in the model set up. No building information was available for the LNG terminal, thus no

[16] United States Environmental Protection Agency (USEPA) (1985) Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations) [Online] Available at: https://www3.epa.gov/scram001/guidance/guide/gep.pdf [Accessed 01 November 2018]

buildings were included in the model set up. Considering the heights of the stacks and the distance to receptors, this is not considered a limitation to the study.

Stack Parameters

The Project includes emissions to air from a number of stationary stacks. The stacks has been treated in the model as point sources and the height, temperature, volume flow rates and exit velocity used to define the source are presented in ***Table 5.17*** and ***Table 5.18*** for modelling Scenario A and B respectively.

Table 5.17: Scenario A – Power Plant Stack Parameters

Stack Parameters	Unit	Stack A	Stack B
Stack Coordinates	Lat/Long	16°46'42.25"N 96° 7'44.47"E	16°46'42.25"N 96°13'4.98"E
Actual Stack Data a			
Stack height	m	40	40
Internal flue diameter	m	5	5
Gas exit velocity	m/s	22.5	22.5
Actual exit temperature	K	376	376
Actual oxygen (O2) content (dry)	%	13.4	13.4
Actual moisture (H2O) content (wet)	%	7.88	7.88
Actual volume flow rate	Am^3/s	442	442
Reference Conditions b			
Temperature	K	273	273
Oxygen content (dry gas)	%	15	15
Moisture content (dry gas)	%	0	0
Volume Flow Rate at Reference Conditions c			
Normalised volume flow rate	Nm^3/s	320	320
Manufactures Guaranteed Emission Concentrations a			
NOx	mg/Nm^3	51	51
Emission Rates at Manufacturers Guarantee			
NOx	g/s	16.3	16.3

Note: [a] *Data supplied by Project Proponent*
[b] *International Finance Corporation (IFC) (2008) Environmental, Health and Safety Guidelines for Thermal Power Plants [Online] Available at: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+management/ehsguidelines [Accessed 13 February 2019].*
[c] *Calculated using the Environment Agency (2013) Pollution Inventory Reporting – Combustion Activities Guidance Note [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/296994/LIT_7825_e97f48.pdf [Accessed 13 February 2019].*

Table 5.18: Scenario B – Generator Stack Parameters

Stack Parameters	Unit	Generator 1 [a]	Generator 2 [a]	Generator 3 [a]	Generator 4 [a]
Stack Coordinates	Lat/Long	16°39'20.47"N 96°13'56.08"E	16°39'20.38"N 96°13'56.29"E	16°39'20.38"N 96°13'56.39"E	16°39'20.30"N 96°13'56.60"E
Stack height b	m	12	12	12	12
Internal flue diameter b	m	0.35	0.35	0.35	0.35
Gas exit velocity b	m/s	33.4	33.4	33.4	33.4
Actual exit temperature c	K	740	740	740	740
Volume Flow Rate d	Am^3/s	3.21	3.21	3.21	3.21
NOx Concentration (wet)	ppm	125	125	125	125
NOx Concentration @ 5%O2, 25°C	mg/Nm^3	355 [e]	355 [e]	355 [e]	355 [e]
NOx Concentration @ 15%O2, 0°C	mg/Nm^3	144 [f]	144 [f]	144 [f]	144 [f]
NOx emission rate g	g/s	0.599	0.599	0.599	0.599

Note: *[a] Assumptions based on Cummins C1160 N5C 1160 kW natural gas generator set*
[b] Data provided by Project Proponent
[c] As per Cummins C1160 N5C 1160 kW specification sheet [Online] Available at: https://powersuite.cummins.com/PS5/PS5Content/SiteContent/en/Binary_Asset/pdf/Commercial/SparkIgnited/d-3243.pdf [Accessed 13 February 2019]
[d] Volume flow rate at actual moisture, oxygen and temperature conditions
[e] mg/Nm^3 is assumed to be dry gas
*[f] Corrected for oxygen and temperature. NO_x concentration complies with emission standard in **Table 2.5**.*
[g] NO_x emission rate calculated based on concentration of 125 ppm and exhaust gas mass flow rate of 1.98 kg/s (as specified in the generator specification sheet). The calculation assumes the molecular weight of NO_x is 46.01 g/mol, and the average molecular weight of natural gas is 19 g/mol.

5.3.3 Assessment of Impacts

5.3.3.1 Scenario A

The potential short and long-term impacts to ambient air quality were assessed based on the impact assessment methodology detailed in ***Section 5.3.2.4***. The detailed modelling results at each discrete receptor point and the maximum on the modelling grid are presented in ***Table 5.19*** and ***Table 5.20***. Contour plots showing plume dispersion from the stack are presented in ***Figure 5.3*** and ***Figure 5.4***.

The maximum 1-hour and annual average PC and PEC is expected to be less than 25% and 100% of the relevant AQS throughout the study area respectively. The resulting impact significance is therefore considered **Negligible**.

