ENVIRONMENTAL IMPACT ASSESSMENT REPORT

YANGON THARKETA COMBINED CYCLE POWER PLANT

(Phase 1: 106 MW)

CHINA'S UNION RESOURCES AND ENGINEERING COMPANY (UREC)

FEBRUARY 2020

Resource & Environment Myanmar Ltd.
B-702/401 Delta Plaza Building, Shwegondaing Rd., Bahan, Yangon. MYANMAR
Tel: (959) 7301 3448; Fax: (951) 552901

www.enviromyanmar.net

U ENERGY THAKETA POWER CO.,LTD

To:

Director General

Environmental Conservation Department,

Ministry of Natural Resources and Environmental Conservation

Nay Pyi Taw, the Republic of the Union of Myanmar

Dated: 1st, June 2017

Subject：Commitment Letter for comply and follow the Environmental Management Plan that mentioned in the ESIA report that prepared for construction of 106 MW Gas Fired Combined Cycle Power Plant for Electricity Generation and Power Supply

Dear Sir,

We refer to the captioned ESIA report, which has been prepared and finalized by Resource & environment Myanmar Co., Ltd. in compliance with EIA procedure (December 2015) and other relevant laws/rules and formally submitted to the Environmental Conservation Department.

We believe, to the best of our knowledge at the time of writing, that;

- The ESIA report is accurate and complete, and;
- The ESIA report has been prepared in strict compliance with applicable laws, rules, regulations and procedures in force.

We hereby undertake that;

UREC in respect of the "**construction of 106 MW Gas Fired Combined Cycle Power Plant for Electricity Generation and Power Supply"** will at all times comply fully with: (i) any and all commitments and obligations as set forth in the ESIA report which has been reviewed by Review Team of MONREC, and (ii) any and all plans and the various components thereof, including without limitation, impacts avoidance, mitigation, and remediation measures, and with respect to both (i) and (ii), including but not limited to such commitments, obligations, plans and measures related to the development, construction, commissioning, operation and maintenance of the project, and any circumstance in which work done or to be done, or services performed or to be performed, in connection with the projects development, construction, commissioning, operation and maintenance is carried out our intended or required to be carried out by any contractor, subcontractor or other party.

No. 35, Pyay Road, 7 quarter, Mayangone Township, yangon Region, The Republic of the Union of Myanmar.
TEL：+95 01653402 FAX：+95 01660447
Site：www.urec.com.cn

When the proposed project will be constructed and operated in Myanmar, UREC will comply and follow the Environmental Management Plan that mentioned in the ESIA report that prepared by Resource & Environment Myanmar Co., Ltd.

Besides, UREC will submit the Environmental Monitoring Report during construction and operation of the proposed project to Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation.

With best regard!

Dong Fan
Managing Director
U ENERGY THAKETA POWER CO., LTD.

Resource and Environment Myanmar Ltd.
B 702 Delta Plaza, Shwegondaing Rd., Bahan, Yangon, Myanmar
Tel: (959) 73013448; Fax: (951) 552901; admin@enviromyanmar.net

DECLARATIONS

DECLARATION - EIA Experts

Resource & Environment Myanmar Co., Ltd. (REM); a local environmental consultant firm, conducted environmental impact assessment and prepared ESIA report for construction of 106 MW Gas Fired Combined Cycle Power Plant for Electricity Generation and Power Supply in compliance with EIA Procedure (December 2015) and other relevant laws/rules and formally submitted to the Environmental Conservation Department (ECD) for final approval.

We do state, to the best of our knowledge at the time of report preparation, that

- To our knowledge, all information contained in this report is accurate and a truthful representation of all findings as relating to the project, and ;
- The ESIA Report has been prepared in strict compliance with all applicable laws, rules regulations and procedure in force.

We also consulted to U Energy to undertake that;

U Energy in respect of the "construction of 106 MW Gas Fired Combined Cycle Power Plant for Electricity Generation and Power Supply" will at all times comply fully with (1) any and all commitments and obligations as set forth in the ESIA Report which has been reviewed by Review Team, and (2) any and all plans and the various components thereof, including without limitation, impact avoidance, mitigation, and remediation measures, and with respect to such commitments, obligations, plans and measures related to the development, construction, commissioning, operation and maintenance of the project, and any circumstance in which work done or to be done, or services performed or to be performed, in connection with the project's development.

Signed: (Zaw Naing Oo) Date: 06-06-2017

Director

For: **Resource & Environment Myanmar Co., Ltd. (REM)**

EXECUTIVE SUMMARY

INTRODUCTION

Yangon is the economic, industrial center and the transportation hub of the Union of Myanmar. At present, with continuous expanding of economy, fast development of industry and improvement on people's living standard in Yangon, its electric power demand also keeps rising and the imbalance between supply and demand becomes increasingly conspicuous. The construction of a power plant near Yangon can fill the gap between power supply and demand. Therefore, ***U Energy Thaketa Power Co., Ltd.*** proposed to invest in construction of a gas-steam combined cycle power plant in Thaketa Yangon.

During the project preparation, a full-scale Environmental and Social Impact Assessment (ESIA) of the plant was carried out by the Resource & Environment Myanmar Ltd. (REM).

According to the IFC guideline, the proposed power plant falls under "category A" and require carrying out EIA in accordance with the Foreign Investment Law and the Environment Conservation Rules 2014.

DESCRIPTION OF THE PROJECT

Project Location

The proposed 106 MW CCPP is located in Thaketa Township in eastern part of Yangon City, with about 8.5km straight-line distance from Ngamoyeik River in the north and about 1.1km straight-line distance from Thanlyin River in the south. The northern side of the plant site is close to the highway of Yangon City, and it is separated by a road from the existing natural gas power plant. The southern side of the plant site is adjacent to the railway, south to which locates a residential area. The eastern and western sides of the plant site are distributed with dense residential areas.

The plant site consists of many refuse landfills, some farmland and wasteland, a few trees and crops and a few ponds in some areas. There are about 6 households on the plant site, mainly residing in the eastern and western parts. There are power transmission lines passing through the southwestern part of the plant site.

The proposed power plant is planned as 500MW in capacity, locates at Thaketa Township that is 10km east to Yangon city.

The Project falls into two phases. Phase I will be built with **installed capacity of 72MW+34MW=106MW**, which consist of one 6FA Gas Turbine & Generator and one Steam Turbine & Generator, using one-drive-one combined cycle. Besides, under the local environment condition and present available natural gas, the actual output shall be **62MW+31MW=93MW at natural gas available volume of 18mmcf/d**.

The three generators in Project Phase I shall be respectively connected to the 66kV outdoor substation through boosting transformer, and shall be connected to Thaketa Substation through 3-circuit outgoing lines.

The four generators in Project Phase II shall be respectively connected to the 230kV outdoor booster station of the power plant with the generator-transformer mode. The 230kV two-circuit outgoing lines "∏" of the four generators shall be connected to Thaketa Substation and Thanlyin Substation.

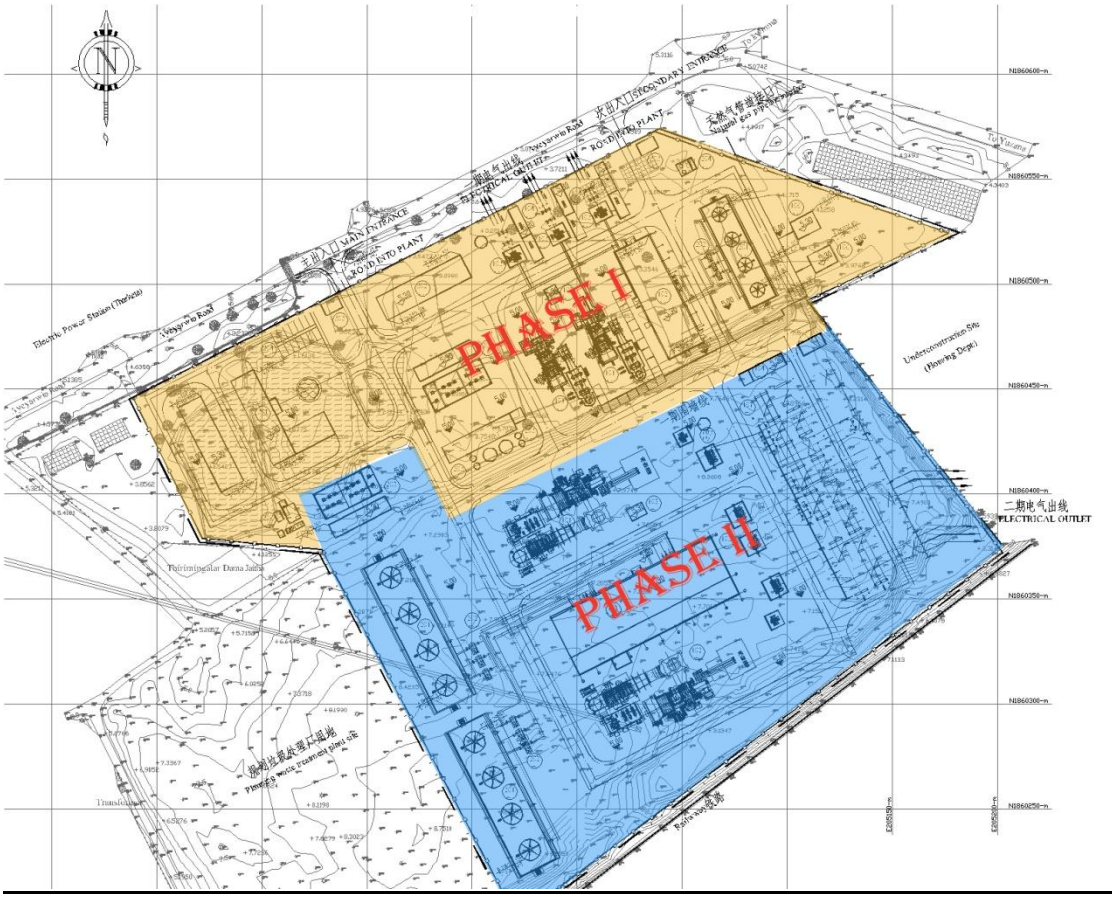


Figure 1 General Layout Plan of Plan Area (Scheme I):

The present ESIA work is prepared for phase 1 - 106 MW CCPP.

The location of the Phase I 106 MW power plant is shown in Figure 1 and the coordinate of plant boundary is shown in Table 1.

Table 1 The Coordinates of the Power Plant Boundary

No.	Longitude	Latitude
A	96º13'34.66"E	16º48'39.61"N
B	96º13'44.84"E	16º48'44.87"N
C	96º13'49.55"E	16º48'43.33"N
D	96º13'38.37"E	16º48'37.79"N
E	96º13'38.17"E	16º48'38.30"N
F	96º13'37.12"E	16º48'38.41"N
G	96º13'36.55"E	16º48'38.08"N

DESCRIPTION OF EXISTING ENVIRONMENT

Physical Environment

Climate, Geology, Soil

The proposed project area has a tropical monsoon climate under the Köppen climate classification system. The city features a lengthy rainy season from April through November where a substantial amount of rainfall is received and a relatively short, dry season from December through March, where little rainfall is seen. It's primarily due to the heavy precipitation received during the rainy season that Yangon falls under the tropical monsoon climate category. During the course of the year, average temperatures show little variance, with average highs ranging from 29 to 36 °C (84 to 97 °F) and average lows ranging from 18 to 25 °C (64 to 77 °F). The hottest time of year in Yangon is in April when it is 30.65°C / 87.2°F on average but could get up to 37°C / 98.6°F maximum. On the other hand, the coldest time of year in Yangon is in January when it is 25.05°C / 77.1°F on average but could get down to 17.9°C / 77.1°F minimum.

Geology of the project area is generally dominated by poorly consolidated sediments deposit over the past 10,000 to 15,000 years (Holocene age) FIGURE 4-5. The geology of the study area consists of Quaternary deltaic sediments, which have been strongly influenced by tectonic movements on deep seated faults.

As part of the baseline study, soil samples were collected in February 2012 and April, 2013. The major soil texture is sandy SILT to SILT around the project site. The heavy metal concentrations of the soil samples were found well within the usual ranges for natural soils. Two grab samples of the bed sediment from Pazundaung (Ngamoeyeik) River were collected and were analyzed for heavy metal concentrations. The heavy metal contents of the soil samples collected from the proposed site are well below those collected from the bed sediment.

Water Quality

Total of four surface water samples were collected in February 2012 and additional 3 surface water sample were collected in April 2013 in the Pazundaung (Ngamoeyeik) River. Physical and chemical parameters were analyzed, and the results compared with Thailand's Surface Water Quality Standards. The output of the index indicates that, all surface water samples were considered as class 3. Analysis of groundwater carried out in this study show that the measured parameters of Heavy metal namely Cadmium, Arsenic, Lead and Mercury were detected and higher than the WHO guideline.

Air quality

Ambient concentrations of NOx and SO2 are significantly lower compared to the WHO air quality standard. For comparison with the baseline data, two locations were chosen within the proposed Power Plant compound where the concentrations of SOx, NOx and CO, SPM and PM10 were monitored over study shows that the concentrations of SPM, SOx, NOx and CO of the proposed site are relatively low and below the WHO air quality standard, while concentration of PM10 is higher than the WHO standards.

Noise

Noise measurements were undertaken at three locations including the project site for 24hr duration. The day noise level has been monitored during 6 AM to 9 PM and night levels during 9 PM to 6 PM. The existing pre-project noise level was measured during 29 April to 2 May, 2013 at the area around the power plant site and the nearby the project site. Day time average noise level ranges from 47 to 59 dB (A) and night time average noise level is between 45 to 57 dB (A).

Ecological Environment

Common terrestrial flora in the study area includes Kokko tree - *Mimosaceae*, Mango tree - *Anacardiaceae*, and *Moraceae* - Pein –hne etc. Three types of terrestrial floral habit - tree, shrub and herb exists in the project areas. Most floral species particularly the trees and shrubs are cultivated and planted. A total of 17 butterfly species were recorded in the proposed project area during the survey period. A total of 14 bird species, which belong to 13 families, were recorded at the proposed project area. A total of four small mammal species were recorded during the survey periods. Twelve reptilian species and six amphibian species were recorded at the proposed project site during the survey period. Among the recorded reptilian species, Indian flap shell turtle *Lissemys punctata* was listed as endangered species and other four reptilian species, *Naja kaouthia*, *Bungarus fasciatus*, *Daboia russellii*, *Ptyas korros* and *Ptyas mucosa*, are listed under Appendix II of CITES indicating as protected species in wildlife trade. The species *Rana tigrina* are listed under IUCN threatened species. These threatened wildlife species were not in the proposed project compound. A total of 30 fish species at upstream and 33 species at downstream were recorded during the survey period, although there was variation in individual catch rates. Two benthic species were recorded in both upstream and downstream areas in the rivers 1 km far from project boundary. A total of 13 plankton species were recorded, where 7 species were observed as zooplankton species and 5 species as phytoplankton species.

Socio-economic Environment

As a part of the Environmental Impact Assessment, socio-economic study was carried out to assess the current baseline of socio-economic condition of the areas surrounding the proposed project site.

Semi-structured interviews and questionnaire distribution were done in Ward No.9 and Ward No.10 (North) in Thaketa Township. There were 100 respondents in the survey, and the survey focused on potential impacts of the project to surrounding residential areas.

Number of respondents in illiterate and primary school level of education was more in No. 10 (North) Ward than that of No.9 Ward. In contrast, number of respondents with middle and high school levels of education was more in No.9 Ward than that of No. 10 (North) Ward. In the survey wards, monthly income level of respondents can be classified into 3 classes such as less than 50,000 kyats, 50,000 to 100,000 kyats and 100,000 to 200,000 kyats. In No.10 (North) Ward, 71 percent of the respondents fell in 100,000 to 200,000 kyats group. Only a few percent of respondents received monthly income below 50,000 kyats per month in No. 10 (North) Ward. Higher percentage in high income groups showed that higher ability of respondents from Ward No.10 (North) to regular their intimate environment than that of respondents from Ward No.9.

Survey results showed that most of the respondents owned household items such as kitchen, toilet, bath rooms, TV sets, furniture and electric goods. However, about 51 percent of respondents from No.10 (North) Ward did not possess electric goods and about 35 percent of respondents did not own TV sets. The more they possess

electric goods, the higher their demand on electricity. It will lead to a positive image on the power plant project although they are not sure to receive electric power from the project. The source of water for respondents are mainly artesian wells (51%) and lake and well (36%). For drinking water 45% boiled water and 40% use purified water.

The power plant project would not influence the existing system of waste disposal and wastewater disposal. Most of the respondents disposed wastewater freely onto the ground and vacant lands although 77 percent of respondents disposed the garbage into the dump sites.

POTENTIAL ENVIRONMENTAL IMPACTS

Environmental Impact during Construction Phase

Ecological Impacts

There are no impacts on Ecology because the proposed power plant site will be built on the disposal site and the surrounding area is occupied by the residential area. During the site preparation, some bush and small trees would have to be cleared therefore removal of these would have some potential impact. Few common amphibian species are available at or near the proposed project site and none of them are nationally threatened. Few common reptilian species are available at or near the proposed project site and none of them are nationally threatened. One reptile specie was identified in the study area but not from within the project site. Reptiles are sensitive animal and sometimes used as indicative species for bio-environmental assessment.

Physico-chemical Impacts

Impact on Water Quality and General Environment

Waste and wastewater generated during the construction phase of the project include construction debris and wastes, and some other solid wastes (e.g., from construction activities), human wastes from people working at the project site (e.g., from labor sheds), and some liquid waste from construction processes. These waste/ wastewater could lead to pollution of water and general environment, if not properly disposed.

Wastewater

Wastewater, in the form of human wastes, will be generated mainly in the temporary labor sheds. This could be a major source of pollution (including water pollution) if not properly disposed. Use of un-sanitary latrines and improper disposal of human waste would create environmental pollution and adversely affect health and well - being of the people at the construction site by increasing the risk of disease transmission.

Solid waste

Construction debris and wastes to be generated during the construction phase would include scrap iron, steel, wooden frames, piping, and other solid wastes. Most of it will be generated toward the end of the construction phase during carrying out of the finishing works, while the site will be cleared of waste materials. The volume of such construction wastes is likely to be significant.

During site preparation, the garbage will be removed from the ground and large amount of solid waste come out (2 or 3 meter thick).

Air Quality Impacts

During the construction of the proposed power plant, air quality could deteriorate from the following various activities:

- Construction of buildings;
- Access road construction, if required;

• Transportation of materials to and from site by construction traffic; and

• Soil stripping and earthworks

It is also assumed that with the significant amount of natural gas being consumed, additional pipelines construction would be required to move the natural gas from the gas source to the power plant.

Since construction of the proposed power plant project would most likely involve significant earthworks, increase in particulate matter in the air from wind-blown dust is also a concern, especially considering the close proximity of the monastery (and also the residential area) to the project site.

Impact on Noise Level

During construction stage major source of noise is expected to stem from transport vehicles. Also noise is expected to be produced from plant construction activities. The construction phase may be broadly classified into two different groups:

i. General Site and Plant Construction,

ii. Water and Effluent Treatment Plant construction, and

iii. Access Road Construction.

Potential Impact

Activity

The sources of noise during construction activities include:

• Construction traffic; and

• Construction activities such as excavation, concreting, backfilling, use of pumps (for pumping excess water) and compressors, etc;

Socio-economic Impacts

The impacts of the project activities during construction phase on important socio-economic parameters are summarized below.

Traffic and Transport

During construction phase, some additional traffic will be generated for bringing in construction material and equipment. This traffic will pass through heavily traveled the existing road. Road traffic flow to and from the project site is likely to increase during the construction phase due to increased movement of vehicles carrying construction materials, equipment and machinery, and personnel.

Public Health

The construction activities of the power plant are likely to have some impact on human health and well-being due to increased noise pollution and vibration, and local air pollution within and around the project site. Construction activities will generate dust.

Noise pollution and vibration will be generated from additional traffic and operation of construction equipment. The school and the residential building located close to the project site will be affected by such noise pollution and vibration. Solid wastes generated by the construction activities and labors may create environmental pollution and thus affect public health, if not properly disposed. One possible impact on public health is that there would be no more offensive odor once the large waste disposal site has been removed and replaced by the proposed gas turbine project. Accident during construction phase is also an important issue. Proper measures including regular

maintenance of equipment and use of protective gear are needed to reduce the risk of such accidents during the construction phase.

Employment

Some job opportunities will be created for labors as well as skilled manpower (including engineers) for construction of the proposed project. Installation of power plant will require relatively small number of skilled personnel and laborers; as such installation is highly automated.

ENVIRONMENTAL IMPACT DURING OPERATIONAL PHASE

The impacts of project activities on most ecological parameters (e.g., floral and faunal habitat and diversity) are mostly insignificant. The effects of project activities a number of physicochemical environmental parameters have been assessed. These parameters include noise level, water quality, and air quality. The impact of the power plant project at its operation phase on socio-economic parameters will be mostly beneficial. Increased power supply will promote well-being of the people suffering from lack of power supply or serious load shedding; it is also likely to have positive impact on industrial activities and employment.

Air Emission Impacts in Operation Phase

The proposed power station will emit NOx which consists of (NO) and (NO_2). Only the latter has been shown to have the potential to cause detriment to health when present above certain threshold concentrations.

Approximately 80 per cent of the oxides of nitrogen emitted will be in the form of NO. Some of this will be converted to NO_2 by reactions in the atmosphere. The proportion converted is a function of dilution of the plume, background concentrations of nitrogen oxides and meteorology.

Table 2: Air Emissions from Gas Turbines Stack

Pollutant	Unit	UREG Stack Emission	IFC Standard	NEQG (Myanmar)
NOx	mg/Nm^3	23	51(25ppm)	100 (Natural gas for all turbine type)
CO	mg/Nm^3	3	not specified	not specified
O2	mg/Nm^3	14.06	not specified	not specified
SO_2	mg/Nm^3	0	not specified	not specified

Monitoring Measurements show that 24hour average concentrations of the proposed project site would be well within the WHO guidelines and USEPA standards. A computer model has been used to estimate the proportion converted and the resulting ground level concentrations of NO_2.

Particulate matters, SO_2 and unburnt hydrocarbons will be negligible quantities for natural gas turbines and the potential impacts will be low significant. Ground level concentrations have been calculated on the automated distance array option extending from within 200 m to 50 km radius from the point source. The spacing between points are increments of 100m was used out to 3,000m, with 500m increments from 3,000m to 10 km, 5 km increments from 10 km to 30 km, and 10 km increments out to 50 Km.

The calculation of 24 hour emission rates shall be based on both normal operating loads, and during startups. Without taking into consideration on start - up condition will not be accepted technically.

The modelling has calculated 24 hours ground level concentration (GLC) of NO_2 and CO emitted from the stack in the surrounding area. These results are then compared to the relevant air quality standards.

The modelling results indicate that the predicted GLC of NO_2 arising as a result of the stack emissions will not exceed any of the reference standards and guidelines for ambient air quality except only around 200m radius from the proposed CCPP. The modelling analysis has shown that the proposed CCPP will lead to significant improvements in the dispersion of air pollutants from the site with large reductions in the predicted contributions of pollutants from the site. The reference standards and guideline values have been designed for the protection of human health and the environment.

Therefore atmospheric emissions from the proposed plant are not predicted to have a significant impact on ambient air quality, human health and the environment including vegetation and ecosystem.

Noise Impacts during Operational Phase

Since the proposed Project will be implemented near the existing facility; and since planned area is in the industrial zone, the plant site will be constructed 200 meters far from nearest receptor. Therefore, no negative impact is expected in vicinity of the proposed Project.

According to the measurement results, the average background noise was found between 45 to 60 dBA. The Residential Area closest to the project area where the facility is to be installed, which is closest to the facility is at a distance of about 200 m. The value of the noise which would reach the house in question would be 40 to 50 dB(A) and this value remains below the daytime, evening and night limit values, which are respectively L_{day} (dBA) 70 and L_{night} (dBA) 70, set forth by the IFC standard.