Table 5.19: Nitrogen Dioxide (NO_2) 1-hour Average – 99.9 Percentile

Site	Baseline (µg/m³) [a]	Airshed classification	AQS [b] (µg/m³)	PC [c] (µg/m³)	PC/AQS (%)	PEC [d] (µg/m³)	PEC/AQS (%)	Impact Significance
Maximum [e]	170	ND	200	9.92	5.0%	180	90%	Negligible
ASR1				6.68	3.3%	177	88%	Negligible
ASR2				5.77	2.9%	176	88%	Negligible
ASR3				5.95	3.0%	176	88%	Negligible
ASR4				2.71	1.4%	173	86%	Negligible
ASR5				3.90	1.9%	174	87%	Negligible
ASR6				2.88	1.4%	173	86%	Negligible
ASR7				2.62	1.3%	172	86%	Negligible
ASR8				3.08	1.5%	173	86%	Negligible
ASR9				3.83	1.9%	174	87%	Negligible
ASR10				2.77	1.4%	173	86%	Negligible
ASR11				2.39	1.2%	172	86%	Negligible
ASR12				2.74	1.4%	173	86%	Negligible
ASR13				2.97	1.5%	173	86%	Negligible
ASR14				2.16	1.1%	172	86%	Negligible
ASR15				2.85	1.4%	173	86%	Negligible

Note: [a] *Maximum 1-hour baseline concentration from AQM1 – AQM 6 (refer to* ***Figure 4.27****)*
[b] *Air Quality Standard*
[c] *Process Contribution*
[d] *Predicted Environmental Concentration*
[e] *The maximum ground level concentration found anywhere on the modelling grid*

Figure 5.3: NO_2 1-hour (99.9%ile) Average Ground Level Concentrations

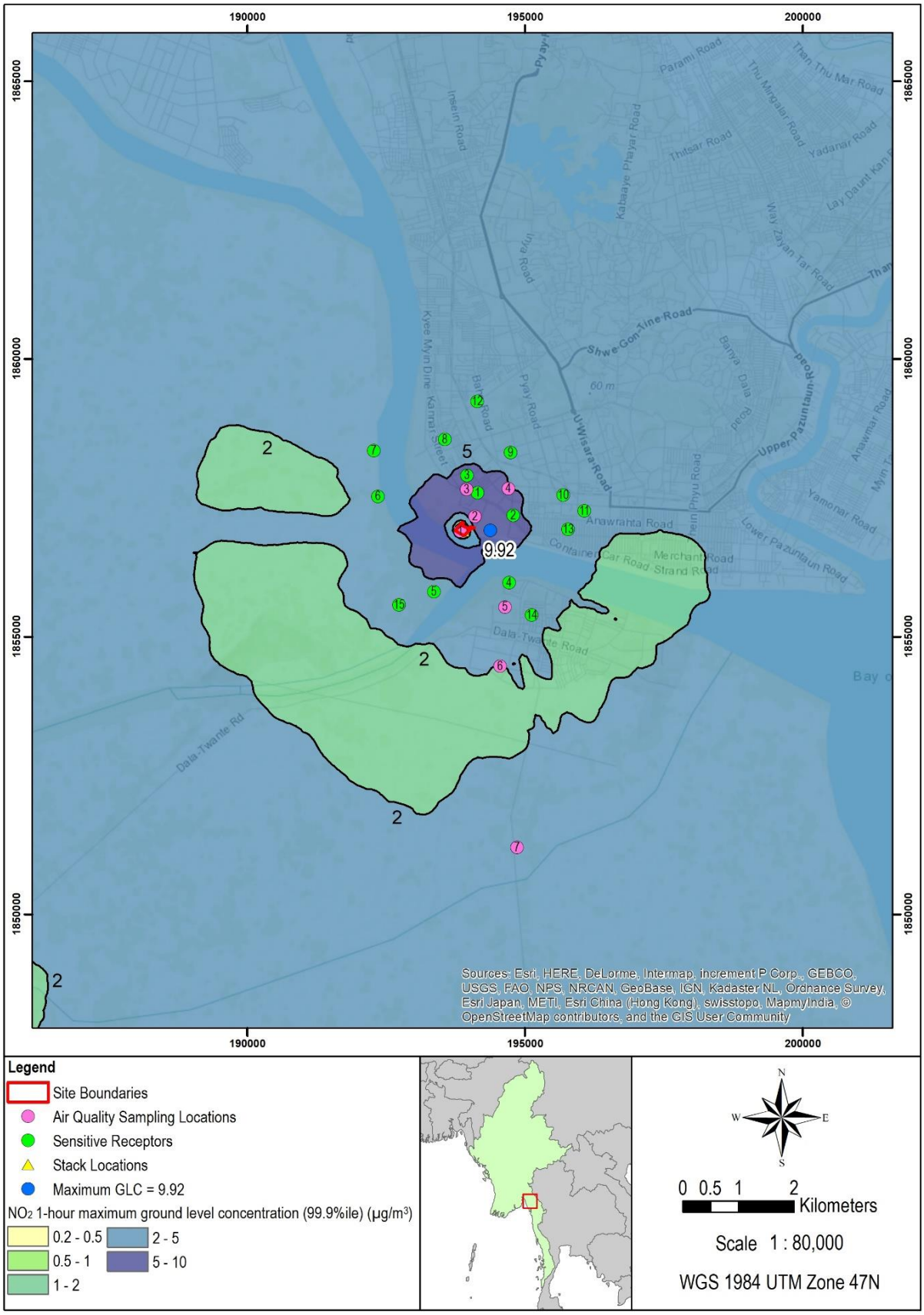
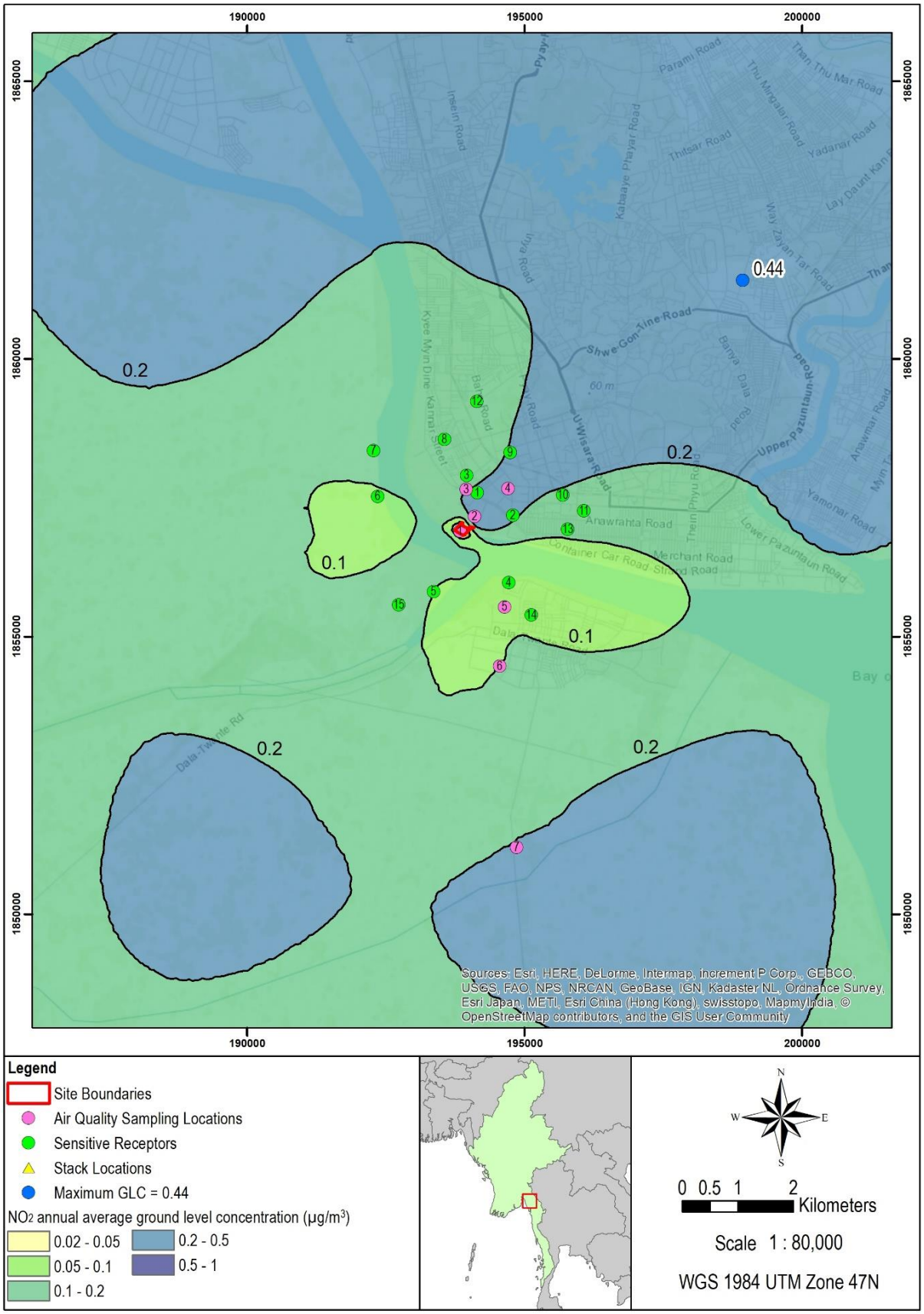