Surface Water and Hydrogeology

Operation of the Gas Power Plant would have impact on surface water and ground water principally because of taking water for cooling system in Gas Turbine. Depending on the design of the Plant (that has not been settled yet), discharge of water from the nearby river will have impact on flow of regular current while taking from ground water well will have impact on lowering of the water table. Also, direct disposal of water into nearby river will have impact on change in water quality. Heat in disposed water will have direct effect to river dwellers and the people who use water.

The gas turbine component along with the 120 MW steam turbine component of the power plant does not generate any thermal effluent which needs to be discharged in the environment. This is because a closed cycle cooling system using cooling towers and condensers which will dissipate the waste heat into the ambient air rather than the surface water body. Only the intermittent losses of water from the system will be supplemented from the intake water and there will not be a discharge of water out of the system into the river unless there is an accident or a temporary shutdown due to operational maintenance.

Socio-economic Impacts

During operation phase, no significant negative impact is anticipated on socio-economic environmental parameters. Significant positive impacts are expected due to improvement in power supply. This will add power to national grid and contribute to the Yangon city. Well-being of the surrounding population, especially Thaketa Township, will be significantly improved due to generation of electricity during peak hours.

Public Opinion on the Project

To access the public opinion, some questions were set up and asked to respondents in the project area. About 66 percent of the respondents noticed on Nature Gas-Combined Cycle Power Plant and among them 80 percent of answers mentioned that there would be no change in the existing environmental conditions due to the power plant. Their considerations on the improvement of the project are concerned with general development, job opportunities, better environment and availability of electricity supply. More than 30 percent of respondents from No.9 and No.10 (North) wards considered that they can access more electricity supply which is generated from their power plant project.

According to the respondents there would be some possible noise, smell and fire problems related to Nature Gas-Combined Cycle Power Plant. These include; scary on the terrible sound from the plant, mental effect of a loud sound produced by machine processes, afraid of possible fire accidents and the foul smell from gas leakage from the pipes.

Overview on the project

Generally, the respondents from the project area are highly satisfied (96 per cent) and not satisfied (4 percent) on the project. From the point of view of business, 98 per cent of respondents are highly satisfied and 2 per cent are not satisfied on the project.

Respondents of the survey from this Project are very satisfied and satisfied on the project related to social welfare, environment, social status, socio- economic conditions, and health and education status. However, 2 per cent of the respondents are in neutral view on the project for aspects of socio-economic environment.

Most of the respondents are satisfied with the overviews of the project on their region and most of the respondents from No.9 and No.10(North) wards fully satisfied with the project.

Recommendation

Based on the survey results, it is recommended to;

1. Operate the plant by using modernized techniques,
2. Reduce a terrible sound from the plant,
3. Eliminate a loud noise produced by machine processes,
4. Prevent possible fire disaster, and
5. Maintain the gas pipes from unnecessary leakage.

In order to these precautions, a general Community Social Responsibility (CSR) plan is established as described in Chapter 7 and it is necessary to open the CSR office for public consultation on possible impacts of the plant. The CSR office will conduct social and health activity in the project area and should consult the public and try to solve the problems related to power plant and its consequences.

MITIGATION MEASURES AND ENVIRONMENTAL MANAGEMENT

Environmental management and monitoring activities for the proposed power plant project could be divided into management and monitoring: (a) during construction phase, and (b) during operation phase. The environmental management program should be carried out as an integrated part of the project planning and execution. For this purpose, it is recommended that the Responsibility person from U Energy Thaketa Power Co., Ltd. for this specific project should take the overall responsibility of environmental management and monitoring. He will form a team with required manpower and expertise to ensure proper environmental monitoring.

The environmental management during the construction phase should primarily be focused on addressing the possible negative impacts arising from: (a) Generation and disposal of sewage, solid waste and construction waste, (b) Increased traffic, (c) Generation of dust (particulate matter), (d) Generation of noise, and (e) Deterioration of water quality. The environmental management should also focus on enhancing the possible beneficial impacts arising from employment of local workforce for construction works. Table 1 summarizes the potentially significant environmental impacts during construction phase, the measures needed to eliminate or offset adverse impacts and enhance positive impacts.

Table 3: Potentially Significant Environmental Impact During Construction Phase and Mitigation Measures

Activity/Issues	Potentially Significant Impacts	Proposed Mitigation Measures	Responsible Parties
Influx of workers	• Generation of sewage and solid waste • Possible spread of disease from workers	• Construction of sanitary latrine and septic tank system (one latrine for 20 persons) • Erecting "no litter" sign, provision of waste bins/cans, where appropriate • Waste minimization, recycle and reuse • Proper disposal of solid waste (in designated waste bins) • Regular medical monitoring of workers	Contractor (Monitoring by HSE section and/or third party)
Transportation of equipment, materials and personnel; storage of materials	• Increased traffic/navigation • Generation of noise, especially affecting the nearby school and residential areas • Deterioration of air quality from increased vehicular movement, affecting people in the surrounding areas • Wind-blown dust from material (e.g., fine aggregate) storage areas	• Scheduling of deliveries during non-school hours and after regular working hours • Protecting school going children from traffic hazard during construction phase, with installation of proper traffic sign and warnings • Speed reduction to 10 km per hour within the school zones • Keeping vehicles under good condition, with regular checking of vehicle condition to ensure compliance with national standards • Watering unpaved/dusty roads (at least twice a day) • Sprinkling and covering stockpiles • Covering top of trucks carrying materials to the site and carrying construction debris away from the site	Contractor (Monitoring by HSE section and/or third party)

Construction activities, Including operation of Construction equipment	• Generation of noise from construction activities (general plant and access road construction), especially affecting the nearby school and residential areas	• Use of noise suppressors and mufflers in heavy equipment • Avoiding, as much as possible, construction equipment producing excessive noise during school hours and also at night • Avoiding prolonged exposure to noise (produced by equipment) by workers • Creating a buffer zone between the school, residential and construction site to reduce disturbance to elder people and to protect school children from health hazard	Contractor (Monitoring by HSE section and/or third party)
	• Deterioration of air quality from wind-blown dust and possible use of equipment, such as stone (aggregate crushers)	• Not using equipment such as stone crushers at site, which produce significant amount of particulate matter • Keeping construction equipment and generators in good operating condition • Using equipment, especially generators with high levels of emission control • Immediate use of construction spoils as filling materials • Immediate disposal/sale of excavated Materials	
	• Accidents	• Regular inspection and maintenance of equipment • Environmental health and safety briefing • Provision of protective gear	
	• Spills and leaks leading to soil and water contamination	• Good house keeping • Proper handling of lubricating oil and fuel • Collection, proper treatment, and disposal of spills	
	• Employment of work/labor force	• Local people should be employed in the project activities as much as possible.	

The environmental management during the operation phase should primarily be focused on addressing the following issues: (a) Emission from the power plant, (b) Generation of noise, and (c) Waste generation at the plant. Table 2

summarizes the potentially significant environmental impacts during operation phase, the measures needed to eliminate or offset adverse impacts and enhance positive impacts.

Table 4 Potentially Significant Environmental Impact During Operation Phase and Mitigation Measures

Activity/ Issues	Potentially Significant Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
Power Generation	• Emission from the power plant	• Using stack as specified in the bid document • Using low nitrogen oxide burners, as specified in the bid document • Installation of stack emission monitoring equipment for major pollutants. An in-house Continuous Air Monitoring Station (CAMS) may be established. • In stack design due consideration should be given to proper insulation • Planting of trees around the project site, especially along the boundary of the school and residential areas located close to the project site • Restrictions may also be imposed on installation of industries in the area that emit significant amount of particulate matter.	Monitoring team (HSE section and/or Third party)
	• Generation of noise	• Provision of silencers for generators and turbines • Planting of trees around the project site • Regular plant maintenance • Regular noise monitoring, especially at the school and residential quarters located • Use of ear-muffs and ear-plugs by plant personnel working in the generator and turbine facilities of the plant	Monitoring team (HSE section and/or Third party)
		• Good housekeeping • Proper construction and maintenance of wastewater disposal system for the plant	

Waste generation	• Inappropriate disposal of sewage causing environmental pollution • Generation of solid waste including sludge from demineralizer. • Possible water pollution	premises • Ensuring proper storage, treatment, and disposal of all solid waste • Monitoring of effluent quality from treatment plant (monitoring requirement and cost estimate provided) • Monitoring of river water quality (monitoring requirement and cost estimate provided)	

Tables 5 and 6 provide a summary of the monitoring schedule for the construction and operational phases, respectively for the proposed power plant.

Table 5 Monitoring Plan During Construction Phase of the Project

Issue	Parameters	Monitoring Frequency
Noise level	Noise at different locations	Every week, particularly during operation of heavy equipment
Process waste	Solid waste	Every week
Health	Health status of school children	Once every 3 months by own clinic developed by U Energy Thaketa Power Co., Ltd. at project site

Table 6 Monitoring Plan During Operational Phase of the Project

Issue	Potential impacts	Parameters to be monitored	Location	Measurement and Method	Frequency	Responsibility	Cost
General	Inspection of mitigation compliance	General compliance with operation manual	Project Compound	Visual inspection	Daily	Safety Production Department	Included in operation and maintenance cost
Air emissions	Stack emissions	SO_2, O_2, NOx, CO	Main Stack	CAMS*	Continuous	Control Room Team	Installation included in EPC Cost, Monitoring and Maintenance Cost

Air emissions	Ambient air quality	Ozone, NO_2, SO_2, PM10, $PM_{2.5}$ (24 hour average)	4 locations	Standard Method	Twice per Year	Third party environmental consultant	Monitoring and Maintenance Cost
River water	Surface water	Water temperature	At cooling water discharge point	Standard Method	Monthly	Safety Production Department	Monitoring and Maintenance Cost
Effluent water		Arsenic, Cadmium, Total Chromium, Copper, Iron, Lead, Mercury, Oil and grease, pH, TSS, Total residual chlorine, Zinc	At wastewater discharge point	Standard method	Quarterly	Third party environmental consultant	Monitoring and Maintenance Cost
Groundwater Quality	Ground Water	Arsenic, Cadmium, Total Chromium, Copper, Iron, Lead, Mercury, Oil and grease, pH, TSS, Total residual chlorine, Zinc	3 locations same as baseline surveys	Standard method	Biannually (twice per year)	Third party environmental consultant	Monitoring and Maintenance Cost
Noise level	Increase in ambient noise levels	Noise level in Leq	5 locations	24 hours	Quarterly	Third party environmental consultant	Monitoring and Maintenance Cost

Waste	Block mud in drain and cause flooding	Amount and condition of mud in the drain Amount of solid waste and collection system	- Public drain - Plant compound	Visual Inspection	Twice per month	Third party environmental consultant	Monitoring and Maintenance Cost
Occupational health and safety	Accidents or incidents due to operation and maintenance activities	Health status and safety	Project Compound/ factory	As to be defined in the Health and safety Plan	As defined in Health and Safety Plan	Safety Production Department	Monitoring and Maintenance Cost
CSR activities	Community development	Activities	Local communities around the power plant	Number of beneficiaries and outcome of the activities	Periodic and need based	Administration department	Monitoring and Maintenance Cost

Actual monitoring time and location will be decided by Client .During the operation phase, the monitoring may be carried out by a competent Contractor.

*** Continuous monitoring if a CAMS is established*

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

An Environmental Impact Assessment (EIA) of the proposed Combined Cycle Power Plant at Thaketa has been carried out, which included development of an Environmental Management Plan (EMP). In the EIA, the effects of the project activities on physico-chemical, ecological and socio-economic parameters during both construction and operation phases have been assessed. The impacts have been identified, predicted and evaluated, and mitigation measures suggested for both construction and operation phases of the proposed power plant.

Since the project site is located in a developed area that does not appear to be ecologically sensitive, impacts of project activities on most ecological parameters (e.g., floral and faunal habitat and diversity) are mostly insignificant. The study suggests that most of the adverse impacts on the physico-chemical environment are of low to moderate in nature and therefore, could be offset or minimized if the mitigation measures are adequately implemented. Noise level has been identified as a significant potential impact of the proposed power plant during both the construction and operation phases. Therefore, proper protective measures should be adopted during the operation and inspection of these equipment. Modeling study revealed that the cumulative noise effect of the proposed 106 MW CCPP during the operational phase at a common point is expected to be dominated by the noise generated by the plant nearest to the receptor. Modeling study suggests that the effect of increased NOx and PM in the ambient air due to emission from the power plants will not be very significant.

The proposed plant will be constructed within a designated area beside the existing Thaketa gas turbine power plant compound. So there is no need for land acquisition. Additionally, there is no settlement in this designated area, and the area is not used for any income generation activities. Therefore, no population will be displaced and no resettlement will be required for the construction of the power plant, and no loss of income is associated with the proposed project.

During operation phase, no significant negative impact is anticipated on socio-economic environmental parameters. Significant positive impacts are expected due to improvement in power supply. During public consultations people welcomed the proposed power plant project at Thaketa. However, they recommended installing a plant of good quality, which will be able to provide uninterrupted power and will be able to keep anticipated air and noise pollution to a minimum level.

Recommendations

The environmental assessment carried out for the proposed combined cycle power plant (CCPP) at Thaketa Township, suggests low to moderate scale of adverse impacts, which can be reduced to acceptable level through recommended mitigation measures as mentioned in the EMP. It is therefore recommended that the proposed 106 MW CCPP may be installed at the Thaketa Township, provided the suggested mitigation measures are adequately implemented. It is also recommended that the environmental monitoring plan be effectively implemented in order to identify any changes in the predicted impacts and take appropriate measures to off-set any unexpected adverse effects.

စီမံကိန်းအကျဉ်းချုပ်ဖော်ပြချက်

နိဒါန်း

ရန်ကုန်မြို့သည် ပြည်ထောင်စု သမ္မတ မြန်မာနိုင်ငံတော်၏ စီပွားရေး၊ စက်မှုလုပ်ငန်းနှင့် ပို့ဆောင်ဆက်သွယ်ရေး အချက်အချာမဏ္ဍိုင် တစ်ခုဖြစ်ပါသည်။ လက်ရှိအချိန်တွင် စီပွားရေးအဆက်မပြတ် တိုးချဲ့မှု၊ ရန်ကုန်မြို့တော်၏ စက်မှု လုပ်ငန်းလျင်မြန်စွာ ဖွံ့ဖြိုးတိုးတက်မှုနှင့် လူနေမှုအဆင့်အတန်း တိုးတက်လာမှုတို့နှင့်အတူ ၄င်း၏ လျှပ်စစ်မီး လိုအပ်ချက် သည် မြင့်မားလာပြီး လျှပ်စစ်မီး ထောက်ပံ့ပေးနိုင်မှုနှင့် လိုအပ်မှု ကွာဟချက်သည် တဖြည်းဖြည်း သိသာထင်ရှားလာပါသည်။ ရန်ကုန်မြို့ အနီးတွင် လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ တည်ဆောက်ခြင်း သည် လျှပ်စစ်ဓာတ်အား ထောက်ပံ့ပေးနိုင်မှု နှင့် လိုအပ်မှု ကွာဟချက်အား ဖြည့်ဆည်းပေးနိုင် ပါသည်။ ထို့ကြောင့် U Energy Thaketa Power Co., Ltd. သည် သဘာဝဓာတ်ငွေ့နှင့် ရေနွေးငွေ့ပေါင်းစပ် လျှပ်စစ်ဓာတ်အားပေး စက်ရုံအား သာကေတမြို့နယ်၊ ရန်ကုန်မြို့တွင် တည်ဆောက်ရေး၌ ရင်းနှီးမြှုပ်နှံရန် အဆိုပြုခဲ့ပါသည်။

စီမံကိန်းပြင်ဆင်နေစဉ် စက်ရုံ၏ ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်းအပြည့်အစုံအား Resource & Environment Myanmar Ltd. (REM) မှ တာဝန်ယူဆောင်ရွက်မည်ဖြစ်ပါသည်။

IFC လမ်းညွှန်ချက်များအရ အဆိုပြုစီမံကိန်းသည် “အမျိုးအစား က” ဖြစ်ပြီ ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ထိခိုက် မှုဆန်း စစ်ခြင်းအား နိုင်ငံခြားရင်းနှီးမြှုပ်နှံမှု ဥပဒေနှင့် ပတ်ဝန်းကျင် ထိန်းသိမ်းရေး နည်းဥပဒေ ၂၀၁၄ခုနှစ် နှင့်အညီ ဆောင်ရွက်ရန်လိုအပ်ပါသည်။

စီမံကိန်းဖော်ပြချက်

စီမံကိန်းတည်နေရာ

အဆိုပြု ၅၀၀ မဂ္ဂါဝပ် လျှပ်စစ်ဓာတ်အားပေးစက်ရုံစီမံကိန်းသည် ရန်ကုန်မြို့နယ်၏ အရှေ့ပိုင်း သာကေတမြို့ နယ်တွင် မြောက်ဘက်ရှိ ငမိုးရိပ်ချောင်းမှ အဖြောင့်အကွာအဝေး ၈.၅ကီလိုမီတာခန့်တွင်၄င်း၊ တောင်ဘက်ရှိ သန်လျင်မြစ် မှ အဖြောင့်အကွာအဝေး ၁.၁ ကီလိုမီတာခန့်တွင် တည်ရှိပါသည်။ စီမံကိန်းနေရာ၏ မြောက်ဘက် ခြမ်းသည် ရန်ကုန်မြို့တော်၏ အဝေးပြေးလမ်းမကြီး အနီးတွင်တည်ရှိပြီး ၄င်းအား လက်ရှိတည်ရှိနေသော သဘာဝဓာတ်ငွေ့သုံးဓာတ်အား ပေးစက်ရုံမှ လမ်းတခုဖြင့် ခြားနားထားပါသည်။ စီမံကိန်းနေရာ၏ တောင်ဘက် ခြမ်းသည် တောင်ဖက်တွင် လူနေအိမ်ဧရိယာဖြစ်သည့် ရထားလမ်းနှင့် ကပ်လျက်တည်ရှိပါသည်။ စီမံကိန်းနေရာ ၏ အရှေ့ဘက်နှင့် အနောက်ဘက်သည် လူနေထူထပ်သည့် ဧရိယာဖြစ်ပါသည်။

စီမံကိန်းနေရာသည် လျှပ်စစ်ဝန်ကြီးဌာနပိုင်မြေနေရာပေါ်တွင်ရှိပြီး အမှိုက်ဖို့မြေများ၊ သစ်ပင်ကောက်နှံပင် အနည်းငယ် နှင့် ရေကန်ငယ် အစရှိသောပတ်ဝန်းကျင်နေရာ နှင့် မြေရိုင်းတို့ပါဝင်ပါသည်။ စီမံကိန်းနေရာတွင် အရှေ့ဘက်နှင့် အနောက်ဘက်၌ အဓိကနေထိုင်ကြသည့် အိမ်ထောင်စု ၆စု ရှိပါသည်။ စီမံကိန်းနေရာ၏ အနောက် မြောက်ဘက်တစ် လျောက် ဖြတ်သန်းသွားသော ဓာတ်အားလိုင်များ ရှိပါသည်။

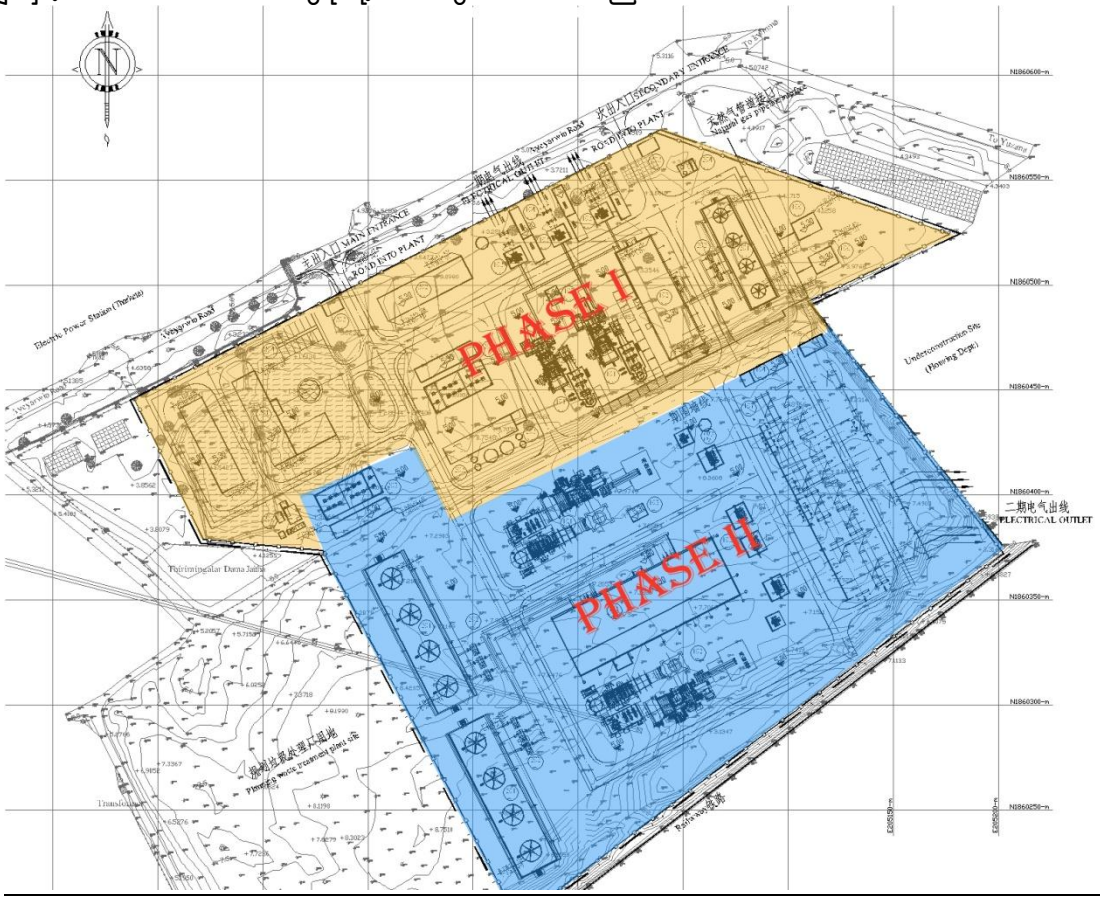
အဆိုပြု လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ သည် ရန်ကုန်မြို့မှ အရှေ့ဘက် ၁၀ကီလိုမီတာအကွာတွင် တည်ရှိပြီး ၅၀၀ မဂ္ဂါဝပ် ထုတ်လုပ်နိုင်စွမ်းရှိစေရန် ရည်ရွယ်ထားပါသည်။

စီမံကိန်းသည် အဆင့်နှစ်ဆင့် ရှိပါသည်။ အဆင့် ၁ သည် တစ်လုံးနှင့် တစ်လုံး ပေါင်းစပ်လည်ပတ်သည့် 6FA ဓာတ်ငွေ့ တာဘိုင်နှင့် ဂျင်နရီတာတစ်လုံး၊ ရေနွေးသွေ့ တာဘိုင်နှင့် ဂျင်နရီတာ တစ်လုံးပါဝင်ပါသည်။ ထို့အပြင် ဒေသပတ်ဝန်းကျင် အခြေအနေနှင့် လက်ရှိရရှိနေသော သဘာဝဓာတ်ငွေ့ပေါ်မူတည်၍ လက်တွေ့ ထွက်ရှိမှုများ

ဓာတ်ငွေ့ရရှိသော ပမာဏ 18mmcf/dတွင် 62MW+31MW=93MW (ခန့်မှန်းခြေ ၁၀၆ မဂ္ဂါဝပ်) ထွက်ရှိမည်ဖြစ်ပါ သည်။