Table 5.20: Nitrogen Dioxide (NO_2) Annual Average

Site	Baseline [a] ($\mu g/m^3$)	Airshed classification	AQS [b] ($\mu g/m^3$)	PC [c] ($\mu g/m^3$)	PC/AQS (%)	PEC [d] ($\mu g/m^3$)	PEC/AQS (%)	Impact Significance
Maximum e	24.6	ND	40	0.446	1.1%	25.0	63%	Negligible
ASR1				0.233	<1%	24.8	62%	Negligible
ASR2				0.228	<1%	24.8	62%	Negligible
ASR3				0.170	<1%	24.7	62%	Negligible
ASR4				0.0704	<1%	24.6	62%	Negligible
ASR5				0.102	<1%	24.7	62%	Negligible
ASR6				0.091	<1%	24.7	62%	Negligible
ASR7				0.131	<1%	24.7	62%	Negligible
ASR8				0.130	<1%	24.7	62%	Negligible
ASR9				0.215	<1%	24.8	62%	Negligible
ASR10				0.192	<1%	24.8	62%	Negligible
ASR11				0.153	<1%	24.7	62%	Negligible
ASR12				0.157	<1%	24.7	62%	Negligible
ASR13				0.122	<1%	24.7	62%	Negligible
ASR14				0.0874	<1%	24.7	62%	Negligible
ASR15				0.117	<1%	24.7	62%	Negligible

Note: [a] *Maximum result from diffusion tube survey (refer to **Table 4.5** and **Table 4.6**)*
[b] *Air Quality Standard*
[c] *Process Contribution*
[d] *Predicted Environmental Concentration*
[e] *The maximum ground level concentration found anywhere on the modelling grid*

Figure 5.4: NO_2 Annual Average Ground Level Concentrations



5.3.3.2 Scenario B

The potential short and long-term impacts to ambient air quality were assessed based on the impact assessment methodology detailed in ***Section 5.3.2.4***. The detailed modelling results at each discrete receptor point and the maximum on the modelling grid are presented in ***Table 5.21*** and ***Table 5.22***. Contour plots showing plume dispersion from the stack are presented in ***Figure 5.5*** and ***Figure 5.6***.

The maximum 1-hour and annual average PC and PEC is expected to be less than 25% and 100% of the relevant AQS throughout the study area respectively. The resulting impact significance is therefore considered negligible.

Table 5.21: Nitrogen Dioxide (NO_2) 1-hour Average – 99.9 Percentile

Site	Baseline (µg/m³) [a]	Airshed classification	AQS [b] (µg/m³)	PC [c] (µg/m³)	PC/AQS (%)	PEC [d] (µg/m³)	PEC/AQS (%)	Impact Significance
Maximum [e]	129	ND	200	37.7	19%	167	84%	Negligible
ASR1				10.1	5.1%	139	70%	Negligible
ASR2				12.1	6.1%	141	71%	Negligible
ASR3				22.0	11%	151	76%	Negligible
ASR4				20.4	10%	150	75%	Negligible
ASR5				7.37	3.7%	137	68%	Negligible
ASR6				7.53	3.8%	137	68%	Negligible
ASR7				7.93	4.0%	137	69%	Negligible
ASR8				6.38	3.2%	136	68%	Negligible
ASR9				4.98	2.5%	134	67%	Negligible
ASR10				4.53	2.3%	134	67%	Negligible
ASR11				3.41	1.7%	133	66%	Negligible
ASR12				3.80	1.9%	133	67%	Negligible

Note: [a] *Maximum 1-hour baseline concentration from AQM7 - AQM10 (refer to* ***Figure 4.27****)*
[b] *Air Quality Standard*
[c] *Process Contribution*
[d] *Predicted Environmental Concentration*
[e] *The maximum ground level concentration found anywhere on the modelling grid*

Figure 5.5: NO_2 1-hour (99.9%ile) Average Ground Level Concentrations

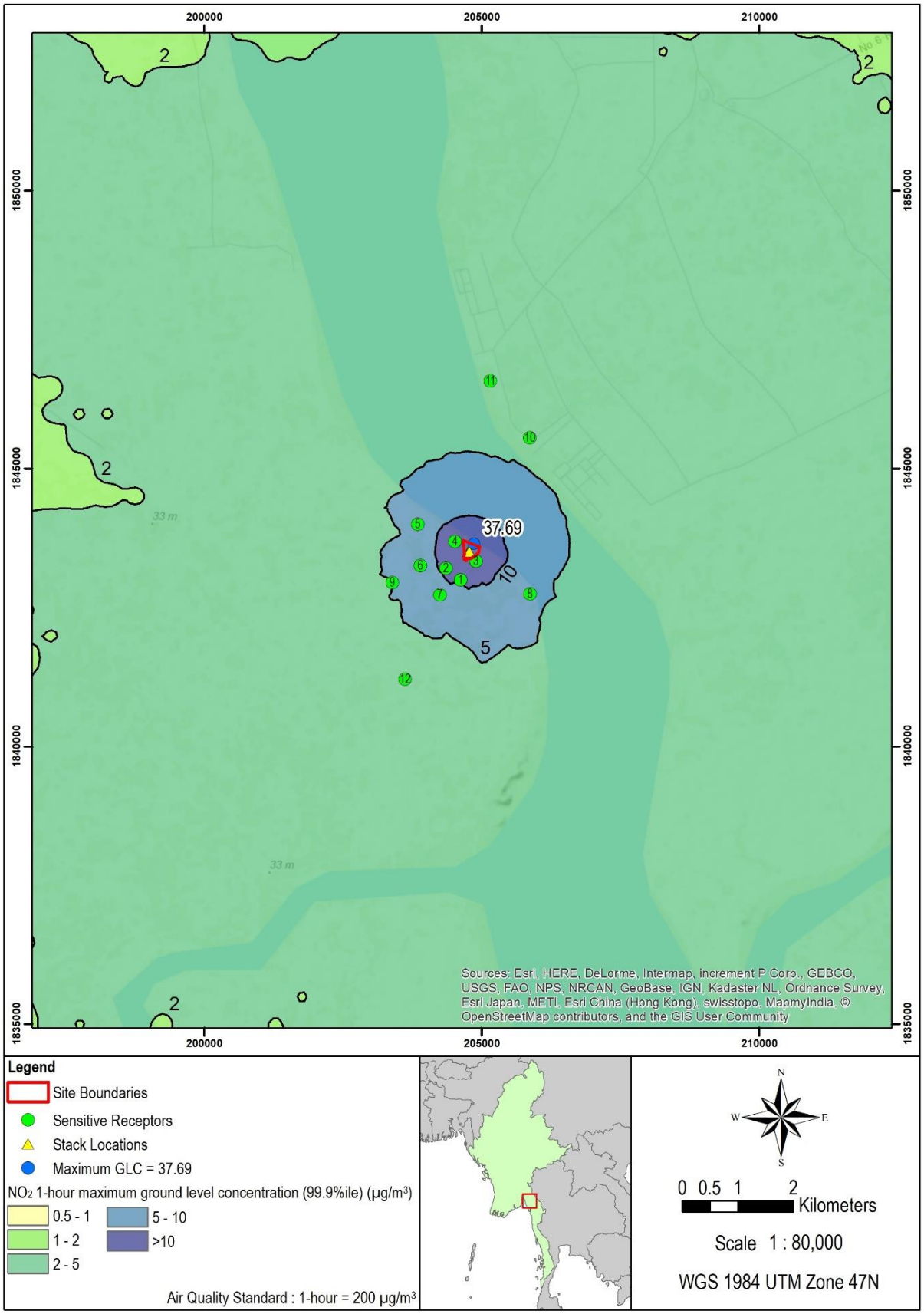
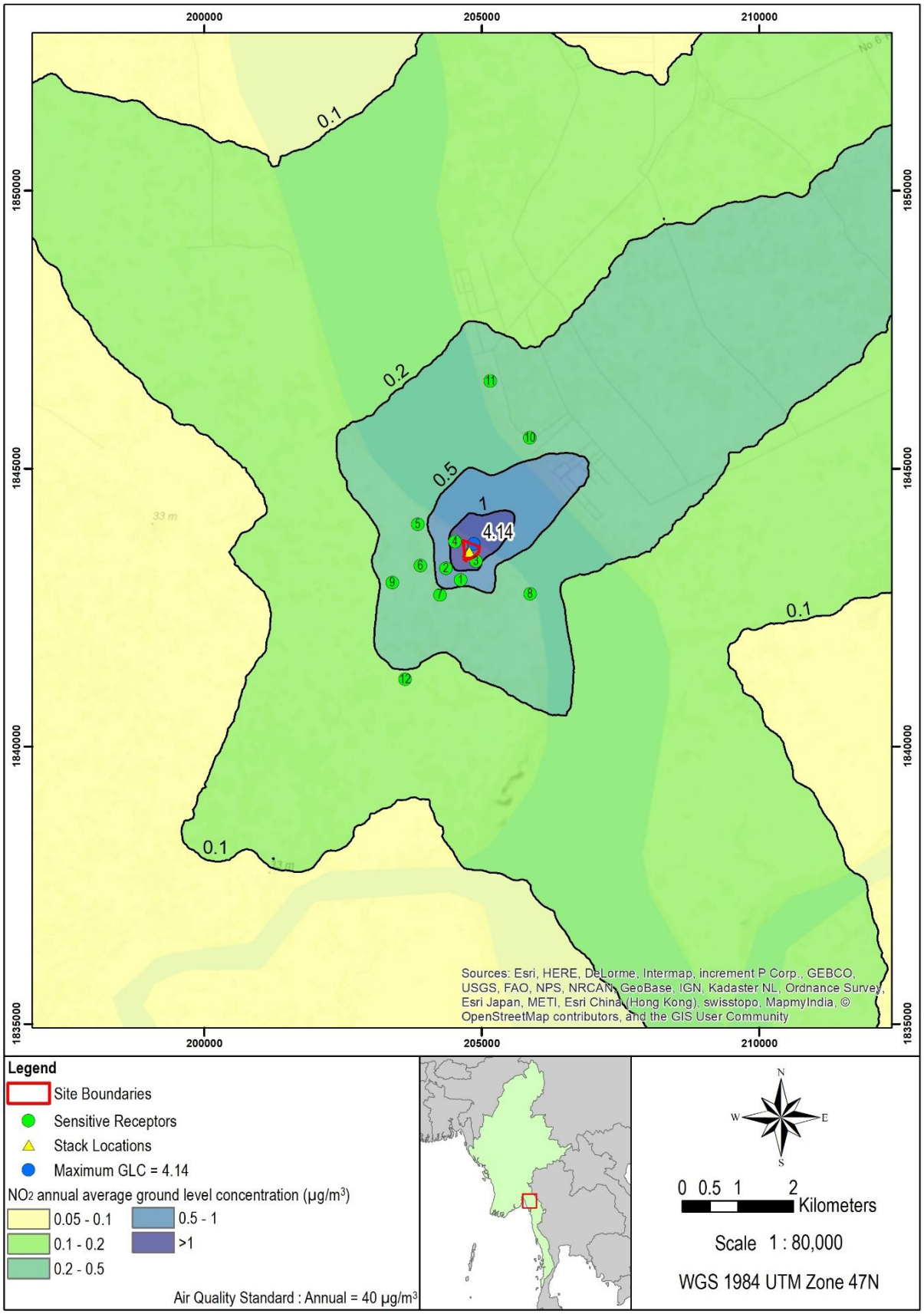