စီမံကိန်း အဆင့် ၁ တွင် ဂျင်နရေတာသုံးလုံးသည် အပြင်ဘက် ၆၆ကေဗွီ ဓာတ်အားခွဲရုံသို့ စွမ်းအားမြှင့် ထရန်စဖော်မာမှ တဆင့် အသီးသီးသွယ်ဆက်ထားမည် ဖြစ်ပါပြီး သာကေတ ဓာတ်အားခွဲရုံသို့ လျှပ်စီးပတ်လမ်း ၃ ခု ပါဝင်သည့် အပြင်ဘက် ဓာတ်အားလိုင်းမှတဆင့် ဆက်သွယ်ထားမည်ဖြစ်ပါသည်။

စီမံကိန်းလုပ်ငန်းအဆင့် ၂ တွင်မူ ဂျင်နရေတာ ၄လုံးသည် လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ၏ အပြင်ဘက်ရှိ ၂၃၀ ကေဗွီ စွမ်းအားမြှင့် ဓာတ်အားပေးရုံသို့ ဂျင်နရေတာ-ထရန်စဖော်မာ စနစ်ဖြင့် ဆက်သွယ်ထားပါသည်။ ဂျင်နရေတာ ၄လုံး၏ ၂၃၀ ကေဗွီလျှပ်စီးပတ်လမ်း၃ခုပါဝင်သည့် အပြင်ဘက် ဓာတ်အားလိုင်းများအား သန်လျင်နှင့် သာကေတဓာတ်အားခွဲရုံသို့ ဆက်သွယ်ထားပါသည်။



ပုံ ၁ ယေဘုယျ စီမံကိန်းစနစ်ချပုံ (အစီအစဉ် ၁)

ယခုပြုလုပ်သော ESIA အစီရင်ခံစာသည် ပထမအဆင့် - ၁၀၆ မဂ္ဂါဝပ် အတွက်ဖြစ်ပါသည်။ ၁၆၆ မဂ္ဂါဝပ် ဓာတ်အားပေးစက်ရုံ အဆင့် ၁ ၏ တည်နေရာကို ပုံ ၁ တွင် ပြသထားပြီး စက်ရုံ၏ ကိုဩဒိနိတ် နယ်နိမိတ်ကို ဇယား ၁ တွင် ပြသထားပါသည်။

ဇယား ၁။ ဓာတ်အားပေး စက်ရုံ၏ ကိုဩဒိနိတ် နယ်နိမိတ်

စဉ်	လောင်ဂျီကျူ	လတ်တီကျူ
A	96°13’34.66”E	16°48’39.61”N
B	96°13’44.84”E	16°48’44.87”N
C	96°13’49.55”E	16°48’43.33”N
D	96°13’38.37”E	16°48’37.79”N
E	96°13’38.17”E	16°48’38.30”N
F	96°13’37.12”E	16°48’38.41”N
G	96°13’36.55”E	16°48’38.08”N

လက်ရှိပတ်ဝန်းကျင် ဖော်ပြချက်

ရုပ်ပတ်ဝန်းကျင်

Climate, Geology, Soil ရာသီဥတု၊ ပထဝီဝင်၊ မြေသား

အဆိုပြုစီမံကိန်းတည်ရှိသည့်နေရာသည် Köppen ရာသီဥတု အမျိုးအစားခွဲခြားသည့် စနစ်အရ အပူပိုင်း မုတ်သုန် ရာသီဥတု ဖြစ်ပါသည်။ မြို့တော်၏ ကာလရှည်ကြာသော မိုးဥတုမှာ ဧပြီလမှ နိုဝင်ဘာလအထိဖြစ်ပြီး လုံလောက် သော မိုးရေချိန်ကိုရရှိပြီး တိုတောင်းသော ခြောက်သွေ့ရာသီမှာ ဒီဇင်ဘာလမှ မတ်လအထိဖြစ်၍ မိုးရွာသွန်းမှု အနည်းငယ်ကိုသာ တွေ့ရပါသည်။ ဤသို့ဖြစ်ရခြင်းမှာ အဓိကအားဖြင့် ရန်ကုန်မြို့၏ အပူပိုင်း မုတ်သုန်ရာသီဥတု အမျိုးအစားဖြစ်သော စိုစွတ်ရာသီအတွင်း ပြင်းထန်စွာ မိုးရွာသွန်းမှု ရရှိသောကြောင့် ဖြစ်ပါသည်။ တစ်နှစ်ပတ်လုံး ၏ ပျမ်းမျှအပူချိန်များသည် ကွာခြားချက်အနည်းငယ်သာ ရှိပါသည်။

အမြင့်ဆုံးပျမ်းမျှအမှတ်များမှာ ၂၉ မှ ၃၆ ဒီဂဂရီစင်တီဂရိတ် (၈၄မှ ၉၇ ဖာရင်ဟိုက်) နှင့် အနိမ့်ဆုံးမှာ ၁၈ မှ ၂၅ ဒီဂဂရီစင်တီဂရိတ် (၆၄မှ ၇၇ ဖာရင်ဟိုက်) တို့ဖြစ်ပါသည်။ ရန်ကုန်မြို့၏ အပူဆုံးလမှာ ဧပြီလဖြစ်ပြီး ပျမ်းမျှအပူချိန်မှာ ၃၀.၆၅ ဒီဂဂရီစင်တီဂရိတ်မှ ၈၇.၂ ဒီဂဂရီစင်တီဂရိတ်ဖြစ်ပြီး အမြင့်ဆုံးမှာ ၃၇ ဒီဂဂရီစင်တီဂရိတ်/၉၈.၆ ဖာရင်ဟိုက် အထိ ဖြစ်နိုင်ပါသည်။ ထို့အ ပြင် ရန်ကုန်မြို့၏ အအေးဆုံးလမှာ ဇန်နဝါရီလဖြစ်ပြီး ပျမ်းမျှ ၂၅.၀၅ ဒီဂဂရီစင်တီဂရိတ်/၇၇.၁ ဖာရင်ဟိုက် ဖြစ်၍ အနိမ့်ဆုံး ၁၇.၉ ဒီဂဂရီစင်တီဂရိတ်/၇၇.၁ ဖာရင်ဟိုက်အထိ ကျဆင်းနိုင်ပါသည်။

စီမံကိန်းနေရာ၏ ပထဝီဝင်အနေအထားမှာ လွန်ခဲ့သော နှစ်ပေါင်း ၁၀၀၀၀မှ ၁၅၀၀၀ကျော် (Holocene age) မှ မတောင့် တင်းမခိုင်မာသောအနည်အနှစ်ပို့ချမှု လွှမ်းမိုးပါသည်။ လေ့လာရေးနယ်မြေ၏ ပထဝီဝင်အနေအထား တွင် ခိုင်မာမြဲမြံသော ပြတ်ရွှေ့ကြောတွင် တိုက်ပြုရွှေ့လျားမှု ခိုင်မာစွာ လွှမ်းမိုးသော နှစ်၄၀၀မြောက် အနည်အ နှစ်ပို့ချမှု ပါဝင်ပါသည်။

အခြေခံအချက်အလက်လေ့လာရေး၏ တစ်စိတ်တစ်ပိုင်းအနေဖြင့် ဖေဖော်ဝါရီလ ၂၀၁၂ခုနှစ်နှင့် ၂၀၁၃ခုနှစ် ဧပြီလတွင် မြေသားနမူနာများကို ကောက်ယူခဲ့ပါသည်။ စီမံကိန်းနေရာအနီးတဝိုက် အဓိကမြေသားအနေအထား မှာ သဲဆန်သောနုန်းမြေ အမျိုးအစားဖြစ်ပါသည်။ နမူနာမြေသားတွင် သတ္တုပါဝင်မှုများကို သဘာဝမြေသား အတွက် ပုံမှန်အကွာအဝေးတွင် ကောင်းစွာတွေ့ရှိထားပါသည်။ ပုဇွန်တောင်မြစ်(ငမိုးရိပ်) အောက်ခံအနည်အနှစ် ၏ နမူနာနှစ်ခုအား ကောက်ယူပြီး သတ္တုပါဝင်မှုအတွက် စစ်ဆေးခဲ့ပါသည်။ အဆိုပြုလုပ်ငန်းနေရာမှ ကောက်ယူ လာသော မြေသားနမူနာ၏ သတ္တုပါဝင်မှု မှာ အောက်ခံ အနည်အနှစ်မှ ကောက်ယူလာသော မြေသား ထက်ပိုမို လျော့နည်းနေကြောင်းတွေ့ရှိရပါသည်။

ရေအရည်အသွေး

၂၀၁၂ခုနှစ်၊ ဖေဖော်ဝါရီလတွင် မြေပေါ်ရေနမူနာ စုစုပေါင်း လေးခုအားကောက်ယူခဲ့ပါသည်။ ၂၀၁၃ခုနှစ်၊ ဧပြီလတွင် ပုဇွန်တောင်မြစ်(ငမိုးရိပ်)၌ နောက်ထပ် မြေပေါ်ရေနမူနာ စုစုပေါင်း သုံးခုအား ကောက်ယူခဲ့ပါသည်။ ရူပနှင့် ဓာတုပါရာ မီတာများအား စစ်ဆေးခဲ့ပြီး ရရှိလာသော ရလဒ်များအား ထိုင်းနိုင်ငံ၏ မြေပေါ်ရေ အရည်အသွေးစံချိန်စံညွှန်းများနှင့် နှိုင်းယှဉ်ခဲ့ပါသည်။ နှိုင်းယှဉ်မှု ရလဒ်များအရမြေပေါ်ရေနမူနာအားလုံးသည် အဆင့် ၃ ဖြစ်ကြောင်း ညွှန်ပြနေပါ သည်။ လေ့လာရေးတွင် ဆောင်ရွက်ခဲ့သော မြေအောက်ရေ ခွဲခြမ်းစိတ်ဖြာ ခြင်းသည် တိုင်းတာရရှိသော Cadmium, Arsenic, Lead နှင့် Mercury ဟုခေါ်ဆိုသော သတ္တုများအား စမ်းသပ်တွေ့ရှိ၍ ၄င်းတို့သည် WHO လမ်းညွှန်ချက်ထက်ပို ၍ မြင့်မားနေသည်ကို ညွှန်ပြနေပါသည်။

လေအရည်အသွေး

ထိတွေ့လေတွင် NOx နှင့် SO2 ပါဝင်မှုများမှာ WHO လေအရည်အသွေးစံချိန်စံညွှန်းနှင့် နှိုင်းစာလျှက် သိသာ ထင်ရှားစွာနိမ့်ဆင်းနေပါသည်။ အခြေခံအချက်အလက်များနှင့် နှိုင်းယှဉ်မှုအတွက် အဆိုပြု လျှပ်စစ်ဓာတ်အားပေး စက်ရုံနယ်နမိတ် အတွင်း တည်နေရာနှစ်ခုက်ိုု ရွေးချယ်ထားပါသည်။ ထိုတည်နေရာနှစ်ခုတွင် SOx, NOx နှင့် CO ပါဝင်မှု နှင့် SPM နှင့် PM10 ပါဝင်မှု တို့အားစောင့်ကြည့်လေ့လာခဲ့ပါသည်။ လေ့လာမှုများသည် အဆိုပြု တည်နေရာ၏ SPM, SOx, NOx နှင့် CO ပါဝင်မှုသည် လွန်စွာ နိမ့်ဆင်းနေပြီး WHOလေအရည်အသွေး စံချိန်စံညွှန်းထက် လျော့နည်းနေသော်လည်း PM10ပါဝင်မှုသည် WHO စံချိန်စံညွှန်းထက် မြင့်မားနေပါသည်။

ဆူညံသံ

ဆူညံသံတိုင်းတာမှုကို စီမံကိန်းနေရာအပါအဝင် တည်နေရာသုံးခု၌ ၂၄နာရီကြာတိုင်းတာမှု ဆောင်ရွက်ခဲ့ပါသည်။ နေ့အချိန် ဆူညံသံအဆင့်မှာ မနက် ၆နာရီမှ ညဉနာရီအထိ၄င်း၊ ညအချိန် ဆူညံသံအဆင့်ကို ညဉနာရီမှမနက်

ဖနာရီအထိ စောင့်ကြည့်တိုင်းတာခဲ့ပါသည်။ တည်ရှိဆဲ စီမံကိန်းအကြို ဆူညံသံအဆင့်အာ ၂၀၁၃ခုနှစ်၊ ဧပြီလ ၂၉ရက်မှ မေလ ၂ရက်အထိ လျှပ်စစ်ဓာတ်အားပေးစက်ရုံနေရာအနီးပတ်ဝန်းကျင်တဝိုက်နှင့် စီမံကိန်းနေရာ အနီးအနားတွင် တိုင်းတာခဲ့ပါသည်။နေ့အချိန်ဆူညံသံပျှမ်းမျှအဆင့်မှာ ၄၈မှ ၅၉ dB (A)ဖြစ်ပြီး ညအချိန် ဆူညံသံပျှမ်းမျှအဆင့်မှာ ၄၅မှ ၅၇ dB (A) ကြားဖြစ်ပါသည်။

ဂေဟဗေဒပတ်ဝန်းကျင်

လေ့လာရေးနယ်မြေတွင် အများဆုံးပေါက်ရောက်သော ကုန်းတွင်း အပင်များတွင် အုန်းပင်- Mimosaceae ၊ သရက်ပင်- Anacardiaceae နှင့် ပိန္နဲပင် - Moraceae တို့ပါဝင်ပါသည်။ စီမံကိန်းနေရာတွင် ကုန်းတွင် အပင်ပေါက်ရောက်မှုမှာ သစ်ပင်၊ ချုံပင်နှင့်အပင်ပျော့တို့ ပေါက်ရောက်ကြပါသည်။ အဓိကအားဖြင့် အများဆုံး တွေ့မြိုးစိတ်ဖြစ်သော အပင်နှင့် ချုံပင်များကို စိုက်ပျိုးကြပါသည်။ လေ့လာမှုပြုလုပ်နေစဉ်ကာလတွင် အဆိုပြု စီမံကိန်းနေရာ၌လိပ်ပြာမျိုးစိတ် ၁၈မျိုးအား မှတ်တမ်းတင်တွေ့ရှိရပါသည်။ အဆိုပြု စီမံကိန်းနေရာ၌ ဌက်မျိုးရင်း ၁၃မျိုးမှ ဌက်မျိုးစိတ် ၁၄မျိုးအား မှတ်တမ်းတင်တွေ့ရှိရ ပါသည်။ လေ့လာမှုပြုလုပ်နေစဉ်ကာလအတွင်း စုစုပေါင်း အသေးစားနို့တိုက်သတ္တဝါမျိုးစိတ် ၄ခုအားတွေ့ရှိရပါသည်။

အဆိုပြု စီမံကိန်းနေရာ၌ တွားသွားမျိုးစိတ် ၂ မျိုးနှင့် ကုန်းနေရေနေသတ္တဝါမျိုးစိတ် ၆မျိုးအား တွေ့ရှိရပါသည်။ မှတ်တမ်းတင်တွေ့ရှိရသော တွားသွားမျိုးစိတ်များမှ အန္ဒိယ အခွံပိုပါ လိပ် Lissemys punctata သည် မျိုးသုဉ်းရန်အန္တရာယ်ရှိမျိုးစိတ်အဖြစ် စာရင်းဝင်ပြီး အခြား တွားသွားမျိုးစိတ်လေးမျိုးဖြစ်သော Naja kaouthia, Bungarus fasciatus, Daboia russellii, Ptyas korros နှင့် Ptyas mucosa များမှာ CITES၏ Appendix II အရ တောရိုင်းတိရိစ္ဆာန်ရောင်းဝယ်ရေးတွင် ကာကွယ်ထားရမည့် မျိုးစိတ်များ အဖြစ်ညွှန်းဆိုနေပါသည်။ Rana tigrina မျိုးစိတ်များမှာ IUCNအရ မျိုးသုဉ်းရန်အန္တရာယ်ရှိမျိုးစိတ် စာရင်းဝင်နေပါသည်။ အဆိုပါ မျိုးသုဉ်းရန်အန္တရာယ် ရှိတောရိုင်း တိရိစ္ဆာန်မျိုးစိတ်များ စီမံကိန်းနေရာတွင် နေထိုင်ကျက်စားခြင်း မရှိပေ။ လေ့လာမှုပြုလုပ်နေစဉ် ကာလတွင် မြစ်အထက်ပိုင်းတွင် ငါးမျိုးစိတ် စုစုပေါင်း ၃၀နှင့် မြစ်အောက်ပိုင်းတွင် ငါးမျိုးစိတ် စုစုပေါင်း ၃၃မျိုး တွေ့ရှိပါသည်။ သို့သော်လည်း မျိုးစိတ်တစ်ခုချင်းစီ၏ ငါးဖမ်းနှုန်း မှာကွာခြားပါသည်။ စီမံကိန်းနယ်မြေမှ ၁ ကီလိုမီတာ ကွာဝေးသော မြစ်အထက်ပိုင်းတွင် နှင့် မြစ်အောက်ပိုင်းတွင် နှစ်ခုလုံးတွင် အကောင်မွား မျိုးစိတ် ၂မျိုးအားတွေ့ရှိရပါသည်။ planktonမျိုးစိတ် ၁၃မျိုးအား မှတ်တမ်းတင်တွေ့ရှိရပြီး ရမျိုးအား zooplankton မျိုး စိတ်အဖြစ်ဖြင့် ၄င်း၊ မျိုးစိတ် ၅မျိုးအား phytoplanktonမျိုးစိတ် အဖြစ် လေ့လာတွေ့ရှိရပါသည်။

လူမှုစီပွားရေး ပတ်ဝန်းကျင်

ပတ်ဝန်းကျင်နှင့်လူမှုဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ဖြင်းတစ်စိတ်တစ်ပိုင်းအနေဖြင့် လူမှုစီးပွားလေ့လာရေးအား အဆိုပြု စီမံကိန်းနေရာ အနီးပတ်ဝန်းကျင်ရှိ ဧရိယာများ၏ လက်ရှိ လူမှုစီးပွား အခြေခံအခြေနေကို ရရှိရန် ဆောင်ရွက်ခဲ့ပါသည်။ အနေတော် လူတွေ့မေးမြန်းခြင်းနှင့် စစ်တမ်းများဖြန့်ဝေခြင်းအား သာကေတမြို့နယ် မြောက်ပိုင် အမှတ် (၉)နှင့် အမှတ် (၁၀) တို့တွင်ပြုလုပ်ဆောင်ရွက်ခဲ့ပါသည်။ စစ်တမ်းကောက်ယူရာတွင် ဖြေဆိုသူ အယောက် (၁၀၀) ရှိ၍ စစ်တမ်းမှာ စီမံကိန်း၏ အနီးပတ်ဝန်းကျင်ရှိ လူနေဧရိယာများအပေါ် ဖြစ်နိုင်ခြေရှိသော သက်ရောက်မှုများအား အဓိကထားပါသည်။ စာမတတ်သူနှင့် မူလတန်းအဆင့် ပညာရေးတတ် ရောက်သူများတွင်အမှတ် (၁၀)ရက်ကွက်၏ ဖြေဆိုသူအရေအတွက်မှာ အမှတ်(၉) ရပ်ကွက်ထက် ပိုမိုများပြား နေပါသည်။ အမှတ် (၉) ရပ်ကွက်တွင် အလယ်တန်းနှင့် အထက်တန်း တတ်ရောက်သူ အရေအတွက်မှာ အမှတ် (၁၀) ရပ်ကွက်ထက် ပိုမိုများပြားနေပါသည်။ စစ်တမ်းကောက်ယူ ရာတွင် ဖြေဆိုသူများ၏ လစဉ်ဝင်ငွေအား ၅၀၀၀၀အောက်၊ ၅၀၀၀၀နှင့် ၁၀၀၀၀၀ကြား နှင့် ၁၀၀၀၀၀မှ ၂၀၀၀၀၀အထိ ဟူ၍ သုံးမျိုးခွဲခြားထားပါသည်။

အမှတ်(၁၀) ရပ်ကွက်တွင် ဖြေဆိုသူ၏ ၇၁ရာခိုင်နှုန်းမှာ ၁၀၀၀၀၀မှ ၂၀၀၀၀၀အထိ ဝင်ငွေရှာနိုင်သော အုပ်စု တွင်တွေ့ရှိရပါသည်။ အမှတ်(၁၀) ရပ်ကွက်(မြောက်ပိုင်း) ဖြေဆိုသူရာခိုင်နှုန်းအနည်းငယ်သာ တစ်လလျှင်

၅၀၀၀၀ကျပ် အောက်လစဉ်ဝင်ငွေ ရရှိပါသည်။ ဝင်ငွေမြင့်မားစွာရရှိသော အုပ်စုများ၏ ရာခိုင်နှုန်းအတော်များများ မှာ အမှတ်(၁၀) ရပ်ကွက်မှ ဖြေဆိုသူများ၏ မြင့်မားသောစွမ်းရည်သည် အမှတ် (၉) ထက်ပို၍ ဖြစ်ပါသည်။ စစ်တမ်းရလဒ်များသည် ဖြေဆိုသူအများစုသည် အိမ်ထောင်ပစ္စည်းများ ဖြစ်သော မီးဖိုချောင်၊ အိမ်သာ၊ရေချိုးခန်း၊ တီဗွီ၊ ပရိဘောဂနှင့် လျှပ်စစ်ပစ္စည်းများ စသည်တို့ကို ပိုင်ဆိုင်ပါသည်။ အမှတ်(၁၀) ရပ်ကွက်မှ ဖြေဆိုသူ ၅၁ ရာခိုင်နှုန်းမှာ လျှပ်စစ်ပစ္စည်းများ မပိုင်ဆိုင်သည့်အပြင် ဖြေဆိုသူ ၃၅ ရာခိုင်နှုန်းခန့်တွင် တီဗွီမရှိပါ။ ၄င်းတို့တွင် လျှပ်စစ်ပစ္စည်း ပိုင်ဆိုင်မှုများလေလေ လျှပ်စစ်မီးလိုအပ်မှု မြင့်မားလေဖြစ်ပါသည်။ စီမံကိန်းမှ လျှပ်စစ်မီးရရှိရန် မသေချာသော်လည်း ထိုအကြောင်းအချက်သည် လျှပ်စစ်ဓာတ်အားပေးစက်ရုံတွင် ကောင်းမွန်သော ပုံရိပ်ထင်ဟပ် စေပါသည်။ ဖြေဆိုသူများ အတွက် ရေအရင်းအမြစ်မှာ အဝီစိတွင်း(၅၁ရာခိုင်နှုန်း)နှင့် ကန်နှင့် တွင်းရေ (၃၄ရာခိုင်နှုန်း) ဖြစ်ပါသည်။

သောက်သုံးရေအတွက် ၄၅ရာခိုင်နှုန်းသော ဖြေဆိုသူများမှာ ရေကျိုချက်သောက်၍ ၄၀ရာခိုင်နှုန်းမှာ ရေသန့်သောက်ပါသည်။ လျှပ်စစ်ဓာတ်အားပေးစက်ရုံစီမံကိန်းသည် လက်ရှိအမှိုက်စွန့်ပစ်ခြင်းနှင့် ရေဆိုးစွန့်ပစ်ခြင်း စနစ်အား သက်ရောက်မည်မဟုတ်ပါ။ ဖြေဆိုသူအများစုမှာ စွန့်ပစ်ရေကို မြေပေါ်တွင်နှင့် လစ်လပ်သော မြေနေရာတွင် လွှပ်လပ်စွာ စွန့်ပစ်သော်လည်း ရရာရာခိုင်နှုန်းမှာ အမှိုက်များကို အမှိုက်ပုံတွင် သွားရောက်စွန့်ပစ်ပါ သည်။

ဖြစ်နိုင်ခြေရှိသော ပတ်ဝန်းကျင်သက်ရောက်မှုများ
ဆောက်လုပ်ရေးအဆင့်အတွင်း ပတ်ဝန်းကျင်သက်ရောက်မှုများ
Ecological Impacts ဂေဟဗေဒပတ်ဝန်းကျင်