Table 5.22: Nitrogen Dioxide (NO_2) Annual Average

Site	Baseline (µg/m³) [a]	Airshed classification	AQS [b] (µg/m³)	PC [c] (µg/m³)	PC/AQS (%)	PEC [d] (µg/m³)	PEC/AQS (%)	Impact Significance
Maximum [e]	24.6	ND	40	4.14	10%	29.2	73%	Negligible
ASR1				0.624	1.6%	25.2	63%	Negligible
ASR2				0.748	1.9%	25.3	63%	Negligible
ASR3				1.55	3.9%	26.1	65%	Negligible
ASR4				1.38	3.4%	26.0	65%	Negligible
ASR5				0.405	1.0%	25.0	62%	Negligible
ASR6				0.351	<1%	24.9	62%	Negligible
ASR7				0.438	1.1%	25.0	63%	Negligible
ASR8				0.282	<1%	24.9	62%	Negligible
ASR9				0.224	<1%	24.8	62%	Negligible
ASR10				0.396	1.0%	25.0	62%	Negligible
ASR11				0.252	<1%	24.8	62%	Negligible
ASR12				0.186	<1%	24.8	62%	Negligible

Note: [a] *Maximum result from diffusion tube survey (refer to **Table 4.5** and **Table 4.6**)*
[b] *Air Quality Standard*
[c] *Process Contribution*
[d] *Predicted Environmental Concentration*
[e] *The maximum ground level concentration found anywhere on the modelling grid*

Figure 5.6: NO_2 Annual Average Ground Level Concentrations



5.3.4 Recommended Mitigation, Management and / or Monitoring Measures

The impact assessment defines the impacts on air quality as negligible based on the design parameters presented in ***Table 5.17*** and ***Table 5.18***. However, the following mitigation and management measures should be used to minimize impacts to air quality during the operation of the Project:

- Implementation of continuous stack emission monitoring throughout the operational lifetime of the CCGT power plant to confirm that the NO_x emission concentration does not exceed the turbine manufacturer guarantee of 51mg/Nm^3.
- Annual stack emission testing at the CCGT power plant will be undertaken to counter check the performance of the continuous emission monitoring system.
- The natural gas fired generators at the terminal will be serviced and maintained in accordance with the manufacturer's specification to maintain high performance.

5.3.5 Residual Impact (post mitigation)

The residual impact to ambient air quality during normal operation will be negligible.

6. CUMULATIVE IMPACTS AND MITIGATION

6.1 Introduction

The IFC Performance Standard 1 (Paragraph 5) defines the broader Project area to include "… areas potentially impacted by cumulative impacts from further planned development of the Project, any existing project or condition, and other project-related developments that are realistically defined at the time the Social and Environmental Assessment is undertaken."

In addition, the IFC Performance Standard 1 (Paragraph 6) states that the "… assessment will also consider potential trans-boundary effects, such as pollution of air, or use or pollution of international waterways, as well as global impacts, such as the emission of greenhouse gases."

Cumulative impacts are those impacts that act together with other impacts (including those from concurrent or planned future third party activities) to affect the same resources and/or receptors as the proposed Project. Cumulative impacts are therefore generally impacts that act with others in such a way that the sum is greater than the parts. This is, however, not always the case – sometimes they will simply be the sum of the parts, but that sum becomes significant.

This chapter considers the cumulative impacts that would result from the combination of the Project and other actual or proposed future developments in the broader Project Area.