အဆိုပြု လျှပ်စစ်ဓာတ်အားပေးစက်ရုံမှာ စွန့်ပစ်မြေနေရာတွင် တည်ဆောက်မည်ဖြစ်ပြီ အနီးပတ်ဝန်းကျင် ဧရိယာအား လူနေအိမ် ဧရိယာမှ သိမ်းပိုက်ထားသောကြောင့် ဂေဟဗေဒပတ်ဝန်းကျင်အပေါ်သက်ရောက်မှု ရှိမည်မဟုတ်ပါ။ စီမံကိန်းနေရာပြင်ဆင်နေစဉ်တွင် ချုံပင်အချို့နှင့် သစ်ပင်ငယ်များ အားရှင်းလင်းမည်ဖြစ်သော ကြောင့် ၄င်းတို့၏အကျိုး သက်ရောက်မှုအချို့ဖြစ်ပေါ်မည်ဖြစ်ပါသည်။ ကုန်းနေရေနေသတ္တဝါမျိုးစိတ်အချို့အား စီမံကိန်းနေရာနှင့် ၄င်း၏အနီး တဝိုက်တွင် ရရှိနိုင်သော်လည်း ၄င်းတို့အား လုံးသည် အမျိုးသားအဆင့် မျိုးသုန်း အန္တရာယ်ရှိ မျိုးစိတ်များ မဟုတ်ပေ။ တွားသွားသတ္တဝါမျိုးစိတ်အချို့အား စီမံကိန်းနေရာနှင့် ၄င်း၏အနီးတဝိုက်တွင် ရရှိနိုင်သော်လည်း ၄င်းတို့အားလုံးသည် အမျိုးသားအဆင့် မျိုးသုန်းအန္တရာယ်ရှိ မျိုးစိတ်များ မဟုတ်ပေ။ လေ့လာသည့်နယ်မြေတွင် တွားသွားသတ္တဝါမျိုး စိတ် တစ်မျိုးအား တွေ့ရှိရသော်လည်း စီမံကိန်းနေရာမှ မဟုတ်ပေ။ တွားသွားသတ္တဝါများသည် ထိခိုက်လွယ်၍ ၄င်းကို ဇီဝပတ်ဝန်းကျင်ဆန်းစစ်ခြင်းအတွက် ညွှန်ပြသည့် မျိုးစိတ်အဖြစ်အသုံးပြုပါသည်။

Physico-chemical Impacts
ရုပဓာတုသက်ရောက်မှု
Impact on Water Quality and General Environment ရေအရည်အသွေးနှင့် ယေဘုယျ ပတ်ဝန်းကျင်အပေါ် သက်ရောက်မှု

စီမံကိန်း၏ တည်ဆောက်ရေးအဆင့်အတွင်း ထုတ်လွှတ်သော စွန့်ပစ်အမှိုက်နှင့် စွန့်ပစ်ရေတွင် ဆောက်လုပ်ရေးကာလတွင်း ထွက်ရှိလာသော ပစ္စည်းများနှင့် အမှိုက်များနှင့် အခြားသော စွန့်ပစ်အစိုင်အခဲအချို့ (ဆောက်လုပ်ရေး လုပ်ငန်းများမှ)၊ စီမံကိန်းနေရာတွင် အလုပ်လုပ်သော လူများမှ ထွက်ရှိသော အမှိုက်များ (ဥပမာ-အလုပ်သမားတန်းလျားများမှ) နှင့် ဆောက်လုပ်ရေးလုပ်ငန်းစဉ်မှ ထွက်ရှိသော စွန့်ပစ်အရည်တို့ ပါဝင်ပါသည်။ အဆိုပါ စွန့်ပစ်ပစ္စည်းနှင့် စွန့်ပစ်ရေတို့မှာ သင့်တော်စွာ မစွန့်ပစ်လျှင် ရေနှင့် ယေဘုယျပတ်ဝန်း ကျင်ကို ညစ်ညမ်းမှုများဖြစ်ပေါ်စေပါသည်။

စွန့်ပစ်ရေ

လူများမှ စွန့်ပစ်သော စွန့်ပစ်ရေသည် ယာယီအလုပ်သမားတန်းလျားများမှ ထွက်ရှိမည်ဖြစ်ပါသည်။ ၄င်းသည် သင့်တော်စွာ မစွန့်ပစ်လျှင် (ရေညစ်ညမ်းမှုအပါအဝင်) ညစ်ညမ်းမှု၏ အဓိကအရင်းခံဖြစ်နိုင်ပါသည်။ မသန့်ရှင်းသော အိမ်သာများအသုံးပြုခြင်းနှင့် လူသုံးစွန့်ပစ်ပစ္စည်းများအား သင့်တော်စွာ မစွန့်ပစ်မှုသည် ပတ်ဝန်းကျင်ညစ်ညမ်းမှုကို ဖန်တီးပြီး ကျန်းမာရေးကို ဆိုးရွားစွာ ထိခိုက်နိုင်ပြီး တည်ဆောက်ရေးလုပ်ငန်းခွင်မှ ကျန်းမာသော လူသားများ အား ရောဂါများပြန့်နှံ့ခြင်း၏ ဘေးအန္တရာယ်ကို တိုးမြင့်စေခြင်းဖြင့် ထိခိုက်စေမည် ဖြစ်ပါသည်။

စွန့်ပစ်အစိုင်အခဲ

တည်ဆောက်ရေးအဆင့်အတွင်း စွန့်ပစ်မည့် ဆောက်လုပ်ရေးအမှိုက်များနှင့် အမှိုက်များတွင် သံအပိုင်းအစများ၊ စတီးလ်အပိုင်းအစများ၊ သစ်သားဘောင်များ၊ ပိုက်လုံးများနှင့် အခြားစွန့်ပစ်ပစ္စည်းများပါဝင်မည် ဖြစ်ပါသည်။ အများစုမှာ တည်ဆောက်ရေးအဆင့် အဆုံးတွင်၄င်း၊ အချောသတ်သည့်အလုပ်များဆောင်ရွက်နေစဉ်တွင်၄င်း၊ အမှိုက်များအား လုပ်ငန်းခွင်မှ ရှင်းလင်းနေစဉ်တွင်၄င်း ထွက်ရှိမည်ဖြစ်ပါသည်။ ဆောက်လုပ်ရေးထွက်အမှိုက်များ၏ ပမာဏသည် သိသာထင်ရှားနိုင်ပါသည်။ လုပ်ငန်းပြင်ဆင်နေစဉ်အတွင် အမှိုက်များအား မြေကြီးမှ ရှင်းလင်း ဖယ်ရှားမည်ဖြစ်ပြီး (၂မီတာ သို့ မီတာအထူရှိသော) စွန့်ပစ်အစိုင်အခဲများ ထွက်ရှိလာမည်ဖြစ်ပါသည်။

လေအရည်အသွေး

အဆိုပြု လျှပ်စစ်မောတ်အားပေးစက်ရုံ တည်ဆောက်နေ စဉ်အတွင်းလေအရည်အသွေးသည် အောက်ဖော်ပြပါ လုပ်ငန်း ဆောက်ရွက်မှုများမှ ဆိုးရွားစေမည်/အရည်အသွေးကျဆင်းစေမည် ဖြစ်ပါသည်။

- အဆောက်အအုံများတည်ဆောက်ခြင်း
- လိုအပ်ပါက စီမံကိန်းသွားလမ်းများတည်ဆောက်ခြင်း
- ဆောက်လုပ်ရေးယာဉ်တန်းများမှ စီမံကိန်းသို့အသွားအပြန် ပစ္စည်းများ ပို့ဆောင်ခြင်း
- အပေါ်ယံမြေသား ဖယ်ရှားခြင်းနှင့် မြေသားလုပ်ငန်းများ

သုံးစွဲမည့် သိသာထင်ရှားသော သဘာဝဓာတ်ငွေ့ ပမာဏ နှင့်အတူ ထပ်တိုးပိုက်လိုင်းများ တည်ဆောက်ခြင်းသည် စီမံကိန်းသို့ ဓာတ်ငွေ့သိုက်မှ သဘာဝဓာတ်ငွေ့အားရွေ့လျားစေမည် ဖြစ်ပါသည်။

အဆိုပြုလျှပ်စစ်မောတ်အားပေးစက်ရုံတည်ဆောက်ရေးသည် အရေးကြီးသည့် မြေသားလုပ်ငန်းများ ပါဝင်နိုင်ခြေများသည့်အတွက် လေထဲတွင် လေနှင့်အတူပါလာသည့် ဖုန်မှုန့်များမှ အမှုန်ကလေးများများပြာလာခြင်းသည် အထူးသဖြင့် စီမံကိန်းအနီးတွင်ရှိသော ဘုန်းကြီးကျောင်းအနီးတဝိုက်တွင် (လူနေဧရိယာများအပါအဝင်) စိုးရိမ်မှုတစ်ခုဖြစ်စေပါသည်။

ဆူညံသံအဆင့်

တည်ဆောက်ရေးအဆင့်အတွင်း ဆူညံသံ၏ အဓိကအရင်းအမြစ်မှာ သယ်ယူပို့ဆောင်ရေးယာဉ်များမှ အရင်းခံမည်ဟု မျော်လင့်ထားပါသည်။ စက်ရုံတည်ဆောက်ရေး လုပ်ငန်းများမှ ဆူညံသံလည်းထွက်ရှိနိုင်သည်ဟု မျော်မှန်းထားပါသည်။ တည်ဆောက်ရေးအဆင့်အား အုပ်စုနှစ်ခု ခွဲခြားထားပါသည်။

- အထွေထွေလုပ်ငန်းခွင်နှင့် စက်ရုံတည်ဆောက်ရေး
- ရေနှင့် စွန့်ပစ်ရေ သန့်စင်သည့် စက်ရုံတည်ဆောက်ရေး
- စီမံကိန်းသွားလမ်းတည်ဆောက်ရေး

ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှုလုပ်ငန်းများ

တည်ဆောက်ရေးလုပ်ငန်းများဆောင်ရွက်စဉ်အတွင်း ဆူညံသံအရင်းအမြစ်များတွင် တည်ဆောက်ရေး ဆိုင်ရာ ယာဉ်တန်းများ/ ကားသွားလာမှု နှင့် မြေတူးခြင်း၊ ဘိလပ်မြေဖျော်ခြင်း၊ *backfilling* ၊ ရေတင်စက်အသုံးပြုခြင်း (ရေရယူရန်အတွက် ရေစုပ်တင်ခြင်း) နှင့် *compressors* ကဲ့သို့ တည်ဆောက်ရေးလုပ်ငန်းများ

လူမှုစီးပွားအကျိုးသက်ရောက်မှုများ
တည်ဆောက်ရေးအဆင့်အတွင်း စီမံကိန်းလုပ်ငန်းများ၏ အရေးကြီးသည့် လူမှုစီးပွားသက်ရောက်မှုများ မှာ အောက်ပါ အတိုင်း အကျဉ်းချုပ်ထားပါသည်။

ယာဉ်အသွားအလာနှင့် ပို့ဆောင်ဆက်သွယ်ရေး
တည်ဆောက်ရေးအဆင့်အတွင်း တည်ဆောက်ရေးပစ္စည်းများနှင့် ကိရိယာများအား သယ်ဆောင်လာရန်အတွက် ထပ်တိုးလာသည့် ယာဉ်သွားလာမှုအချို့ ဖြစ်ပေါ်မည်ဖြစ်ပါသည်။ ထိုယာဉ်တန်းများသည် လက်ရှိတည်ရှိသော လမ်းမပေါ်တွင် ကုန်တင်ပစ္စည်းများဖြင့် လေးလံစွာ ဖြတ်သန်းသွားလာမည် ဖြစ်ပါသည်။ စီမံကိန်းလုပ်ငန်းခွင်မှ ဥဒဟို သွားလာမည့် ယာဉ်ဖြတ်သန်းသွားလာမှု သည်တည်ဆောက်ရေးအဆင့်အတွင်း ဆောက်လုပ်ရေး ပစ္စည်း များ၊ ကိရိယာများ၊ စက်ပစ္စည်း များနှင့် ဝန်ထမ်းများအား သယ်ဆောင်သွားလာသည့် ယာဉ်သွားလာမှုတိုးမြှင့်လာ မှုကြောင့် တိုးများ နိုင်ခြေရှိပါသည်။

လူထုကျန်းမာရေး
လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ တည်ဆောက်ရေး လုပ်ငန်းများသည် တိုးမြှင့်လာသော ဆူညံသံနှင့် တုန်ခါမှု နှင့် စီမံကိန်း နေရာအနီးတဝိုက်နှင့် စီမံကိန်းနေရာအတွင်း ဒေသတွင်းလေထု ညစ်ညမ်းမှုတို့ကြောင့် လူထုကျန်းမာ ရေးနှင့် သုခကို သက်ရောက်မှုအချို့ရှိစေနိုင်ပါသည်။ တည်ဆောက်ရေး လုပ်ငန်းများသည် ဖုန်မှုန့်များကို ဖြစ်စေပါသည်။
ဆူညံသံနှင့် တုန်ခါမှုများအား ထပ်တိုးလာသည့် ယာဉ်အသွားအာနှင့် တည်ဆောက်ရေးပစ္စည်းများ လည်ပတ်ခြင်း မှ ထုတ်လွှတ်ပါသည်။ စီမံကိန်းနေရာနှင့် နီးကပ်စွာတည်ရှိနေသော ကျောင်းနှင့် လူနေအဆောက်အအုံများအား ဆူညံသံနှင့် တုန်ခါမှုကဲ့သို့သော အရာများမှ သက်ရောက်စေပါသည်။ တည်ဆောက်ရေး လုပ်ငန်းများနှင့် အလုပ် သမားများမှ ထုတ်လွှတ်လိုက်သော စွန့်ပစ်အစိုင်အခဲများသည် ပတ်ဝန်းကျင်ညစ်ညမ်းမှုကို ဖြစ်စေနိုင်ပြီး သင့်တော်စွာ မစွန့်ပစ်ပါက လူထုကျန်းမာရေးကို ထိခိုက်စေပါသည်။ လူထုကျန်းမာရေးအပေါ် ဖြစ်နိုင်ခြေရှိသော သက်ရောက်မှုမှာ ကြီးမားသည့် အမှိုက်စွန့်ပစ်ရာနေရာအား ပြောင်းရွှေ့လိုက်ပြီး အဆိုပြု ဓာတ်ငွေ့တာဘိုင် စီမံကိန်းအား အစားထိုးလိုက်သည်နှင့်တပြိုင်နက် မနှစ်မြို့ဖွယ်အနံများ ထွက်ရှိလာတော့မည်မဟုတ်ပေ။ တည် ဆောက်ရေးအဆင့်အတွင်း မတော်တဆထိခိုက်မှုသည် အရေးကြီးသော ကိစ္စရပ်တစ်ခုဖြစ်ပါသည်။ စက်ကိရိယာ များအား ပုံမှတ်စစ်ဆေးထိန်းသိမ်းခြင်းနှင့် ကာကွယ်ရေးကိရိယာများ၊ အဝတ်အစားများ အပါအဝင် သင့်တော် သည့်နည်းလမ်းများသည် တည်ဆောက်ရေးအဆင့်အတွင်း မတော်တ ဆထိခိုက်များ၏ ဘေးအန္တရာယ်အား လျော့ချရန် လိုအပ်ပါသည်။

အလုပ်ခန့်အပ်ခြင်း

အလုပ်သမားများနှင့် ကျွမ်းကျင်လုပ်သားအရင်းအမြစ်များ (အင်ဂျင်နီယာများအပါအဝင်)အတွက် အလုပ်အကိုင် အခွင့်အလမ်းများအား အဆိုပြုစီမံကိန်း၏ တည်ဆောက်ရေးအတွက် ဖန်တီးပေးမည်ဖြစ်ပါသည်။ ဓာတ်အားပေး စက်ရုံတပ်ဆင်ခြင်းသည် အလိုအလျောက်တပ်ဆင်သည့်အတွက် ကျွမ်းကျင်ဝန်ထမ်းအနည်းငယ် နှင့် လုပ်သား အနည်းငယ် လိုအပ်ပါသည်။

လည်ပတ်ရေးအဆင့်အတွင်း ပတ်ဝန်းကျင်သက်ရောက်မှုများ

ဂေဟဗေဒဆိုင်ရာ ဂေဟဗေဒဆိုင်ရာ ကန့်သတ်ချက်ဘောင်များအပေါ် (အပင်နှင့် အကောင် နေထိုင်ကျက်စားမှု နှင့် မျိုးစုံမျိုးကွဲ) စီမံကိန်းလုပ်ငန်းများ၏ သက်ရောက်မှုများသည် အများအားဖြင့် သိသာထင်ရှားပါသည်။ ရှုပဓာတုပတ်ဝန်းကျင် ဆိုင်ရာ ကန့်သတ်ချက်မူဘောင်များအပေါ်မူတည်၍ စီမံကိန်းလုပ်ငန်းများ၏သက်ရောက်မှု

အား ဆန်းစစ်ပြီးဖြစ်ပါသည်။ ထိုကန့်သတ်ချက်ဘောင်များတွင် ဆူညံအဆင့်၊ရေအရည်အသွေးနှင့် လေအရည်အသွေးတို့ပါဝင်သည်။ လည်ပတ်သည့် အဆင့်တွင် လူမှုစီးပွားအပေါ် လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ စီမံကိန်း၏ သက်ရောက်မှုသည် အများအားဖြင့် အကျိုးဖြစ်ထွန်း စေသော သက်ရောက်မှုများသာဖြစ်ပါသည်။

တိုးမြှင့်လာသော ဓာတ်အားပံ့ပိုးမှုသည် လူအများခံစားနေရသော လျှပ်စစ် ဓာတ်အားပြတ်တောက်ခြင်းနှင့် အလွန်အမင်း ဓာတ်အားကျဆင်းခြင်းမှ ကင်းဝေးစေသည့်အတွက် စက်မှုလုပ်ငန်းများနှင့် အလုပ်ခန့်အပ်မှုအပေါ် ကောင်းသောအကျိုး သက်ရောက်မှုများ ဖြစ်စေနိုင်ပါသည်။

လည်ပတ်ရေးအဆင့်တွင် ထုတ်လွှတ်လေဆိုင်ရာအကျိုးသက်ရောက်မှု

အဆိုပြု လျှပ်စစ်ဓာတ်အားစက်ရုံသည် (NO) နှင့် (NO2) ပါဝင်သည့် NOx ထုတ်လွှတ်မည်ဖြစ်ပါသည်။ အထက်တွင် ဖော်ပြထားသည့် ပါဝင်မှုများကို ဖော်ပြရာတွင် (NO2) သာလျှင် ကျန်းမာရေးအား ထိခိုက်မှု ဖြစ်ပွားနိုင်ခြေရှိသည်ဟု ပြသထားပါသည်။

နိုက်ထရိုဂျင်အောက်ဆိုဒ် စဝရာခိုင်နှုန်းခန့်သည် NO အဖြစ် ထုတ်လွှတ်မည် ဖြစ်ပါသည်။ ၄င်းတို့ထဲမှ အချို့သည် လေထုထဲတွင် ဓာတ်ပြုမှုများကြောင့် NO2 အဖြစ်ပြောင်းလဲသွားမည်ဖြစ်ပါသည်။ ပြောင်းလဲသွားသည့် အချိုးအစားမှာ ဖုန်မှုန့်များ ဓာတ်သတ္တိလျော့ပါးသည့် လုပ်ဆောင်ချက်၊ နိုက်ထရိုဂျင်အောက်ဆိုဒ် အခြေခံပါဝင်မှုနှင့် မိုးလေဝသတို့ ဖြစ်ပါသည်။

ဇယား ၂။ မီးခိုးခေါင်းတိုင်မှထွက်ရှိမည့် လေထုထုတ်လွှတ်မှုများ

Pollutant	Unit	UREG Stack Emission	IFC Standard	NEQG (Myanmar)
NOx	mg/Nm^3	23	51(25ppm)	100 (Natural gas for all turbine type)
CO	mg/Nm^3	3	not specified	not specified
O2	mg/Nm^3	14.06	not specified	not specified
SO_2	mg/Nm^3	0	not specified	not specified

စောင့်ကြည့်တိုင်းတာသည့်နည်းလမ်းများသည် အဆိုပြု စီမံကိန်းနေရာ၏ ပျှမ်းမျှ ၂၄နာရီ ပါဝင်မှုသည် WHO လမ်းညွှန်ချက်များနှင့် USEPA စံချိန်စံညွှန်းများအတွင်း ကျရောက်နေပါသည်။ ပြောင်းလဲသွားသည့် အချိုးအစားနှင့် NO2 ပါဝင်မှု အခြေခံအဆင့်ရလဒ်အား ခန့်မှန်းရန် ကွန်ပျူတာမော်ဒယ်ကို အသုံးပြုထား ပါသည်။

ဓာတ်ငွေ့တာဘိုင်အတွက် SO2 အမှုန်ကလေးများနှင့် မလောင်ကျွမ်းသော ဟိုက်ဒရိုကာဗွန်များသည် လစ်လျူရှုနိုင်သောပမာဏဖြစ်ပါသည့်အပြင် ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှုမှာ သိသာထင်ရှားမှုနည်းပါးပါသည်။ ပါဝင်မှု အခြေခံအဆင့်အား တည်နေရာအရင်းအမြစ် ၅၀ကီလိုမီတာမှ ၂၀၀မီတာအတွင်းတိုးချဲ့ထားသည့် အကွာအဝေး

automated distance array option ပေါ်မူတည်၍ တွက်ချက်ထားပါသည်။ တည်နေရာများအကြား အကွာအဝေးတိုးသွားသော ၁၀၀မီတာ သည် ၃၀၀၀မီတာပြန့်နှံ့စေမည်ဖြစ်ပြီး ၅၀၀မီတာတိုးပါက ၃၀၀၀မီတာမှ ၁၀ကီလိုမီတာသို့၄င်း၊ ၅ကီလိုမီတာတိုးပါက ၁၀ကီလိုမီတာမှ ၃၀ကီလိုမီတာသို့၄င်းနှင့် ၁၀ကီလိုမီတာတိုးပါက ၅၀ကီလိုမီတာအထိ ပြန့်နှံ့မည်ဖြစ်ပါသည်။

၂၄နာရီထုတ်လွှတ်မှုနှုန်း တွက်ချက်ခြင်းအား ပုံမှန်လည်ပတ်ရေးဝန်များနှင့် အစပြုမှုများ နှစ်ခုလုံး အပေါ်အခြေခံထားပါသည်။ အစပြုခြင်းအားထည့်သွင်းမစဉ်းစားသည့် နည်းပညာအရလက်ခံနိုင်မည် မဟုတ်ပေ။

နမူနာများသည် အနီးအနား ပတ်ဝန်းကျင်တွင် ခေါင်းတိုင်မှ ထွက်လွှတ်သော NO2 နှင့် CO အခြေခံအဆင့်ပါဝင်မှုအား ၂၄နာရီတွက်ချက်ထားပါသည်။ အဆိုပါ ရလဒ်များအား သက်ဆိုင်ရာ လေအရည်အသွေးစံချိန်စံညွှန်းများနှင့် နှိုင်းယှဉ်မည် ဖြစ်ပါသည်။
နမူနာရလဒ်များသည် ခေါင်းတိုင်ထုတ်လွှတ်မှု၏ထွက်ပေါ်လာသော ရလဒ်အရ ခန့်မှန်းNO2 အခြေခံအဆင့်ပါဝင်မှုသည် အဆိုပြု ဓာတ်အားပေးစက်ရုံစီမံကိန်းမှ အချင်း၂၀၀မီတာ အနီးတဝိုက် မှလွဲ၍ လေအရည်အသွေးအတွက် ကိုးကားမည့် စံချိန်စံညွှန်းများနှင့် လမ်းညွှန်ချက်များထက် ကျော်လွန်မည်မဟုတ်ပေ။ နမူနာဆန်းစစ်ခြင်းသည် အဆိုပြုစီမံကိန်းသည် စီမံကိန်းနေရာမှ လေထုညစ်ညမ်းမှုများ၏ ပြန့်နှံ့ခြင်းတွင် သိသာထင်ရှားသည့် တိုးတက်မှုများ ဖြစ်ပေါ်စေမည်ဖြစ်ပါသည်။ ကိုးကားစံချိန်စံညွှန်းများနှင့် လမ်းညွှန်ချက် တန်ဖိုးများအား လူထုကျန်းမာရေးနှင့် ပတ်ဝန်းကျင်ကာကွယ်ရေးတို့အတွက် ပုံဖော်ရေးဆွဲထား ပါသည်။

ထို့ကြောင့် အဆိုပြု စက်ရုံမှ လေထုထုတ်လွှတ်မှုသည် ထိတွေ့လေအရည်အသွေး၊ လူထုကျန်းမာရေးနှင့် အပင်ပေါက် ရောက်မှုနှင့် ဂေဟဗေဒစနစ်အပါအဝင် ပတ်ဝန်းကျင်အပေါ် သိသာထင်ရှားသည့် ထိခိုက်မှုရှိလိမ့်မည် မဟုတ်ပေ။

လည်ပတ်ရေးအဆင့်အတွင်း ဆူညံသံသက်ရောက်မှု
အဆိုပြုစီမံကိန်းသည် လက်ရှိတည်ရှိသော အဆောက်အအုံအနီးတွင် အကောင်အထည်ဖော်ဆောင်မည်ဖြစ်သည့်အတွက် နှင့် လျာထားသည့်ဇရိယာသည် စက်မှုဇုန်နေရာတွင် တည်ရှိသောကြောင့် စက်ရုံနေရာသည် အနီးဆုံးသက်ရောက်ခံများမှ ၂၀၀မီတာအကွာတွင် တည်ဆောက်မည်ဖြစ်ပါသည်။ အဆိုပြုစီမံကိန်းအနီးဝန်းကျင်တွင် အနုတ်သဘောဆောင်သော သက်ရောက်မှုများရှိနိုင်လိမ့်မည်မဟုတ်ဟု ခန့်မှန်းထားပါသည်။

တိုင်းတာသည့်ရလဒ်များအရ ပျမ်းမျှ နောက်ခံဆူညံသံမှာ ၄၅ မှ ၆၀ dBAတွင် ဖြစ်နေသည်ကို တွေ့ရှိရပါသည်။ စီမံကိန်းနှင့် အနီးဆုံး အဆောက်အအုံများတပ်ဆင်မည့်နေရာဖြစ်သော အဆောက်အအုံများနှင့် အနီးဆုံးဖြစ်သော လူနေထိုင်သည့်ဇရိယာသည် ၂၀၀မီတာအကွာအဝေးတွင် ဖြစ်ပါသည်။ အိမ်များသို့ရောက်ရှိနိုင်သော ဆူညံသံအဆင့်များ မှာ ၄၀မှ ၅၀ dBA ဖြစ်ပြီး ထိုတန်ဖိုးသည် IFCမှချမှတ်ထားသည့် မနက်၊ ညနေနှင့် ညအချိန်ကန့်သတ်တန်ဖိုးများ အသီးသီးဖြစ်သော Lday ၇၀ dBAနှင့် Lnight ၇၀ dBA အောက်သို့ကျရောက်နေပါသည်။

မြေပေါ်ရေနှင့် ဇလဘူမိဗေဒ
သဘာဝဓာတ်ငွေ့သုံး လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ လည်ပတ်ရေးသည် အဓိကအားဖြင့် ဓာတ်ငွေ့တာဘိုင်တွင် အအေးခံစနစ်အတွက် ရေရယူသည့်အတွက် မြေပေါ်ရေနှင့် မြေအောက်ရေအပေါ် သက်ရောက်မှုများရှိမည်ဖြစ်ပါသည်။ စက်ရုံဒီဇိုင်းအပေါ်မူတည်၍ အနီးအနားမြစ်သို့ ရေစွန့်ထုတ်မှုသည် ပုံမှတ်ရေစီး၏ စီးဆင်းမှုအား သက်ရောက်စေပါသည်။ တစ်ဖက်တွင် မြေအောက်ရေ ရေတွင်းမှ ရေရယူခြင်းသည် ရေမျက်နှာပြင်အား လျော့ကျစေသည့် သက်ရောက်မှုရှိနိုင်ပါ သည်။ အနီးအနားမြစ်သို့ ရေတိုက်ရိုက်စွန့်ပစ်မှုသည် ရေအရည်အသွေး အပြောင်း

အလဲဖြစ်စေသည့် သက်ရောက်မှုဖြစ်ပေါ်စေပါသည်။ စွန့်ပစ်ရေ၏အပူသည် မြစ်တွင်းနေထိုင်သူများနှင့် မြစ်ရေ အသုံးပြုသူများအား တိုက်ရိုက်အကျိုး သက်ရောက်စေပါသည်။

လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ၏ ၁၂၀မဂ္ဂါဝပ် ရေနွေးငွေ့တာဘိုင်အစိတ်အပိုင်းတစ်လျောက် ဓာတ်ငွေ့တာဘိုင် အစိတ်အပိုင်းသည် ပတ်ဝန်းကျင်တွင် စွန့်ပစ်ရန်လိုအပ်သော အပူစွန့်ထုတ်အရည်ကို ထုတ်လုပ်မည်မဟုတ်ပေ။ ထိုသို့ဖြစ်ရသည်မှာ စွန့်ပစ်အပူကို ရေမျက်နှာပြင်ထဲတွင်ထက် ထိတွေ့လေထဲတွင် တဖြည်းဖြည်းပျောက်ကွယ်သွားမည့် အအေးခံတာဝါများနှင့် အကန့်များစွာပါဝင်သော စက်မှုစွမ်းအင်သုံး လေမှုတ်အအေးခံတာဝါသုံး အလုံပိတ်အအေးခံစနစ် ကြောင့်ဖြစ်ပါသည်။ စနစ်မှ ဆက်တိုက်မဟုတ်သော ရေဆုံးရှုံးမှုအား ရေရယူခြင်းမှ ထောက်ပံ့ပေးမည်ဖြစ်ပါသည်။ မတော်တဆ သို့မဟုတ် လည်ပတ်ရေးဆိုင်ရာ ထိန်းသိမ်းမှုကြောင့် ယာယီရပ်ဆိုင်းခြင်း မရှိလျှင် စနစ်မှ မြစ်အတွင်းသို့ ရေစွန့်ပစ်ခြင်း ရှိလိမ့်မည်မဟုတ်ပေ။

လူမှုစီးပွား အကျိုးသက်ရောက်မှုများ

စီမံကိန်း လည်ပတ်ဆောင်ရွက်နေစဉ်အတွင်း လူမှုစီးပွားရေးဆိုင်ရာ ပတ်ဝန်းကျင်သက်ရောက်မှုများ အနေဖြင့် သိသာထင်ရှားသည့် မည်သည့်ထိခိုက်မှုမျှ ရှိမနေပါ။ လျှပ်စစ်ဓာတ်အား ထောက်ပံ့မှု တိုးတက်လာသည်နှင့် အမျှ ကောင်းကျိုးသက်ရောက်မှုများသာ သိသိသာသာ ဖြစ်ပေါ်လာနိုင်ပါသည်။ ယင်းမှ လျှပ်စစ်ဓာတ်အားများကို မဟာဓာတ်အားလိုင်းသို့ ထည့်သွင်းပြီး ရန်ကုန်မြို့တွင် ဖြန့်ဖြူးသွားမည် ဖြစ်ပါသည်။ အထူးသဖြင့် သကေတ မြို့နယ်အတွင်း နေထိုင်သူများသည် လျှပ်စစ်မီး ပြတ်သည့်အချိန်များတွင် လျှပ်စစ်မီးရရှိမှု သိသိသာသာ တိုးတက် လာပါလိမ့်မည်။

စီမံကိန်းအပေါ် ပြည်သူ့အမြင်သဘောထား

ပြည်သူ့သဘောထားကို ဆိုရလျှင် အချို့မေးခွန်းများကို ကြိုတင်ပြင်ဆင်၍ စီမံကိန်းဧရိယာအတွင်းရှိ နေထိုင်သူ များအား မေးမြန်းခဲ့ပါသည်။ ဖြေကြားသူ လူဦးရေ ၆၆ ရာခိုင်နှုန်းခန့်သည် သဘာဝဓာတ်ငွေ့ လျှပ်စစ်ဓာတ်အား ပေးစက်ရုံကို သတိထားမိခဲ့ကြပြီး ယင်းတို့မှ အဖြေ ၈၀ ရာခိုင်နှုန်းတွင် စက်ရုံကြောင့် ရှိနေပြီးသော သဘာဝ ပတ်ဝန်းကျင် အခြေအနေ တစ်စုံတရာ ပြောင်းလဲမှု မရှိပါဟု ဖြေကြားထားပါသည်။

စီမံကိန်း၏ တိုးတက်လာမှုအပေါ်တွင်ရှိသော ၄င်းတို့၏ သုံးသပ်ချက်များမှာ အထွေအထွေတိုးတက်မှု၊ အလုပ် အကိုင်အခွင့်အလမ်း၊ ပိုမိုကောင်းမွန်သော သဘာဝဝန်းကျင်၊ လျှပ်စစ်ဓာအားထောက်ပံ့မှုများ ရရှိလာခြင်း စသည်တို့နှင့် ဆက်စပ်နေပါသည်။ (၉) ရပ်ကွက် ၊ (၁၀) ရပ်ကွက် (မြောက်ပိုင်း) မှ ဖြေဆိုသူ ၃၀ ရာခိုင်နှုန်းကျော် သည် စက်ရုံစီမံကိန်းမှ လျှပ်စစ်ဓာတ်အား ထောက်ပံ့မှု ပိုမိုရရှိနိုင်ကြောင်း သုံးသပ်ခဲ့ပါသည်။

ဖြေဆိုသူများသည် သဘာဝဓာတ်ငွေ့သုံး လျှပ်စစ်ဓာတ်အားပေး စက်ရုံမှ ဆူညံသံများ၊ အနံ့အသက်များနှင့် မီးဘေး ပြဿနာများ ရှိလာနိုင်ကြောင်း ပြောကြားခဲ့ပါသည်။ ယင်းတွင် စက်ရုံမှ ဆိုးရွားသည့်အသံအပေါ် စိုးရိမ်ထိတ်လန့် ခြင်း၊ စက်ပစ္စည်းများမှ ကျယ်လောင်သော ဆူညံသံများကြောင့် စိတ်ညစ်ညူးခြင်း၊ မတော်တဆ မီးဘေးအန္တရာယ်များဖြစ်ပေါ်လာမှာ စိုးရိမ်ခြင်း၊ ဓာတ်ငွေ့ပိုက်လိုင်းမှ ယိုစိမ့်မှုများကြောင့် အနံ့အသက်ဆိုးများ ထွက်ပေါ်လာခြင်း စသည်တို့ ပါဝင်ပါသည်။

စီမံကိန်းအပေါ် ချခံ □ငံသုံးသပ်ချက်

ယေဘုယျအားဖြင့်ဆိုရလျှင် စီမံကိန်းနေရာရှိ ဖြေဆိုသူ (၉၆) ရာခိုင်နှုန်းသည် စီမံကိန်းအပေါ် လှိုက်လှိုက်လဲ့လဲ့ ကျေနပ်ခဲ့ပြီး (၄) ရာခိုင်နှုန်းခန့်သာ သဘောမကျ ရှိခဲ့သည်။ စီးပွားရေး ရှုထောင့်မှ ကြည့်လျှင် ဖြေဆိုသူ ၉၈ ရာခိုင်နှုန်းသည် စီမံကိန်းအပေါ် လှိုက်လှိုက်လဲ့လဲ့ ကျေနပ်ခဲ့ပြီး ၂ ရာခိုင်နှုန်းခန့်သာ သဘောမကျ ရှိခဲ့သည်။

စီမံကိန်းနေရာအတွင်း ကွင်းဆင်းလေ့လာခဲ့ရာမှ ပါဝင်ဖြေဆိုခဲ့သူများမှာ စီမံကိန်းနှင့် ဆက်စပ်နေသော လူမှုရေးရာ သာရေးနာရေးကိစ္စရပ်များ၊ ပတ်ဝန်းကျင်၊ လူမှုရေးရာအခြေအနေ၊ လူမှုစီးပွား အခြေအနေများဒ၊ ကျန်းမာရေးနှင့် ပညာရေးတို့အပေါ်၌ ကျေနပ်လက်ခံခဲ့ပါသည်။ သို့သော်လည်း ဖြေဆိုသူ ၂ ရာခိုင်နှုန်းခန့်သည် လူမှုစီးပွားဆိုင်ရာ သာဘာဝဝန်းကျင်နှင့် ပတ်သက်၍ စီမံကိန်းအပေါ်၌ ကြားနေအမြင်ရှိနေသည်။

ဖြေဆိုသူအများစုသည် ၎င်းတို့၏ ဒေသတွင်ရှိသော စီမံကိန်းအပေါ် သုံးသပ်ချက်များကို ကျေကျေနပ်နပ်ရှိ ခဲ့ပြီး (၉) ရပ်ကွက်၊ (၁၀) ရပ်ကွက် (မြောက်ပိုင်း) ရှိ ဖြေဆိုသူအများစုသည် စီမံကိန်းနှင့် ပတ်သက်၍ အပြည့်အဝ ကျေနပ်ခဲ့ကြပါသည်။

ထောက်ခံချက်

ကွင်းဆင်းလေ့လာချက်များပေါ်မူတည်၍ အောက်ပါအကြောင်းအရာများကို ထောက်ခံပေးထားပါသည်။

၁။ နောက်ဆုံးပေါ် နည်းပညာသုံး စက်ဖြင့် လည်ပတ်ရန်

၂။ စက်ရုံမှ အနှောက်အယှက်ဖြစ်စေသည့် ဆိုးရွားသော အသံများကို လျော့ချရန်

၃။ စက်ကိရိယာများ လည်ပတ်ခြင်းမှ ထွက်ပေါ်လာသော ကျယ်လောင်သည့် ဆူညံသံများကို ပယ်ချရန်

၄။ မီးဘေးအန္တရာယ်များကို ကာကွယ်တားဆီးရန်

၅။ သဘာဝ ဓာတ်ငွေ့ ပိုက်လိုင်းများအား မလိုအပ်သည့် စိမ့်ထွက်ခြင်း ယိုစီးခြင်းတို့မရှိစေရန် ထိန်းသိမ်းပြုပြင်သွားရန်

ယခုကဲ့သို့ ကြိုတင်ကာကွယ်မှုများအရ အထွေထွေ လူမှုအဖွဲ့အစည်းဆိုင်ရာ တာဝန်ယူမှု (CSR) အစီအစဉ် တစ်ရပ် ရေးဆွဲပြဋ္ဌာန်းလိုင်ကြောင်း အခန်း (၇) တွင် ဖော်ပြထားပါသည်။ စက်ရုံမှ ဖြစ်ပေါ်နိုင်သော သက်ရောက်မှု များအပေါ် လူထုတွေ့ဆုံဆွေးနွေးခြင်းများအတွက် CSR ရုံး ဖွင့်လှစ်ရန် လိုအပ်ပါသည်။ CSR ရုံးမှ စီမံကိန်း နေရာအတွင်း လူမှုရေး နှင့် ကျန်းမာရေး ကိစ္စရပ်များကို ဆောင်ရွက်သွားမည်ဖြစ်သည်။ ရုံးမှ လူထုနှင့် တွေ့ဆုံ ဆွေးနွေးမှုများပြုလုပ်သင့်သည့်အပြင် စက်ရုံနှင့် စက်ရုံလုပ်ငန်းများဖြင့် ဆက်စပ်နေသော ပြဿနာရပ်များ ကို ဖြေရှင်းရန် ကြိုးစားသင့်ပါသည်။

ထိခိုက်မှုလျော့ချရေး နည်းလမ်းများနှင့် ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှု အစီအစဉ်

အဆိုပါ လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ စီမံကိန်းအတွက် ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှု အစီအစဉ်နှင့် စောင့်ကြပ်ကြည့်ရှုရေးလုပ်ငန်းရပ်များကို စီမံခန့်ခွဲရေးနှင့် စောင့်ကြပ်ကြည့်ရှုရေး ဟူ၍ခွဲခြားနိုင်ပါသည်။ (က) တည်ဆောက်ရေးလုပ်ငန်းများ ဆောင်ရွက်နေစဉ် (ခ) စက်ရုံ လည်ပတ်နေစဉ်။ စီမံကိန်း အကောင်အထည်ဖော် ဆောင်ရွက်ခြင်းနှင့် ပြီးမြောက်အောင် ဆောင်ရွက်ခြင်းတို့၏ ပေါင်းစပ် ကဏ္ဍတစ်ရပ် အနေဖြင့် ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှု အစီအစဉ်ကို ဆောင်ရွက်သွားသင့်ပါ သည်။ ထိုရည်ရွယ်ချက်ကြောင့် ဆိုရလျှင် ဤစီမံကိန်းအတွက် ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှု နှင့် စောင့်ကြည့်ရှုရေး၏ တာဝန်ယူမှု အားလုံးကို UREC မှ တာဝန်ရှိပုဂ္ဂိုလ်မှ တာဝန်ယူဆောင်ရွက်သင့်ပါသည်ဟု ထောက်ခံပြောကြားထား ပါသည်။ ယင်းပုဂ္ဂိုလ်သည် သင့်တော်သော ပတ်ဝန်းကျင် စောင့်ကြပ်ကြည့်ရှုရေးများကို တိတိကျကျ စောင့်ကြည့်သွားရန် လိုအပ်သော လူဦးရေဖြင့် ကျွမ်းကျင်မှု အပြည့်ရှိသည့် အဖွဲ့တစ်ခုဖွဲ့စည်းသွားမည် ဖြစ်သည်။

ဆောက်လုပ်ရေးလုပ်ငန်း လုပ်ဆောင်နေစဉ်အတွင်း ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှု ကို (က) မိလ္လာ အညစ်အကြေး၊ အစိုင်အခဲ စွန့်ပစ်ပစ္စည်း နှင့် ဆောက်လုပ်ရေးလုပ်ငန်းမှ စွန့်ပစ်ပစ္စည်းများ ထွက်ပေါ်လာခြင်းနှင့် စွန့်ပစ်ခြင်း (ခ) ယဉ်အသွားအလာ ပိုများလာခြင်း (ဂ) အမှုန်အမွှားများ ထွက်ပေါ်လာခြင်း (ဃ) ဆူညံသံများ ထွက်ပေါ်ခြင်း (င) ဆိုးရွားလာသော ရေအရည်အသွေး စသည်တို့မှ ဖြစ်ပေါ်လာသော ဖြစ်တတ်သည့် ဆိုးကျိုးသက်ရောက်မှုများကို ရည်ရွယ်၍ အဓိကထား ဆောင်ရွက်သွားသင့်ပါသည်။ ဆောက်လုပ်ရေး အလုပ်များအတွက် ဒေသနေများအား

အလုပ်အပ်နှံခြင်းမှ ရရှိလာမည်ဖြစ်သော အကျိုးရှိသည့် သက်ရောက်မှုများအပေါ် ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှုသည် အလေးထား ဆောင်ရွက်သင့်ပါသည်။ ဇယား (၁) ၌ ဆောက်လုပ်ရေးအဆင့်တွင် ဖြစ်နိုင်သည့် သိသာထင်ရှားသော ပတ်ဝန်းကျင်ဆိုင် ရာ သက်ရောက်မှုများ၊ ဖယ်ရှားရမည့် နည်းလမ်းများ (သို့) ဆိုးကျိုးသက်ရောက်များကို ပြန်လည် အစားထိုး ကုစားပေးမည့် နည်းလမ်းများ နှင့် ကောင်းကျိုးသက်ရောက်မှုများကို တိုးမြှင့်ခြင်းများအား အကျဉ်းချုပ် ဖော်ပြထားပါသည်။

ဇယား (၃) ဆောက်လုပ်ရေး အဆင့်တွင် ဖြစ်နိုင်သော သိသာထင်ရှားသည့် ပတ်ဝန်းကျင်ဆိုင်ရာ သက်ရောက်မှု နှင့် လျော့ချသည့် နည်းလမ်းများ

ဆောင်ရွက်ချက်/ အကြောင်းအရာများ	ဖြစ်နိုင်ခြေရှိသည့် သိသာထင်ရှားသည့် သက်ရောက်မှုများ	အဆိုပြုထားသည့် လျော့ချရေး နည်းလမ်းများ	တာဝန်ရှိသော အဖွဲ့အစည်းများ
အလုပ်သမားများ ဝင်ရောက်လာခြင်း	• မိလ္လာ အညစ်အကြေးများနှင့် အစိုင်အခဲ စွန့်ပစ်ပစ္စည်းများ ထွက်ပေါ်လာခြင်း • အလုပ်သမားများ မှတဆင့် ရောဂါပြန့်ပွား လာနိုင်ခြင်း	• သန့်ရှင်းသော အိမ်သာ နှင့် မိလ္လာကန် စနစ် တည်ဆောက်ခြင်း (အိမ်သာတစ်ခုလျှင် လူဦးရေ ၅စ်ဆယ်ကျ) • အမှိုက်မပစ်ရ သင်္ကေတ ဆိုင်းဘုတ်များ စိုက်ထူခြင်း၊ သင့်တော်သည့် နေရာများတွင် အမှိုက်ပုံးများ ထားရှိခြင်း • စွန့်ပစ်ပစ္စည်းများ အနည်းဆုံးထိ လျော့ချခြင်း၊ ပြန်လည်အသုံးပြုမည့် အရာများ ပြုလုပ်ခြင်း၊ ပြန်လည်သုံးခြင်း • သင့်လျော်သောအစိုင်အခဲစွန့်ပစ်စံနစ်များ • အလုပ်သမားများအား ပုံမှန် ကျန်းမာရေး စောင့်ကြပ်ကြည့်ရှု ခြင်း	ကန်ထရိုက်တာ (ပတ်ဝန်းကျင် ကျန်းမာရေးနှင့် ဘေး အန္တရာယ် ကင်းရှင်းရေး ကဏ္ဍ (သို့) တတိယ အဖွဲ့အစည်း မှ စောင့်ကြပ်ကြည့်ရှုခြင်း)
စက်ကိရိယာများနှင့် လိုအပ်သော ပစ္စည်းများ သယ်ယူပို့ဆောင်ရေးနှင့် သုံးမည့် ပစ္စည်းများအား သိုလှောင်ခြင်း	• ယာဉ်အသွားအလာ (သို့) ရေကြောင်းသွားလားခြင်းများ ပိုများလာခြင်း • ဆူညံသံများထွက်ပေါ်ခြင်း၊ အထူးသဖြင့် အနီးတဝိုက်ရှိ စာသင်ကျောင်းများနှင့် လူနေအိမ်များကို သက်ရောက်မှု ရှိနေခြင်း • ယာဉ်အသွားအလာများလာခြင်း ကြောင့် လေထုအရည်အသွေး ကျဆင်းလာခြင်း ။	• ပစ္စည်းများ ဖြန့်ဝေခြင်းကို ကျောင်းချိန်မ ဟုတ်သည့် အချိန်များနှင့် ပုံမှန် အလုပ်ချိန်များ ပြီးသည့်အချိန်မှ သာ • ဆောက်လုပ်ရေး လုပ်ငန်းများ ဆောင်ရွက် နေစဉ်အတွင်း ကျောင်းသွားသည့် ကလေး များ ယဉ်ပါတ်ဆို့မှုများမှ ကာကွယ်ရန် သင့် တော်သော ယဉ်လမ်းညွှန်များ၊ သတိပေး ဆိုင်းဘုတ်များ စိုက်ထူခြင်း၊ • ကျောင်းနေရာတစ်ဝိုက်အတွင်း အရှိန်ကို တစ်နာရီလျှင် ၁၀ ကီလိုမီတာထိ လျှော့ချခြင်း • အမျိုးသားရေး စံချိန်စံညွှန်းများ ကိုလိုက်နာ ကျင့်သုံး၍ စက်များကို ပုံမှန် စစ်ဆေး၍ ကောင်းမွန်အောင် ကရုတစိုက် ထိန်းသိမ်းရမည် • ကတ္တရာလမ်း မဟုတ်သော၊ ဖုန်ထူသော လမ်းများကို တစ်နေ့လျှင် နှစ်ကြိမ် ရေဖြန်းခြင်း • ရေပက်ဖြန်းပေးခြင်း ၊ ပြန့်ကျဲနေသော အရာဝတ္ထုများအား ဖုံးအုပ်ထားခြင်း	ကန်ထရိုက်တာ (ပတ်ဝန်းကျဆိုင်ရာ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး ကဏ္ဍ (သို့) တတိယ အဖွဲ့အစည်း မှ စောင့်ကြပ်ကြည့်ရှုခြင်း