6.2 Identified Cumulative Impacts

The development of the Project is proposed in an industrial area of Yangon City. The existing TTCL Ahlone 120MW CCGT power plant and a government owned 275MW CCGT power plant exist close to the Project. Accurately quantifying emissions from these existing units is challenging and the results would likely result in unrealistic impact predictions. Consideration of the cumulative impacts was instead undertaken by way of an ambient air quality monitoring survey. The survey, commissioned to collect existing ambient air quality data prior to the Project becoming operational (otherwise known as the baseline), was undertaken at several sites in the vicinity of the Project (refer to ***Section 4***). It is considered acceptable to assume that emission from the existing industry will have been captured within the baseline and as such have already been assessed within the AQIA presented in ***Section 5***.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Construction

During the construction phase of the Project, the potential impacts to air quality are primarily associated with TSP and PM_{10} from demolition, earthwork activities, construction of the Project infrastructure, and trackout of dusty materials onto the public road network. The significance of the impact to ambient air quality associated with these activities can be major adverse at sensitive receptor locations within 350 m if not managed accordingly.

Based on the magnitude and risk of potential impacts during the construction phase, a series of process specific management and mitigation measures have been identified. Assuming that the stated management and mitigation presented in this assessment is implemented correctly and diligently, the residual impacts are expected to be negligible for the majority of the construction phase. However, due to the nature of construction activities, the scale and duration of the construction phase, and the possibility of extreme weather conditions, it is possible that communities will experience occasional, short-term dust annoyance. Therefore, although the proposed mitigation is designed to be effective and reduce dust emissions as far as possible, it is recognised that in practice, infrequent short-term minor adverse impacts are possible.

Emissions from mobile and non-mobile plant as well increased traffic movements on the public road network were also considered and the resulting impacts are found to be negligible.

7.2 Operation

The potential impacts to ambient air quality from the continuous operation of the combined cycle gas turbine power plant and gas generators at the liquefied natural gas receiving terminal were assessed quantitatively using the USEPA approved dispersion model AERMOD.

The assessment concludes that the residual impact on ambient air quality during normal operation is expected to be negligible. Good practice management and monitoring measures are advised, including continuous emissions monitoring, annual stack testing and regular maintenance and servicing.

ERM has over 160 offices across the following countries and territories worldwide

Argentina
Australia
Belgium
Brazil
Canada
China
Colombia
France
Germany
Hong Kong
Hungary
India
Indonesia
Ireland
Italy
Japan
Kazakhstan
Kenya
Malaysia
Mexico
Myanmar
The Netherlands
New Zealand
Norway
Panama
Peru
Poland
Portugal
Puerto Rico
Romania
Russia
Singapore
South Africa
South Korea
Spain
Sweden
Switzerland
Taiwan
Thailand
UAE
UK
US
Vietnam

PT. ERM Indonesia
Centennial Tower
40th Floor
Suite #B1
Jl. Jend. Gatot Subroto Kav. 24-25
Jakarta 12930, Indonesia

T: +62 21 2295 8383
F: +62 21 2295 8384

www.erm.com

The business of sustainability

ERM

APPENDIX R CORMIX MODELLING REPORT

CORMIX Modelling TPMC's Planned Power Plant and LNG Surface Water Discharges

Prepared for TTCL Power Myanmar Co., Ltd.

12 April 2019

Project No.: 0439461

The business of sustainability

ERM

Document details	
Document title	CORMIX Modelling TPMC's Planned Power Plant and LNG Surface Water Discharges
Document subtitle	Prepared for TTCL Power Myanmar Co., Ltd.
Project No.	0439461
Date	12 April 2019
Version	1.0
Author	Kelli Kearns, Jacob Guise, Shwet Prakash
Client Name	TTCL Power Myanmar Company Limited (TPMC)

Signature Page

12 April 2019

CORMIX Modelling TPMC's Planned Power Plant and LNG Surface Water Discharges

Prepared for TTCL Power Myanmar Co., Ltd.

Name Shwet Prakash
Job Title Partner

Name Kelli Kearns
Job Title Staff Engineer

Environmental Resources Management

75 Valley Stream Parkway

Suite 200

Malvern, PA 19355

CONTENTS

List of Tables

List of Figures

Acronyms and Abbreviations

Name	Description
°C	Degrees Celsius
ΔT	Change in temperature
CORMIX	Cornell Mixing Zone Expert System
IFC	International Finance Corporation
m	metres
m/s	metres per second
m^3/hr	Cubic metres per hour
MBtu h^{-1}	Million British Thermal Units per hour
TPMC	TTCL Power Myanmar Company
USEPA	United States Environmental Protection Agency
W/(m^2 °C)	Watt per square metre per degree Celsius

1. BACKGROUND

The primary purpose of this study is to determine the size and configuration of the plumes resulting from TPMC's heated power plant discharge and cold water LNG process water discharge to the Yangon River.