	အနီးတစ်ဝိုက်ရှိ လူများအပေါ် သက်ရောက် နေခြင်း • ပစ္စည်းများ သိုလှောင်ထားရာ နေရာမှ လေနှင့်အတူ ဖုန်မှုန့်များ ထွက်ပေါ်ခြင်း	• စီမံကိန်းနေရာသို့ ပစ္စည်းများ သယ်လာသော ကားကြီးများနှင့် စီမံကိန်းနေရာမှ ဆောက်လုပ်ရေး လုပ်ငန်းသုံး ပစ္စည်းများ သယ်လာသော ကားကြီးတို့အပေါ်တွင် ဖုံးအုပ်၍ သွားလာရန်	
ဆောက်လုပ်ရေး လုပ်ငန်းသုံး ပစ္စည်းများ လည်ပတ်ခြင်း အပါအဝင် ဆောက်လုပ်ရေး လုပ်ငန်းစဉ်များ	• အထူးသဖြင့် အနီးအနားရှိ ကျောင်း များနှင့် နေထိုင်ရာ နေရာများကို သက်ရောက် နေသော ဆောက်လုပ်ရေး လုပ်ငန်းမှ ဆူညံသံများ ထွက်ပေါ်ခြင်း • ကျောက်ခဲစက်များကဲ့သို့ စက်ကိရိယာများ အသုံးပြုခြင်း၊ လေနှင့် အတူ ဖုန်မှုန့်များ ထွက်ပေါ်ခြင်းမှ လေထုအရည်အသွေး ကျဆင်းလာခြင်း • မတော်တဆ ထိခိုက်မှုများ	• စက်ကိရိယာ အကြီးစားများ လည်ပတ်ရာ တွင် အသံထိန်းချုပ်ကိရိယာများ နှင့် • ကျောင်းချိန်အတွင်း နှင့် ညအချိန်များတွင် ဆောက်လုပ်ရေး လုပ်ငန်းများမှ ဆူညံသံ ထွက်ပေါ်လာခြင်းကို တတ်နိုင်သမျှ ရှောင်ရှားသွားရန် • အလုပ်သမားများကြောင့် လုပ်ငန်းသုံးပစ္စည်း များမှ ဆူညံသံများတာ ရှည်စွာ ထွက်ပေါ်လာခြင်းကို ရှောင်ရှားရန် • ကျောင်းနေ ကလေးငယ်များ ကျန်းမာရေး အန္တရာယ်မှ ကာကွယ်ရန်၊ သက်ကြီးရွယ်အို များကို အနှောက်အယှက် ဖြစ်စေသည့် အတားအဆီးများအား လျှော့ချရန် ကျောင်း၊ နေထိုင်ရာ နေရာများနှင့် ဆောက်လုပ်ရေး နေရာများ အတွင်း ကာကွယ်ရေးဇုန်တစ်ခု ရေးဆွဲရန် • အမှုန်များ သိသိသာသာ ထွက်ပေါ် တတ်သော ကျောက်ခဲစက်ကဲ့သို့ စက်ကိရိ ယာများ အသုံးမပြုရ • ဆောက်လုပ်ရေး လုပ်ငန်းသုံး ပစ္စည်းများနှင့် စက်များအား စက်ရုံလည်ပတ်ချိန်တွင် ကောင်းကောင်း ထိန်းသိမ်းဆောင်ရွက်ရန် • ထုတ်လွှတ်မှုကို အမြင့်ဆုံး ထိန်းချုပ်နိုင်သည့် စက်ကိရိယာများကိုသာ သုံးစွဲရန် • ဆောက်လုပ်ရေး လုပ်ငန်းမှ အဖိတ်အစင်များ ကို အစားသွင်း ပစ္စည်းများအဖြစ် ချက်ချင်း အသုံးပြုရန်	ကန်ထရိုက်တာ (ပတ်ဝန်းကျင်ဆိုင်ရာ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး ကဏ္ဍ (သို့) တတိယ အဖွဲ့အစည်း မှ စောင့်ကြပ်ကြည့်ရှုခြင်း

	• မြေဆီလွှာနှင့် ရေထုကို ညစ်ညမ်းစေသော အဖိတ်အစင်နှင့် ယိုစိမ့်မှုများ • အလုပ်ခန့်အပ်ခြင်း/ အလုပ်သမား အင်အား	• တူးဖော်ရရှိထားသော အရာများကို ချက်ချင်း စွန့်ပစ်ရန် (သို့) ရောင်းချရန် • စက်ကိရိယာများကို ပုံမှန်စစ်ဆေးခြင်းနှင့် ပြင်ဆင်ခြင်းများ ပြုလုပ်သွားရန် • ပတ်ဝန်းကျင်ဆိုင်ရာ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး သတင်းအချက်အလက်များ • ကာကွယ်ရေးသုံး ကိရိယာများအား ကြိုတင်စီမံထားခြင်း • ကောင်းမွန်စွာ စနစ်တကျ ထိန်းသိမ်း ဆောင်ရွက်ခြင်း • စက်ချောဆီနှင့် လောင်စာများအား ကောင်းမွန်စွာ ကိုင်တွယ် အသုံးပြုခြင်း • အဖိတ်အစင်များ စုဆောင်းခြင်း၊သင့်တော် သည့် သန့်စင်မှုများ ပြုလုပ်ခြင်း နှင့် စွန့်ပစ်ခြင်း • ဒေသနေ ပြည်သူများအား ဖြစ်နိုင်သမျှ အများဆုံး အလုပ်ခန့်အပ်ပေးရန်	

စီမံကိန်း လုပ်ငန်းများ လည်ပတ်နေစဉ်အတွင်း ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှုသည် အဓိကအားဖြင့် အောက်ပါ အကြောင်းအရာများကို အလေးထားသင့်ပါသည်။

(က) စက်ရုံမှ ထုတ်လွှတ်မှုများ

(ခ) ဆူညံသံများ ဖြစ်ပေါ်ခြင်း

(ဂ) စက်ရုံမှ စွန့်ပစ်ပစ္စည်းများ ထွက်ရှိခြင်း

ဇယား (၂) တွင် စီမံကိန်းလည်ပတ်နေစဉ် ဖြစ်ပေါ်နိုင်သော သိသာထင်ရှားသည့် ပတ်ဝန်းကျင်ဆိုင်ရာ သက်ရောက်မှုများ၊ ဆိုးကျိုးသက်ရောက်မှုများကို လျှော့ချရန် (သို့) ပြန်လည်ကုစားရန် လိုအပ်သည့် နည်းလမ်းများနှင့် တိုးတက်လာသော ကောင်းကျိုးသက်ရောက်မှုများ ကို အကျဉ်းချုပ်ဖော်ပြထားပါသည်။

ဇယား (၄) စီမံကိန်းလည်ပတ်နေစဉ် ဖြစ်ပေါ်နိုင်သော သိသာထင်ရှားသည့် ပတ်ဝန်းကျင်ဆိုင်ရာ သက်ရောက်မှုနှင့် လျော့ချရေး နည်းလမ်းများ

ဆောင်ရွက်ချက်/ အကြောင်းအရာများ	ဖြစ်နိုင်ခြေရှိသည့် သိသာထင်ရှားသည့် သက်ရောက်မှုများ	အဆိုပြုထားသည့် လျော့ချရေး နည်းလမ်းများ	တာဝန်ရှိသော အဖွဲ့အစည်းများ
လျှပ်စစ်ဓာတ်အား ထုတ်လွှတ်ခြင်း	• လျှပ်စစ်ဓာတ်အားပေး စက်ရုံမှ ထုတ်လွှတ်မှု	• စာရွက်စာတန်းများတွင် ထည့်သွင်း ဖော်ပြ ထားသည့် မီးခိုးခေါင်းတိုင်ကိုသာ အသုံးပြုခြင်း • စာရွက်စာတန်းများတွင် ထည့်သွင်း ဖော်ပြ ထားသည့်အတိုင်းန်ြုက်ထရိုဂျင် ဓတ်ငွေ့အနည်း ဆုံးထွက်သည့် မီးဖိုကိုသာ အသုံးပြုရန် • အဓိက ညစ်ညမ်းစေသည့်အရာများအတွက် ထုတ်လွှတ်မှုကို စောင့်ကြပ်ကြည့်ရှုနိုင်သော ခေါင်းတိုင်များ တပ်ဆင်ခြင်း၊ လေထုစောင့်ကြည့် ရေး စခန်းလည်း တည်ဆောက်သွားမည်။ • ခေါင်းတိုင် ဒီဇိုင်းကိုလည်း သင့်တော်သည့် အကာအကွယ်များ ထည့်သွင်းရေးဆွဲရန် စဉ်းစားသင့် သည်။ • စီမံကိန်းနေရာ အနီးတစ်ဝိုက်တွင် သစ်ပင်များ စိုက်ပျိုးခြင်း၊ အထူးသဖြင့် ကျောင်းခြံဝန်းတစ် လျှောက် နှင့် စီမံကိန်းနေရာနှင့် နီးကပ်စွာ တည်ရှိနေသည့် အခြေချ နေထိုင်ရာနေရာများ	ကန်ထရိုက်တာ (ပတ်ဝန်းကျင်ဆိုင်ရာ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး ကဏ္ဍ (သို့) တတိယ အဖွဲ့အစည်း မှ စောင့်ကြပ်ကြည့်ရှုခြင်း
	• ဆူညံသံ ထွက်ပေါ်ခြင်း	• သိသာထင်ရှားသည့် အမှုန်အမွှားများ ထွက်ရှိ သည့် စက်မှုဇုန်များ တည်ဆောက်ရာတွင် ကန်သန့်ချက်များ သတ်မှတ်ထား သင့်ပါသည်။ • စက်များနှင့် တာဘိုင်များအတွက် အသံထိန်း ကိရိယာများ ကြိုတင်စီမံခြင်း • စီမံကိန်းနေရာတစ်ဝိုက် သစ်ပင်များ စိုက်ပျိုးခြင်း • စက်ရုံအား ပုံမှန်ထိန်းသိမ်းပြုပြင်ခြင်းများ ပြုလုပ် ခြင်း • ပုံမှန် ဆူညံသံ စောင့်ကြပ်ကြည့်ရှုများ ပြုလုပ်ခြင်း၊ အထူးသဖြင့် ကျောင်းနှင့် လူနေထိုင် ရာ နေရာများ • စက်ရုံ၏ စက်ပစ္စည်းများနှင့် တာဘိုင်ကိစ္စရပ်များ ဆောင်ရွက်ရာတွင်	ကန်ထရိုက်တာ (ပတ်ဝန်းကျင်ဆိုင်ရာ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး ကဏ္ဍ

စွန့်ပစ်ပစ္စည်းများ ထွက်ရှိခြင်း	• မိလ္လာရေများစနစ်တကျ မစွန့်ပစ် မှုကြောင့် ပတ်ဝန်းကျင် ညစ်ညမ်း မှုကို ဖြစ်စေခြင်း • သန့်စင်သည့် ကန်ထဲမှ အနည် အနှစ်များ အပါအဝင် အစိုင်အခဲ စွန့်ပစ်ပစ္စည်းများ ထွက်ရှိခြင်း • ဖြစ်တတ်သည့် ရေထု ညစ်ညမ်းမှုများ	အသံထိန်းသည့်နားကြပ်များ နားကာများ အသုံးပြုခြင်း • ကောင်းမွန်စွာ စနစ်တကျ ထိန်းသိမ်းစောင့် ရှောက်ခြင်း • စက်ရုံနေရာအတွင်းရေဆိုးစွန့်ပစ်သည့်စနစ်အား လိုအပ်သလို အကောင်အထည်ဖော်ဆောင်ခြင်း နှင့် ပြုပြင်ထိန်းသိမ်းခြင်းများ ပြုလုပ်ခြင်း • အစိုင်အခဲ စွန့်ပစ်ပစ္စည်းများကို သင့်တော်သည့် သိုလှောင်ခြင်း၊ သန့်စင်ခြင်းနှင့် စွန့်ပစ်ခြင်းများကို သေသေချာချာ ဆောင်ရွက်စေခြင်း •သန့်စင်စက်ရုံမှ ထွက်ရှိသော စွန့်ပစ်ရည် အရည်အသွေးကို စောင့်ကြပ်ကြည့်ရှုသွားရန် (စောင့်ကြပ်ကြည့်ရှုရေး လိုအပ်ချက်များနှင့် ခန့်မှန်းခြေ ကုန်ကျစရိတ်ကို အပါအဝင်) • မြစ်ရေ အရည်အသွေး စောင့်ကြပ်ကြည့်ရှုခြင်း (စောင့်ကြပ်ကြည့်ရှုရေး လိုအပ်ချက်များနှင့် ခန့်မှန်းခြေ ကုန်ကျစရိတ်ကို အပါအဝင်)	(သို့) တတိယ အဖွဲ့အစည်း မှ စောင့်ကြပ်ကြည့်ရှုခြင်း

ဇယား (၅) နှင့် (၆) တွင် အဆိုပါ စီမံကိန်း၏ တည်ဆောက်ရေးနှင့် လည်ပတ်ရေး အဆင့်များတွင် စောင့်ကြပ်ကြည့်ရှုရေး အစီအစဉ် အကျဉ်းချုပ်ကို ဖော်ပြပေးထားပါသည်။

ဇယား (၅) စီမံကိန်း အကောင်အထည် ဖော်ဆောင်နေစဉ် စောင့်ကြပ်ကြည့်ရှုရေး အစီအစဉ်

အကြောင်းအရာ	**သတ်မှတ်ချက်များ**	**စောင့်ကြပ်ကြည့်ရှုမည့် အကြိမ်**
ဆူညံသံအဆင့်	တည်နေရာအမျိုးမျိုးတွင်ရှိသော ဆူညံသံ	အပတ်စဉ်၊ စက်ပစ္စည်း အကြီးစားများ လည်ပတ်နေစဉ်အတွင်း
စွန့်ပစ်ပစ္စည်း အခြေအနေ	အစိုင်အခဲ စွန့်ပစ်ပစ္စည်း	အပတ်စဉ်
ကျန်းမာရေး	ကျောင်းနေ ကလေးများ၏ ပညာရေး အခြေအနေ	စီမံကိန်းနေရာတွင် UREC မှ ဖွင့်လှစ်ထားသော ဆေးခန်းဌာန သုံးပတ် တစ်ကြိမ်

ဇယား (၆) စီမံကိန်း လည်ပတ်နေစဉ် စောင့်ကြပ်ကြည့်ရှုရေး အစီအစဉ်

Issue	**Potential impacts**	**Parameters to be monitored**	**Location**	**Measurement and Method**	**Frequency**	**Responsibility**	**Cost**
General	Inspection of mitigation compliance	General compliance with operation manual	Project Compound	Visual inspection	Daily	Safety Production Department	Included in operation and maintenance cost
Air emissions	Stack emissions	SO_2, O_2, NOx, CO	Main Stack	CAMS*	Continuous	Control Room Team	Installation included in EPC Cost, Monitoring and Maintenance Cost
Air emissions	Ambient air quality	Ozone, NO_2, SO_2, PM10, $PM_{2.5}$ (24 hour average)	4 locations	Standard Method	Twice per Year	Third party environmental consultant	Monitoring and Maintenance Cost

River water	Surface water	Water temperature	At cooling water discharge point	Standard Method	Monthly	Safety Production Department	Monitoring and Maintenance Cost
Effluent water		Arsenic, Cadmium, Total Chromium, Copper, Iron, Lead, Mercury, Oil and grease, pH, TSS, Total residual chlorine, Zinc	At wastewater discharge point	Standard method	Quarterly	Third party environmental consultant	Monitoring and Maintenance Cost
Groundwater Quality	Ground Water	Arsenic, Cadmium, Total Chromium, Copper, Iron, Lead, Mercury, Oil and grease, pH, TSS, Total residual chlorine, Zinc	3 locations same as baseline surveys	Standard method	Biannually (twice per year)	Third party environmental consultant	Monitoring and Maintenance Cost
Noise level	Increase in ambient	Noise level in Leq	5 locations	24 hours	Quarterly	Third party environmental	Monitoring and Maintena

	noise levels					consultant	nce Cost
Waste	Block mud in drain and cause flooding	Amount and condition of mud in the drain Amount of solid waste and collection system	- Public drain - Plant compound	Visual Inspection	Twice per month	Third party environmental consultant	Monitoring and Maintenance Cost
Occupational health and safety	Accidents or incidents due to operation and maintenance activities	Health status and safety	Project Compound/ factory	As to be defined in the Health and safety Plan	As defined in Health and Safety Plan	Safety Production Department	Monitoring and Maintenance Cost
CSR activities	Community development	Activities	Local communities around the power plant	Number of beneficiaries and outcome of the activities	Periodic and need based	Administration department	Monitoring and Maintenance Cost

စောင့်ကြပ်ကြည့်ရှုမည့် အချိန်နှင့် နေရာ အတိအကျကို စီမံကိန်း အကောင်အထည်ဖော်ဆောင်သူမှ ဆုံးဖြတ်ပေးသွားပါလိမ့်မည်။ စီမံကိန်း လည်ပတ်ဆောင်ရွက်နေစဉ်အတွင်း စောင့်ကြပ်ကြည့်ရှုရေးများကို သတ်မှတ်ထားသည့် ကန်ထရိုက်တာမှ ဆောင်ရွက်သွားပါလိမ့်မည်။

*** လေထုစောင့်ကြည့်ရေး စခန်းတည်ဆောက်ပြီးစီးခဲ့ပါလျှင် စဉ်ဆက်မပြတ်စောင်ကြည့်သွားရန်*

သုံးသပ်ချက်များနှင့် ထောက်ခံချက်များ

သုံးသပ်ချက်များ

သာကေတတွင် တည်ဆောက်ရန် ရည်ရွယ်ထားသော လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း ကို ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှု အစီအစဉ်နှင့်တကွ ဆောင်ရွက်ထားပါသည်။ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းတွင် စီမံကိန်း တည်ဆောက်ချိန်၊ လည်ပတ်ချိန် နှစ်ခုစလုံး ဆောင်ရွက်နေစဉ်အတွင်း ရှုပ - ဓာတုဆိုင်

ရာ၊ အပင်နှင့် သတ္တဝါဆိုင်ရာ၊ လူမှုစီးပွားဆိုင်ရာ အခြေအနေများ အပေါ်၌ စီမံကိန်းကြောင့် သက်ရောက်မှုများကို ဆန်းစစ်ဆောင်ရွက် ထားပါသည်။ အကျိုးသက်ရောက်မှုများကို ဖော်ထုတ်သတ်မှတ်ခြင်း၊ ကြိုတင်ခန့်မှန်းခြင်း၊ ဆန်းစစ်ဆောင်ရွက်ခြင်းများ ပြုလုပ်ထားပြီး လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ တည်ဆောက်ချိန်၊ လည်ပတ်ချိန် နှစ်ခုစလုံး ဆောင်ရွက်နေစဉ်အတွင်းတွင် ထိခိုက်မှု လျော့ချရေးနည်းလမ်းများကိုလည်း အကြံပြု ဆွေးနွေးထားပါ သည်။

စီမံကိန်းနေရာသည် ဂေဟစနစ် ထိခိုက်မှု မသိသာသည့် ဖွံ့ဖြိုးတိုးတက်နေပြီးသော နေရာတွင် တည်ရှိနေသည့် အပြင် ဂေဟစနစ် ကန့်သတ်ချက်များ (ဥပမာ၊ အပင်နှင့် သတ္တဝါတို့၏ နေထိုင်ကျက်စားရာ နေရာများနှင့် ဇီဝမျိုးစုံမျိုးကွဲ) အများစုပေါ်တွင် စီမံကိန်း ဆောင်ရွက်ချက်များကြောင့် သက်ရောက်မှုများ သည်လည်း များသော အားဖြင့် သိသာသည့် ထိခိုက်မှုများ ရှိမနေပါ။ သဘာဝအခြေအနေကို ဆန်းစစ်ရာတွင် ရှုပ-ဓာတု သဘာဝဝန်းကျင် တွင်ရှိသော ဆိုးကျိုး သက်ရောက်မှု အများစုသည် သက်ရောက်မှု နည်းပါးကြောင်း၊ ထို့ကြောင့် ထိခိုက်မှု လျော့ချ ရေး နည်းလမ်းများကောင်းများကို စနစ်တကျဖြင့် ပြီးမြောက်အောင် ဆောင်ရွက်ပါက ပြန်လည်ကုစားနိုင်သည့် အပြင် အနည်းဆုံးထိ လျော့ချနိုင်ကြောင်း လေ့လာမှုများမှ အကြံပြုဖော်ပြပေးထားပါသည်။ အဆိုပါ လျှပ်စစ် ဓာတ်အားပေးစက်ရုံ တည်ဆောက်ချိန် နှင့် လည်ပတ်နေစဉ်အတွင်း ဆူညံသံ သက်ရောက်မှုသည် သိသိသာသာ ဖြစ်စေနိုင်ပါသည်။ ထို့ကြောင့် သင့်တော်သည့် ကာကွယ်ရေးနည်းလမ်းများအား စီမံကိန်း လည်ပတ်နေစဉ်နှင့် လည်ပတ်နေသည့် စက်ကိရိယာများအနီးသို့ သွားရောက်ချိန်များတွင် လိုက်နာသွားရပါမည်။ စက်ရုံ လည်ပတ်နေ သည့် ပုံမှန်အချိန်တွင် အဆိုပါ ၁၀၆ မဂ္ဂါဝပ်ရှိသည့် လျှပ်စစ်ဓာတ်အားပေး စက်ရုံ၏ ဆက်စပ်လျက်ရှိသော ဆူညံသံ သက်ရောက်မှုသည် သက်ရောက်ခံများနှင့် အနီးစပ်ဆုံးရှိနေသည့် စက်ရုံမှ ထွက်ပေါ်လာသော ဆူညံသံ များအဖြစ် ခန့်မှန်းရကြောင်း အကောင်အထည်ဖော် လေ့လာထားချက်များမှ သိနိုင်ပါသည်။ ဓာတ်အားပေး စက်ရုံ မှ ထုတ်လွှတ်မှုများအရ ထိတွေ့ဝန်းကျင်ရှိ လေထုထဲတွင် တိုးပွားလာသော NOx နှင့် PM သက်ရောက်မှုသည် ပြောပလောက်အောင် ရှိမနေကြောင်း အကောင်အ ထည်ဖော် အဆိုပြုထားသောစက်ရုံကို လက်ရှိတည်ရှိနေသော သာကေတ သဘာဝဓာတ်ငွေ့သုံး လျှပ်စစ်ဓာတ်အား်းပေး စက်ရုံဝန်း၏ ဘေးကပ်ရက်ရှိ သတ်မှတ်ထားသော နေရာအတွင်း တည်ဆောက်သွားပါမည်။ ထို့ကြောင့် မြေယာလို အပ်ချက်များ ရှိမနေပါ။ ဖြည့်စွက်ပြောဆိုရလျှင် သတ်မှတ်ထားသော နေရာတွင် အိမ်ယာမြေများ အခြေချ နေထိုင်ခြင်း ရှိမနေပါ။ ထိုနေရာသည် ဝင်ငွေရရှိမည့် ကိစ္စရပ်များ လုပ်ဆောင်မည့် နေရာလည်းမဟုတ်ပါ။ ထို့ကြောင့် စီမံကိန်း တည်ဆောက်ရာတွင် နေရာရွှေ့ပြောင်းရ သည့် လူဦးရေများ ရှိမနေသကဲ့သို့ အခြေချနေထိုင်မှုများလည်း မရှိပါ။ စီမံကိန်း ကြောင့် ဝင်ငွေဆုံးရှုံးများလည်း ရှိလာမည် မဟုတ်ပါ။

စီမံကိန်း လည်ပတ်ဆောင်ရွက်နေစဉ်အတွင်း လူမှုစီးပွားဆိုင်ရာ ပတ်ဝန်းကျင်ထိခိုက်မှုများတွင် သိသာထင်ရှား သော ထိခိုက်မှုများ ရှိမနေပါ။ တိုးတက်လာသော လျှပ်စစ်ဓာတ်အား ထောက်ပံ့ပေးမှုကြောင့် ကောင်းကျိုးများ သိသာထင်ရှား လာနိုင်ပါသည်။ လူထုတွေ့ဆုံဆွေးနွေးပွဲများ ဆောင်ရွက်နေစဉ်အတွင်း သာကေတမြို့နယ်မှ နေထိုင်သူများသည် လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ စီမံကိန်းကို ကြိုဆိုကြပါသည်။ သို့သော်လည်း လျှပ်စစ်ဓာတ် အားပေးရာတွင် အနှောက်အ ယှက်မဖြစ်စေနိုင်သော အရည်အသွေးပြည့်မီသည့် စက်များကိုသာ တပ်ဆင်ရန်၊ လေထုနှင့် အသံဆူညံမှု များကိုလည်း အနိမ့်ဆုံးအဆင့်ထိ လျှော့ချ ထိန်းသိမ်းထားရန် တောင်းဆိုထားပါသည်။

ထောက်ခံချက်များ

သာကေတမြို့နယ်တွင်ရှိသော လျှပ်စစ်ဓာတ်အားပေး စက်ရုံအတွက် ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းကို ဆောင်ရွက်ထားပါသည်။ ဆိုးကျိုးသက်ရောက်မှုများသည် ပတ်ဝန်းစီမံခန့်ခွဲမှု အစီအစဉ်တွင် ဖော်ပြထားသော စိတ်ချရသည့် ထိခိုက်မှုလျော့ချရေး နည်းလမ်းများအရ လက်ခံနိုင်သည့်အဆင့်ထိ လျှော့ချနိုင်သော ပမာဏ အောက်တွင်သာ ရှိကြောင်း ၎င်းမှ အကြံပြုထားပါသည်။ ထို့ကြောင့် ၁၀၆ မဂ္ဂါဝပ်ရှိသော လျှပ်စစ်ဓာတ်အားပေး စက်ရုံကို သာကေတမြို့နယ်အတွင်း တည်ဆောက်ရန် ရည်ရွယ်ထားပါသည်။ ထိခိုက်မှု လျှော့ချရေးနည်းလမ်းများ

ကိုလည်းဖြည့်စွက်ထည့်သွင်းသွားပါမည်။ ကြိုတင်ခန့်မှန်းထားသော သက်ရောက်မှုများအတွင်း မည်သည့် ပြောင်း လဲမှုကိုမဆို သတ်မှတ်ရန် ပတ်ဝန်းကျင် စောင့်ကြပ်ကြည့်ရှုရေး အစီအစဉ်များကိုလည်း ဆောင်ရွက်သွား မည်ဖြစ် ကြောင်း ထောက်ခံပေးထားပါသည်။ မမျှောင်လင့်ထားသော မည်သည့်ဆိုးကျိုး သက်ရောက်မှုမျိုးကိုမဆို ကုစား ဆောင်ရွက်ပေးသွားရန် သင့်တော်သော နည်းလမ်းများကို အသုံးပြုသွားမည်ဟု လည်း ထောက်ခံပေး ထားပါသည်။

TABLE OF CONTENTS

APPENDICES

CHAPTER I

INTRODUCTION

1.1 Project Background

The Thaketa gas-fired combined cycle power plant project is a joint venture between China's Union Resources and Engineering Companay (UREC) and Myanmar's Ministry of Electricity and Energy (MOEE). The JV Company is named as U Energy Thaketa Power Co., Ltd. A memorandum of understanding for the project was first signed in January 2013 and a subsequent agreement inked in November 2014.

In order to increase the capacity of electricity production, U Energy Thaketa Power Co., Ltd. proposed to invest in construction of a gas-steam combined cycle power plant beside the existing power plant site at Thaketa, Yangon. It is expected that electric power generated from such Power Plant shall improve shortfall in power supply and demand in Yangon Region.

During the project preparation, a full-scale Environmental and Social Impact Assessment (ESIA) of the plant was carried out by the Resource & Environment Myanmar Ltd. (REM). In order to generate electric power to add Myanmar's National Grid, the project has planned in an approximately 0.12 square km (29.68 acres) area in sub-urban of the Yangon City. The proposed generator and associated facilities covers shrub land and disposal site.

The project site is located about 10 km east of Yangon city and occupies the area between Pazundaung (Ngamoeyeik) Creek and Bago River. The location of proposed power plant is shown in Plate - A.

According to the IFC guideline, the proposed power plant falls under "Category B" and require carrying out EIA in accordance with the Foreign Investment Law and the Environment Conservation Law (2012) and Environmental Impact Assessment Procedures (2015).

1.2 Objective

REM collected environmental baseline data and prepare ESIA report to incorporate environmental consideration into the decision-making process and to improve planning and then to establish sustainable power development.

The main objective of this study is:

- To collect the original social and natural environment condition before implementation the project
- to document various environmental and social related field activities that are being planned and or being undertaken by the MOEP (now Ministry of Energy and Electricity) and its developers for laying of the gas turbine and associated power-generating facilities
- to highlight the environmental and social impact, and to support the documents for environmental management plan, strategies, styles and produce being employed in the Gas Turbine area and to meet the expectation of the International Finance Corporation, Myanmar's existing law, and the international conventions/ protocols/ agreements signed by Myanmar.

1.3 Scope of Study

a) Identification of the legal and policy framework applicable to the project;
b) Description of the principal project features and technical specifications including preconstruction, testing and commissioning operation and maintenance (as provided by MOEP);
c) Description of the environmental and social baseline of the project in terms of key sensitivities and potential constraints on the construction and operation and maintenance of the power plant;
d) Assessment of the air, land, noise, water, and the natural (biological) environment including parameters of human interest (social issues) based on primary surveys and available secondary data;
e) Identification of potential adverse environmental and social impacts during construction and operation of the generator and mitigation measures to be adopted by Ministry of Energy and Electricity and developers;

f) To undertake preliminary EIA study based on this base line data and to develop environmental and Social Action Plan (ESAP) outlining preventive and control strategies for minimizing adverse impacts during construction and operation (including maintenance) phase of the project.

1.4 Approach and Brief Methodology

The consultant adopts following approach for the project:

Identification and review of the applicable national and international environmental and social regulatory and institutional framework.

Establishing environmental and social baseline conditions of the project site by the following;

- Reconnaissance survey to observe environmental and social characteristics around the Gas Turbine;
- Primary baseline data collection in and around the power plant area with respect to water, soil, air and noise quality, and traffic density on roads;
- Socioeconomics survey to assess the socioeconomic status of the area involving private land
- Ecological survey of flora and fauna prevailing in and around the gas turbine through primary and secondary surveys;
- Identification of land use of the project area through satellite imageries and field survey;
- Identification, prediction of environmental and social impacts of the project.

1.5 Existing Power Plant

The following is the detail of existing gas turbine plant.

1. Machinery

No.	*Type*	*Power*	*Total*
(a)	FRAME 5 Gas Turbine	19MW x 3	57 MW
(b)	Steam Turbine Generator	35 MWx1	35 MW
		Total	92 MW

2. Transformer

31 MVA (66/11) KV	3 nos.	Gas Turbine
44MVA (66/11) KV	1 no.	Steam Turbine
100 MVA (230/66-33/11) KV	3 nos.	Main Transformer
5MVA (33/1 1) KV	1 no	Distribution Transformer

3. Natural Gas
   For generating 3 machines 25.5 Million cubic feet of natural gas is needed.
4. Date of Distribution

No. 1 Gas Turbine	- Feb. 5, 1990
No. 2 Gas Turbine	- March 22, 1990
No. 3 Gas Turbine	- March 22, 1990
Steam Turbine	- Feb. 1, 1997

5. Condition of electricity distribution
   Power generated by Thaketa Gas power plant delivered via 230 kV line and through 5 nos. of 33 kV and 2 nos. of 11kV to the southern and eastern part of Yangon area. Prior to the development of the project, it is essential to undertake the relevant environmental studies in accordance with the stage of project development

1.6 Project Proponent and Implementation Organization for Environmental Impact Assessment

Project Proponent

Name of Principle Organization:	U Energy Thaketa Power Co., Ltd.
Address:	No. 35, Pyay Road, 7 quarter, Mayangone Township, Yangon Region, The Republic of the Union of Myanmar
Phone:	095018038
Email:	dongfan@urecei.com

Implementation Organization for EIA Assessment

The organizations of the implementation of the environment impact assessment (EIA) (hereinafter referred to as the "EIA Study Team") is Resource & Environment Myanmar Co., Ltd. The members of the EIA Study Team are listed in Table 1.6-1. The profile of each organization and the curriculum vitae of the key experts of the EIA Study Team are attached in Appendix -12.

Table 1.6-1 ESIA Team for CCPP power plant

Sr. No.	Name	Field of Study	Responsibility
1.	Dr. Win Maung	Principal Consultant	Ecology (Fauna)
2.	Daw Khin Ohnmar Htwe	Principal Consultant	Socio-Economic
3.	U Zaw Naing Oo	Principal Consultant	Environmental Management Plan
4.	Dr. Myint Aung	Principal Consultant	Ecology (Flora)
5.	U Thura Aung	Principal Consultant	Environmental Geology
6.	U Soe Yu Htun	Senior Consultant	Physical Baseline Data Collection
7.	U Kyaw Naing Oo	Senior Consultant (Ecology)	Wildlife
8.	U Ngwe Moe	Principal Consultant	Environment, health and safety
9.	Dr. Tin Tin Khaing	Principal Consultant	Ecology
10.	Dr. Sandar Win	Principal Consultant	Ecology
11.	U Kyaw Zin Win	Principal Consultant	GIS and Geology
12.	Daw Lai Lai Win	Principal Consultant	Wastewater and Reporting
13.	U Chit Myo Lwin	Senior Consultant	Physical Environment
14.	U Nyan Lin Maung	Senior Consultant	Ecology
15.	U Min Min Oo	Senior Consultant	Impact Assessment and Reporting
16.	UREC provided the detailed description of Proposed Project and Mitigation Measures		Electrical Engineer

CHAPTER II

POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 Myanmar Law and Regulation (Background)

Myanmar has already had some legislations and regulations which are, the more or the less, relating to natural environmental aspects since before its independence. The Forest Act and the Burma Wildlife Protection Act, for example, have been enacted respectively in 1902 and 1936 for the sustainability of the forest products. Amended versions of such earlier act and newly promulgated one are briefly outlined to give a perspective on the existing legal and administrative framework concerning the environmental affairs in Myanmar.

National Commission on Environmental Affairs (NCEA) was formed in 1990 with the purposes of setting environmental standards and creating environmental policies for utilizing natural resources and controlling environmental pollutions.

NCEA has adopted a National Environmental Policy in 1994 to ensure the incorporation of environmental concerns in planning for economic development. The NEP emphasizes "the responsibility of the State and every citizen to preserve its natural resources in the interest of present and future generations". In accordance with Notification No. 26/94 made in 1994, National Environmental Policy was stated as follows.

"To establish sound environment policies, utilization of water, land, forests, mineral, marine resources and other natural resources in order to conserve the environment and prevent its degradation, the Government of the Union of Myanmar hereby adopts the following policy: The wealth of the nation is its people, its cultural heritage, its environment and its natural resources. The objective of Myanmar's environmental policy is aimed at achieving harmony and balance between these through the integration of environmental considerations into the development process to enhance the quality of the life of all its citizens. Every nation has the sovereign right to utilize its natural resources in accordance with its environmental policies; but great care must be taken not to exceed its jurisdiction or infringe upon the interests of other nations.

It is the responsibility of the State and every citizen to preserve its natural resources in the interests of present and future generations. Environmental protection should always be the primary objective in seeking development".

The commission also formulated a blue print, the Myanmar Agenda 21, in 1997 in response to the call of the Earth Summit to develop national strategies to implement the Global Agenda 21. This document may serve as a framework for integrating environmental considerations in future national development plans as well as sectorial and regional development plans in Myanmar with the purpose of securing the aims of sustainable development.

The *Myanmar Agenda 21* is divided into 4 Parts and 19 Chapters and encompasses a broad range of sectors and issues. Building on the National Environment Policy, the agenda takes into consideration the programme guidelines found in the *Global Agenda 21* and is aimed at strengthening and promoting systematic environmental management in the country.

Most importantly, the *Myanmar Agenda 21* makes recommendations for the drafting and promulgation of a framework law which can further promote the integration of environmental and developmental concerns in the decision-making processes of the country.

2.2 Environmental Conservation Law

The Myanmar Environmental Conservation Law (2012) has been enacted to implement the National Environmental Policy. This law includes principles and guidelines for sustainable development, conservation of clean environment, and preservation of natural and cultural heritage. Under this law regulations and standards will be issued from time to time which the Company will be required to comply with.

2.3 Applicable Legislations, Guidelines and the Legal Framework of Environmental Issues Past and Present Environmental Legislation of Myanmar

The National Commissions for Environmental Affairs (NCEA) formed in February 1990 outlined **Myanmar Agenda 21**, which contains social, economic, institutional and infrastructural strengthening programmes as well as environmental conservation programmes.

To achieve sound environmental management in Myanmar, the respective Ministries fundamentally devise 56 environmental policies and regulations that are directly related with environmental conservation and protection. The State law and Order Restoration Council ratified the **Forest Law in November 2018**, in order to conserve the environmental factors and to maintain a sustained yield of the forest produce and **Protection of Wild life and Wild Plants and Conservation of Natural Area Law in 2018.**

In order to uphold further environmental protection, promote sustainable development and bring into line for environmental affairs, in April 2011, National Environmental Conservation Committee (NECC) was reformed for the national environmental management in Myanmar. The Ministry of Natural Resources and Environmental Conservation (MONREC) was upgraded in place of the environmental management. The Government entered the set-up of Environmental Conservation Department as a separate organization under the Ministry of Natural Resources and Environmental Conservation (MONREC) on 11 October 2012. The Ministry of Natural Resources and Environmental Conservation (MONREC) promulgated The Environmental Conservation Law on 30th March, 2012.

Until June 2014, the procedure of Environmental Impact Assessment has not yet enacted. At present, MOECAF has already issued the Environmental Conservation Rules (ECRs) and EIA Procedures based on Environmental Conservation Law no. 42 (A).

The Project Proponent (The Company) shall prepare an Environmental Impact Assessment (EIA) for the project in accordance with the requirements and regulations of the Ministry of Natural Resources and Environmental Conservation (MONREC).

Applicable National Laws, Rules and Regulations

The project proponent, U Energy Thaketa Power Co., Ltd. and its contractor will comply with all National Laws, rules and regulations that related to the present project activities. The followings are the list of laws and regulations that applied and commits to follow related to the present project.

Table 2.3-1 Legal Framework Related to the Present Project

No.	Title	Section/Rule	Brief Description
1.	Environmental Conservation Law, 2012	Section 14, 15, 2, 29	Provision of basic guidance to integrate environmental conservation in sustainable development, ministry's responsibility to develop relevant guideline and regulation, setting up monitoring system, waste management, conservation of natural resource and cultural heritage.
2.	Environmental Conservation Rules, 2014	Rule 69	The principle of this rule is to support the execution conducted by ministry as required by environmental conservation law. The project company commits to comply rule 69 (a) and (b).
3.	EIA Procedures, 2015	Article 102 – 110, 113, 115, 117	Description of categories of project to conduct EIA and IEE requirement, content of EIA, submission and approval principle, environmental certificates, responsibilities of ministry and project proponent.

No.	Title	Section/Rule	Brief Description
4.	National Environmental Quality (Emission) Guidelines, 2015		MOECAF formulated the National Environmental Quality (Emission) Guidelines (NEQG) in coordination with ADB in December 2015. The NEQG determines the guideline values for general emission such as air emissions, wastewater, noise levels, odor, and those for sector-specific emission such as emission from forestry, agribusiness/food production, chemicals, oil and gas, infrastructure, general manufacturing, mining, and power.
5.	Conservation of water resources and Rivers law (2016)	Section 6 (a), 8 (a), 11, 19, 21 (a), 22, 24 (b), 30	The project shall not carry out any act or channel shifting with the aim to ruin the water resources and rivers and creeks and cause the wastage of water resources willfully without disposing any harms to water resources.
6.	The Ethnic Rights Protection Law, 2015	Section 5	The project proponent will disclose to the resident ethnic nationalities about the project fully.
7.	Myanmar Insurance Law, 1993	Section 15, 16	The project will compensate for all the general damages to the environment and injuries to public to ensure the needed insurances such as making insurance for the project owned vehicles and injured person.
8.	Myanmar Investment Law, 2016	50 (d), 51, 65 (e) to (p, q), 73	The project shall obtain relevant government permissions.
9.	Myanmar Investment Rules, 2017	Section 202, 204, 206, 212	The project company commits to comply with the conditions of the permit and other applicable laws when making an investment.
10.	Private Industrial Enterprise Law, 1990	Section 3 (f), 4, 11 (a) (g), 13 (b) (g) (h), 25 (b)	The project company commits to comply the related sections mentioned in the law.
11.	The Protection and Preservation of Antique Objects Law, 2015	Section 12	It aims to implement the policy of protection and preservation of the perpetuation of antique objects and to protect and preserve antique objects so as not to deteriorate due to natural disaster or man-made destruction.
12.	Protection and Prevention of Ancient Buildings Law, 2015	Section 15 (c) (d), 20 (f)	This law aims at conservation of historically valuable buildings deemed under the law.
13.	The Protection and Preservation of Cultural Heritage Region Law, 2019		The objectives are as follows: • To implement the protection and preservation policy of cultural heritage • To protect and preserve the cultural heritage regions and the cultural heritage therein • To uplift hereditary pride and to cause dynamism of

No.	Title	Section/Rule	Brief Description
			patriotic spirit of citizens by protecting and preserving the cultural heritage regions. • To promote public awareness • To protect the cultural heritage regions from destruction • To carry out protection and preservation of the cultural heritage regions in conformity with the International Convention approved by the State.
14.	The Public Health Law, 1972	Section 3, 5	To ensure the public health include not only employees but also resident people and cooperation with the authorized person or organization of health department. The project owner will cooperate with the authorized person or organization in line with the section 3 and 5 of said law. **Section 3:** The project owner will abide by any instruction or stipulation for public health. **Section 5:** The project owner will accept any inspection, anytime, anywhere if it is needed.
15.	The Prevention and Control of Communicable Diseases Law, 1995	Section 3 (a) (b), 4, 9, 11	The proponent makes ensure the healthy work environment and prevention the communicable diseases by the cooperation with the relevant health department.
16.	The Control of Smoking and Consumption of Tobacco Product Law, 2006	Section 9	The person-in-charge of the project company will: • Keep the caption and mark non-smoking area. • Arrange the specific place for smoking area. • Supervise and carry out measures so that no one will smoke at the non-smoking area. • Accept the inspection when supervisory body comes to the project.
17.	The Labour Organization Law, 2011	Section 17 to 22	The Labour Organization Law replaced the Trade Union Act enacted in 1927 for protecting the rights of the workers, having good relations among the workers or between the employer and the worker, and for forming and carrying out the labour organizations systematically and independently. Under the law, the labour organization has the right to carry out freely in drawing up their constitution and rules. It has the right to negotiate and settle with the employer if the workers are unable to obtain the right of the workers contained in the labor laws. On the other hand, the employer shall recognize the labour organizations and assist as much as possible if the labour organizations request for help for the interest of his workers.
18.	The Settlement of	Section 38,	This law was enacted for safeguarding the right of workers or

No.	Title	Section/Rule	Brief Description
	Labour Dispute Law, 2012	39, 40, 51	having good relationship between employer and workers and making peaceful workplace or obtaining the rights fairly, rightfully and quickly by settling the dispute of employer and worker justly. It stipulates that employer in which more than 30 workers are employed shall form the workplace coordinating committee consisting of the representatives of workers and the representatives of employer.
19.	Employment and Skill Development Law, 2013	Section 14, 15, 30	The law aims to facilitate employment which is appropriate to the age and ability of the job seeker and to help workers obtain employment and to provide stability of employment and skills development for employees ant also too help employers obtain appropriate employees.
20.	The Leave and Holiday Act, 1951; Amendment in 2014	Section 3, 4, 5, 7 (a)	This act has been used as the basic framework for leaves and holidays for workers with minor amendment in 2006 and 2014. This defines the public holidays that every employee shall be granted with full payment. It also defines the rules of leaves for workers including medical leave, earned leave and maternity leave.
21.	Workmen's Compensation Act, 1923		It stipulates that employer is required to make payments to employees who become injured or who die in any accidents arising during and in consequence of their employment. Such compensation also must be made for disease which arise as a direct consequence of employment, such as carpal tunnel syndrome.
22.	Social Security Law, 2012	Section 11(a), 15(a), 18(b), 48, 49, 75	The Social Security Law, enacted in 1012, was amended the Social Security Act in 1954. It stipulates the formation and implementation of social security system.
23.	The Factory Act, 1951; Amended in 2016		The hydropower project can be operated as a factory with the employees and to ensure the healthy, safety, welfare, fair working-times and clean environment for the employees. The law focuses all stipulations for the employer. The project owner commits to comply nearly all sections. The project owner has to abide by all provisions for healthy, safety, welfare, working-hours and other needs. **Gender provision** • No woman, adolescent or child will be employed in the company to lift, carry or move any load so heavy as to be likely to cause injury. [section 36 (a)] • Pregnant women workers are not forced to work at night. [section 36 (d)]
24.	The Minimum Wage	Section 12, 13 (a) (b) (c)	The law was replaced the 1949 Minimum Wage Act. The Law provides a framework for minimum wage determination, the

No.	Title	Section/Rule	Brief Description
	Law, 2013	(d) (e) (f) (g), 18	presidential office establishing a tripartite minimum wage committee shall decide minimum wage with industrial variation base on a survey on living costs of workers possibly every two years. This also stipulates equal payment.
25.	The Payment of wages Law, 2016	Section 3, 4, 5, Chapter 3, Security, 14	Receipt of wages is made regularly. Unlawful deductions are not to be made. The Law sets out : • The obligations on employers regarding the payment of employees' wages • The methods and time frames for payment • The permissibility of deducting wages • The duties and responsibilities of the Director General and investigating officers of the Factories and General Labor Laws Inspection Department (the "Department") under the Ministry of Labor, Immigration and Population.
26.	The Myanmar Engineering Council Law, 2013	Section 34, 37	The project company commits to comply the following (section 37). • No one will perform any engineering work and technological work which are specified as being dangerous to the public by a rule enacted under this law without having received a registration certificate issued by the council, except for engineers appointed in a government department or an organization in the performance of their duties.
27.	The Prevention of Hazard from Chemical and Related Substances Law, 2013	Section 15, 16, 17, 21, 27	The Prevention of Hazard from Chemical and Related Substances Law, the central law of chemicals management in Myanmar enacted in 2013, stipulates that when chemicals and related substances is to be transferred, stored, used, or disposed, operating approval certificate should be obtained in accordance with the regulations based on the international treaties.
28.	Occupational Safety and Health Law (2019)	12, 16, 17, 18, 26 (a-m), (o), (q), (r), 27, 34, 36	The project proponent will comply to obtain the right to continued medical treatment, family assistance benefit, invalidity benefit, superannuation benefit, survivors' benefit, unemployment benefit, the right to residency and ownership of housing after retirement in addition to healthcare and pecuniary benefit for sickness, maternity, death, employment injury of the workers.
29.	The Electricity Law, 2014	Section 11, 13, 18, 20, 22, 26, 28, 68	Generally, set forth the principle of permission required by relevant authorities to installation, generation, transmission, distribution and inspection tasks. Permission might be withdrawn under the circumstance that licensed organization infringe the requirements stipulated in agreement. Projects are

No.	Title	Section/Rule	Brief Description
			divided into three categories as small, medium and large. The project company commits to comply section 11, 13, 18, 20, 22, 26, 28, and 68.
30.	27. The Boiler Law, 2015	Section 5, 12 (b), 14, 15, 18, 19, 20, 21, 24, 29, 30, 31, 40	The objectives are as follows: • To obtain boilers in compliance with Myanmar Standards or International Standards • To prevent the country and citizens from hazards caused by boiler accidents • To use boilers in compliance with Myanmar Standards or International Standards within the country • To develop boiler technology and to produce experts capable of manufacturing, handling, repair, and maintenance of boilers • To optimize the use of boilers through effective utilization of fuel energy • To reduce the environmental, social and health impacts through long-lasting use of boilers.
31.	The Fire Force Law, 2015	Section 25 (a, b)	To ensure to prevent the fire, to provide the precautionary material and apparatuses, if the fire caused in the project area to be defeated because the project is business in which electricity and any inflammable materials such as petroleum are used. So, the project owner has to institute the specific fire service in line with the law. **Sub-section (a) of section 25:** The project proponent will institute the specific fire services. **Sub-section (b) of section 25:** The project owner will provide materials and apparatuses for fire precaution and prevention.
32.	Motor Vehicles Law, 2015 and Rules, 1987		It aims to drive safely motor vehicles in public area through registration according to official rules and regulations, to provide driving license, to protect the road users from the road risks and vehicles perils, to avoid traffic congestion and to use high technology transportation systems.
33.	The Protection of Wildlife, Wild Plants and Conservation of Natural Area Law, 2018		To ensure the protection of natural areas and wildlife and wild plants those are in the natural areas. **Section 35:** The project owner will not pollute the air and water, cause the damages to water way, poison into the water, dispose the poisonous substances or mineral waste in the natural area. **Section 36:** The project owner will not product, collect or destroy any protect natural plant without permission; destroy any natural existence or biodiversity.