CORMIX, a United States Environmental Protection Agency (U.S. EPA) approved steady-state model, was selected to evaluate surface water discharge thermal plumes from TPMC's Power and LNG plants. CORMIX, primarily a design tool for discharges, is often used to evaluate water quality impacts from point source discharges. The system emphasizes the role of boundary interaction to predict steady-state mixing behavior and plume geometry (http://www.cormix.info/). This report summarizes the application of the CORMIX model to TPMC's planned thermal and cold water discharges.

With the use of CORMIX, key limitations relevant to this study included:

1. For all inputs, CORMIX has specific data ranges where the model is most accurate, and these should be followed. To ensure accuracy of results, CORMIX is limited to computations within these ranges. For example, the horizontal angle, theta, may range between -45° and 90°.
2. Average depth and the depth at the discharge cannot differ from each other by +/- 30%. CORMIX is limited to performing computations within this condition. For a submerged single pipe, there are two cases. For deeply submerged cases the height of the discharge port above the bottom has to be less than or equal to one-third the depth of the discharge. For near surface cases the height of the discharge above the bottom has to be greater than or equal to two thirds of the depth of the discharge, but less than or equal to the depth of the discharge.
3. CORMIX, being a steady-state model, only uses constant inputs for temperature, velocity, etc.

Some of these limitations required ERM to make assumptions related to the discharge and ambient properties. Additionally, limited data and information for the design and ambient conditions necessitated assumptions. Finally, assumptions were made to make the analysis and the results a conservative representation of reality to address any uncertainty related to all assumptions made. Key assumptions and reference standards used in this study are summarized as follows (by location):

1.2 Power Plant Site

- ERM assumed the Power Plant discharge pipe enters perpendicular to the Yangon River and is resting along the river channel bottom. The discharge pipe was assumed to be located at the shoreline as a simplification for CORMIX modelling, as the tidal nature of the ambient waterbody can result in varying shoreline extents.
- As a conservative approach to modelling, it was assumed that the intermittent flow stream was excluded from diluting the heated effluent from the power plant, that there is no heat loss within the facility prior to entering the Yangon River, and that effluent conditions provided by TPMC are worst case.

1.3 LNG Site

- ERM assumed the Power Plant discharge pipe enters perpendicular to the Yangon River and is resting along the river channel bottom. At low tide, the pipe is 39.9 meters from the shoreline, and at high tide, the pipe is 28.5 meters from the shoreline, as estimated by ERM from the engineering drawings.
- As a conservative approach to modelling, it was assumed that no additional flow would be included that would dilute the cooled effluent from the LNG plant, that cooled water exiting the facility is preserved to the point where the flow enters the Yangon River, and that effluent conditions provided by TPMC are worst case.

- Lastly, for the LNG, it was assumed that a less than 3 °C temperature change from the ambient would be the appropriate criteria. This is based on IFC (2015), which specifies limits for temperature increase above ambient.

1.4 Both Sites

- It was assumed background temperatures and salinity values based on data collected as part of the broader ESIA were reflective of a wide variety of conditions (high and low extreme values).
- Assumed that the ambient wind speed was 1 m/s to minimize surface heat loss, a conservative assumption.

As a conservative approach, the discharge plume estimates are based on the maximum anticipated effluent rate and heat load, extreme seasonal Yangon River temperatures, variant high/low Yangon River velocities, and corresponding depths. The thermal plume was modelled as a single port discharge using CORMIX's single port discharge ("CORMIX1") module. For the Power plant: The continuous, 210 cubic metre per hour effluent discharge has a temperature value of 42 °C. The effluent was modelled for comparison to IFC standards, which state that the effluent should result in a temperature increase of no more than 3 °C within 100 meters from the point of discharge. For the LNG: the continuous effluent discharge was modelled based on a temperature reduction value of 10 °C below the ambient, as provided by TPMC. The effluent was modelled for comparison to modified IFC standards for cooling water. While the standard requires "the effluent should result in a temperature increase of no more than 3 °C" within 100 meters from the point of discharge", the same temperature differential (3 °C) was considered for temperature decrease for the LNG modelling analysis.

Eight scenarios were developed for each of the Power Plant and the LNG. The scenarios were based on the minimum and maximum ambient velocity, ambient temperature, and water depth. The ambient velocity ranged from 0.057 m/s to 3.1 m/s, while the ambient temperature ranged from 25.1 to 31.3 °C for both the Power Plant and LNG. While the depth ranged from 2.25 m to 10.4 m for the Power plant, and 7.1 m to 10.5 m for the LNG. Example of a scenario includes: Low velocity, Low temperature, and Low depth.

The locations of the power plant and LNG process water discharge along the Yangon River are shown in ***Figure 1.1***. A detailed view of the power plant location and entrance to the Yangon River are shown in ***Figure 1.2*** with the ambient flow direction. A detailed view of the power plant location and entrance of the Yangon River are shown in ***Figure 1.3*** with the ambient flow direction.