No.	Title	Section/Rule	Brief Description
34.	The Forest Law, 2018	Section 40 (a - 3, 4), 41(a) (b), 42 (a), 43 (a) (b) (c)	To implement forest policy and environmental conservation policy, to promote the sector of public cooperation in implementing these policies, to develop the economy of the State, to prevent destruction of forest and biodiversity, to carry out simultaneously conservation of natural forests and establishment of forest plantations and to contribute to the fuel requirements of the country.
35.	The Law on Standardization, 2014		National Standards and Quality Department enacted the law on Standardization in 2014 and the main objectives of the law area: • To enable to determine Myanmar standards; • To enable to support export promotion by enhancing quality of production organizations and their products, production processes and services; • To enable to protect the consumers and users by guaranteeing imports and products area not lower than prescribed standard, and safe from health hazards; • To enable to support protection of environmental related products, production processes and services from impact, and conservation of natural resources; • To enable to protect manufacturing, distributing and importing the disqualified goods which do not meet the prescribed standard and those which are not safe and endangered to the environment; • To support on establishing the ASEAN Free Trade Area and to enable to reduce technical barriers to trade. • To facilitate technological transfer and innovation by using the standards for the development of national economic and social activities in accordance with the national development program.
36.	Foreign Investment Law, 2012	Section 17(a-j), 23	The project company commits to comply with the conditions of the permit and other applicable laws when making an investment.
37.	Foreign Investment Rule	Rule 54	
38.	YCDC Law (2018)		The project shall comply the requirements of YCDC law.

2.4 Environmental Impact Assessment

The EIA procedure, issued on 29 December 2015, defines the requirements for the EIA and states that: "*An EIA investigation shall consider all biological, physical, social, economic, health, cultural and visual-components of the environment, together with all pertinent legal matters relating to the environment (including land use, resources use, and ownership of and rights to land and other resources) that may be affected by the Project during all project phases*

including pre-construction, construction, operation, decommissioning, closure, and post-closure; and shall identify and assess all Adverse impacts and risks that potentially could arise from the project.

Article 7 – This Procedure does not address specific matters in relation to resettlement or in relation to Projects that may have an Adverse Impact on Indigenous People. Projects involving resettlement or potentially affecting Indigenous People shall additionally comply with separate procedures issued by responsible ministries, and in the absence of such procedures all such Projects shall adhere to international best practice on Involuntary Resettlement and Indigenous People."

Three different steps are foreseen for the EIA processes which are described in the following sections:

- screening phase;
- scoping phase; and
- EIA Investigation and Report Preparation

2.4.1 Screening Phase

The EIA process starts with the screening process as shown in the below Figure. The MONREC is empowered and has the exclusive authority to define the screening criteria for a project.

Guidance is provided as to which projects or activities should carry out an Initial Environmental Examination (IEE) or EIA, as presented in the Annex to the law. If, as a result of that determination, an IEE or an EIA is required, then the proponent of the project or activity has to prepare, obtain approval for, and implement an appropriate Environmental Management Plan (EMP) in respect of the proposed project or activity. Any appeal from such determination must be made in accordance with the EIA Procedure.

The Annex shows for each type of economic activity, the criteria for selection of whether IEE or EIA apply to the proposed economic activity. The MONREC determines whether the project is an IEE type project or an EIA type project or if it is exempted from undertaking any environmental assessment.

The Project Proponent might be required to submit a project proposal (completed in accordance with MONRECF's guidelines) to the EC department of MONREC for screening.

Within 15 days from receiving the complete project proposal, the MONREC shall determine the required type of environmental assessment (EIA, IEE, or none) and shall inform the Project Proponent in writing about its determination. In addition, the MONREC can change the status of an IEE Type Project to be an EIA Type Project if any of the above additional factors are relevant in this sense.

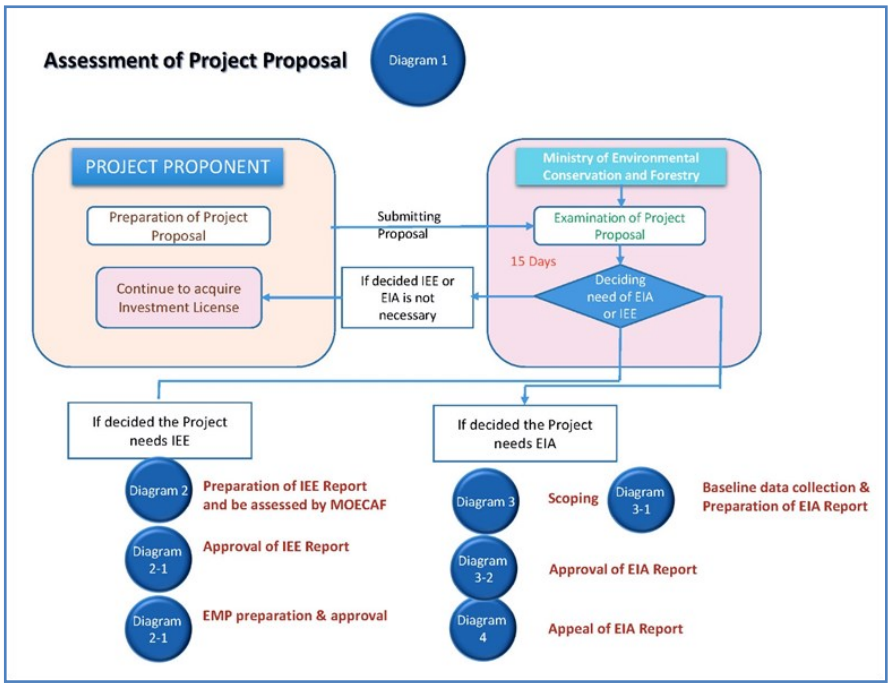


Figure 2.4-1 EIA Process Screening Phase

2.4.2 Scoping Phase

All EIA type projects are required to undergo the Scoping phase. The project proponent shall be responsible to ensure that the Scoping and the preparation of the Term of Reference (TOR) for the EIA report are undertaken in a professional manner and in accordance with any applicable guidelines issued or adopted by the MONREC. The scoping shall, in respect to the proposed project:

- define the study area, AoI, time boundaries, project phases, and potential stakeholders;
- start the process of understanding the applicable regulations and standards, and their context for project design and completion of the EIA;
- make a provisional identification of environmental, social and, if any, health impacts, focusing in particular on the environmental, social and health issues that need to be addressed in subsequent EIA studies;
- provide an indication of the required baseline data and information and methods to get them (although there is no need to actually collect any data at this stage);
- provide an opportunity for consultants, relevant authorities, project developers, interested and affected parties to express their views and concerns regarding the proposal before an EIA proceeds;
- enable an efficient and comprehensive assessment process that saves time, resources, costs and delays; and
- identify potentially affected communities and other stakeholders with an interest in the project.

As part of the scoping, the project proponent shall ensure that the following public consultation and participation process is carried out.

- disclose information about the proposed project to the public and civil society through 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; and

- arrange the required complement of consultation meetings as advised by the MOECAF, with local communities, potentially PAPs, local authorities, community-based organizations, and civil society.

The project proponent shall prepare a scoping report and TOR for the EIA investigations and submit the completed Scoping Report and TOR to the MONREC for review and approval. The Scoping process is shown in the following Figure.

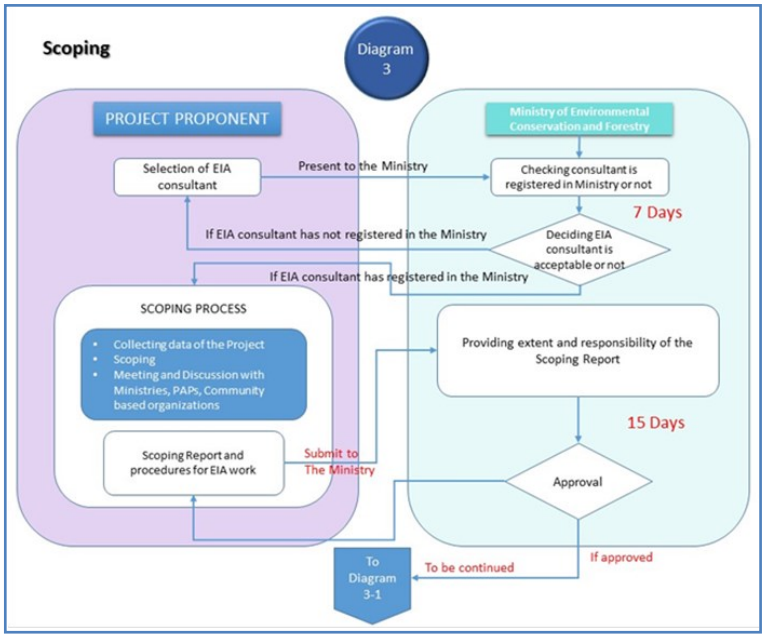


Figure 2.4-2 EIA Scoping Process

2.4.3 EIA Investigation and Report Preparation

The Project Proponent has to ensure that the EIA investigation properly addresses all adverse impacts and is undertaken in accordance with the approved TOR. The EIA investigation shall consider all biological, physical, social, economic, health, cultural and visual components of the environment, together with all pertinent legal matters relating to the environment (including land use, resources use, and ownership of and rights to land and other resources) that may be affected by the Project during all project phases, including pre-construction, construction, operation, decommissioning, closure, and post-closure; and shall identify and assess all adverse impacts and risks for environment, social and, if relevant, health that potentially could arise from the Project.

The EIA Procedure does not address the social impacts of involuntary resettlement or which relate to indigenous people. Separate procedures shall be issued by responsible ministries, and in the absence of such procedures all such Projects shall adhere to international practice on involuntary resettlement and indigenous people.

The Project Proponent is obliged to use, comply with and refer to applicable national standards, international standards adopted by the Government and/or the MONREC, or, in the absence of relevant national or adopted international standards, such standards as may be agreed with the MONREC.

The EIA Report shall consider the views, concerns, and perceptions of stakeholders, communities and individuals that could be affected by the Project or who otherwise have an interest in the Project. The EIA should include the results of public consultations and negotiations with the affected populations on the environmental and social issues. Public concerns should also be taken into account in assessing impacts, designing mitigation measures, and selecting monitoring parameters. After completing all investigations and public consultation and participation processes required for EIA Type Projects, the Project Proponent shall submit the EIA Report to the MONREC in both digital and hard copy, together with the required service fee.

The MONREC shall within 10 days after submission disclose the EIA Report to civil society, PAPs, concerned government organizations, and other interested stakeholders. The MONREC shall submit the EIA Report to the EIA Report Review Body for comment and recommendations and also arrange for public consultation meetings at national and State/ Regional/ local levels where the Project Proponent shall present the EIA Report. All received comments and recommendations, including those of the EIA Report Review Board, will be collected and reviewed by the MONREC prior to making a final decision on approval of the EIA Report.

The MONREC shall deliver its final decision within 90 days from the receipt of the EIA Report. All costs incurred in completing to the EIA Report disclosure and review, including the public participation process, shall be borne by the Project Proponent. Upon completion of its review of the EIA Report, the MONERC will issue an ECC or inform the Project Proponent of its decision to reject the EIA Report and publically disclose its decision. The proposed flow chart covering the EIA review process is shown in the following Figure.

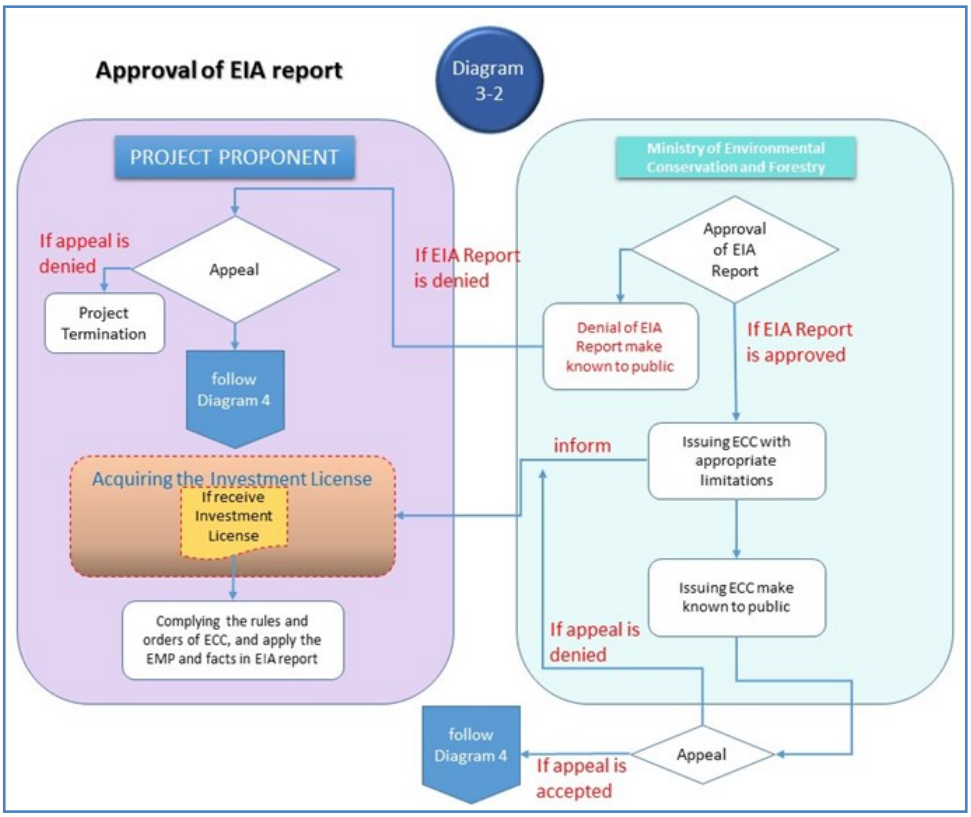


Figure 2.4-3 EIA Review and Approval within the Myanmar EIA Process

In conclusion, the IEE and EIA approval process can be summarized as reported in the following Table.

Table 2.4-1 The IEE & EIA Approval Process in Myanmar

EIA Process	Duration	MIC Permission	Duration
IEE/EIA/NON-Proposal Screening	15 days	Proposal Screening	15 days
		MIC Permission	90 days
IEE Process			
- Approval of IEE experts	7 days		
- IEE report preparation	-		
- IEE report approval	60 days		

EIA Process	Duration	MIC Permission	Duration
EIA Process			
- Approval of EIA experts	7 days		
- Developing EIA scoping report and TOR	-		
- Scoping report and TOR approval	15 days		
- Investigation/preparing EIA report	-		
- EIA report approval	90 days		

2.4.4 U Energy's Commitments

The 106 MW project is the first phase of the about 500 MW joint venture project named U Energy Thaketa Power Co. Ltd. established by the department of electric power management of Myanmar and Union Resources & Engineering Company (UREC) and will be operated under build-operate- transfer (BOT) system. Joint Venture Agreement (JVA) was signed on 22-9-2016 and MOEE can get 3% free share for this project. U Energy will perform 30 years for generation and concession period. After 30 years, Thaketa power station would be transferred back to MOEE in accordance with BOT Contract. Power Purchase Agreement (PPA) was signed on January 2016. Construction of this project started in May 2016 and completed in February 2018. Commercial operation date was 28 February 2018 and the electricity is being supplying to National Grid in compliance with the relevant laws and regulations.

- U Energy confirms to take responsibility for implementing environmental mitigation measures in accordance with the commitment in the Environmental Management Plan that mentioned in the EIA report.
- The company will fully comply with existing rules and regulations concerning environment both on social and environmental aspect in Myanmar and IFC EHS General Guidelines.
- Operation by U Energy and its contractors will at all times comply fully with the commitments, mitigation measures, and plans in EIA report.
- The Measures are hereby formulated in order to standardize entrusted operation and maintenance management of U Energy and ensure the safe, stable and reliable operations of the power plant.
- U Energy will submit the Environmental Monitoring Report during construction and operation of the proposed project to Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation.

2.5 International Treaties

Myanmar has also made commitments to the following international agreements and protocols on environmental, social, safety and occupational issues.

United Nations Framework Convention on Climate Change

Article 4 Commitments

Section 1(f) Take climate change considerations into account, to the extent feasible, in their relevant social, economic and environmental policies and actions, and employ appropriate methods, for example impact assessments, formulated and determined nationally, with a view to minimizing adverse effects on the economy, on public health and on the quality of the environment, of projects or measures undertaken by them to mitigate or adapt to climate change;

2.6 Environmental Target Values for Consideration of Surrounding Environment

According to Article 10 of the Environmental Conservation Law, MOECAF (MONREC) shall set the following environmental quality standards, with the approval of the Union Government and the Committee:

(a) Suitable surface water quality standards for the public usage of rivers, streams, canals, springs, marshes, swamps, lakes, reservoirs, and other inland water sources of the public;

(b) Water quality standards for coastal and estuarine areas;

(c) Underground water quality standards;

(d) Atmospheric quality standards;

(e) Noise and vibration standards;

(f) Emissions standards;

(g) Effluent standards;

(h) Solid waste standards; and

(i) Other environmental quality standards stipulated by the Union Government.

As of December, 2015, emission guideline and target values of ambient air quality, air emission, wastewater, and noise levels were set in **National Environmental Quality (Emission) Guidelines (NEQG)**, while other standards have not been set yet by MONREC.

Each quantitative target value to be applied is described below.

1. Air Quality
2. Water Quality
3. Noise
4. Vibration

2.6.1 Air Quality

(1) Target Value of Ambient Air Quality

NEQG has set the ambient air quality in Myanmar as shown in Table 2.6-1.

On the basis of the above standards, the tentative target value for air quality in the Project, as shown in Table 2-3 has been set with the following considerations:

- Target parameters of ambient air quality in Myanmar's standards are applied if it has set (SO_2, NO_2, $PM_{2.5}$, and PM_{10}).
- The averaging period adopted is 24 hours, which could be measured using the available equipment in Myanmar whereas currently it is impossible to implement continuous measurement for one month or one year at the project site due to battery/electrical capacities.

The following guideline applies to combustion processes fueled by gaseous, liquid, and solid fuels and biomass and designed to deliver electrical or mechanical power, steam, heat, or any combination of these, regardless of the fuel type (except for solid waste which is covered under the guideline for Waste Management Facilities), with a total rated heat input capacity above 50-megawatt thermal input on high heating value basis. It applies to boilers, reciprocating engines, and combustion turbines in new and existing facilities.

Table 2.6-1 Air Emission Level set in NEQG

Combustion Technology / Fuel	Parameter/Guideline Values		
	Particulate matter PM_{10}[a]	Sulfur Dioxide	Nitrogen Oxides
Combustion turbine			
Fuels other than natural gas (unit > 50MW[c])	50 mg/Nm^3[b]	Use of ≤ 1 % sulfur fuel	310[j] mg/Nm^3
Natural gas (all turbine types; unit > 50 MW)	-	-	100 mg/Nm^3
Boiler			
Natural gas	-	-	240 mg/Nm^3
Reciprocating engine			
Natural gas	-	-	200 mg/Nm^3

[a] *Particulate matter 10 micrometers or less in diameter*

[b] *Milligrams per normal cubic meter at specified temperature and pressure*

[c] *Megawatt*

2.6.2 Water Quality

The project is required to comply with all relevant national, WBG and IFC guidelines and standards.

Industry-specific guidelines apply during the operations phase of this project and cover direct or indirect discharge of wastewater to the environment. They are also applicable to industrial discharges to sanitary (domestic) sewers that discharge to the environment without any treatment. Wastewater generated from project operations includes process wastewater, wastewater from utility operations, runoff from process and storage areas, and miscellaneous activities including wastewater from laboratories, and equipment maintenance shops. Projects with the potential to generate process wastewater, sanitary sewage, or storm water should incorporate the necessary precautions to avoid, minimize, and control adverse impacts to human health, safety or the environment. Industry-specific guidelines summarized hereinafter shall be applied by all projects, where applicable, to ensure that effluent emissions conform to good industry practice.

For project types where industry-specific guidelines are not set out in these Guidelines, the following general guideline values, or as stipulated on a case-by-case basis, apply during project operations.

Table 2.6-2 Effluent Level

Parameter	Unit	Guideline Value
Arsenic	mg/l	0.5
Cadmium	mg/l	0.1
Iron	mg/l	1
Lead	mg/l	0.5
Mercury	mg/l	0.005
Oil and grease	mg/l	10

pH	S.U[a]	6-9
Temperature increase	ºC	<3[b]
Total residual chlorine	mg/l	0.2
Total suspended solids	mg/l	50
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Zinc	mg/l	1

[a] Standard unit

[b] Temperature increase due to discharge of once-through cooling water

2.6.3 Noise

Noise Level Set in NEQG

In NEQG, the noise level is set as shown in Table 2.6-3 and noise prevention and mitigation measures should be taken by all projects where the predicted or measured noise impacts from a project facility or operation exceed the applicable noise level guideline at the most sensitive point of reception. Noise impact should not exceed the levels shown below or result in a maximum increase in background levels of three decibels at the nearest offsite receptor location.

Table 2.6-3 Target Noise Level Set in NEQG

Receptor	One Hour LAeq (dBA)	
	Daytime (7:00-22:00) (10:00-22:00 for public holidays)	Nighttime (22:00-7:00) (22:00-10:00 for public holidays)
Residential, institutional, educational	55	45
Industrial, commercial	70	70

Source: NEQG (December 2015)

2.6.4 Biodiversity and Sensitive Habitats

Biodiversity and sensitive habitats in Myanmar are regulated by the Protection of Wildlife, Wild plants and Conservation of Natural Area Law and the National Biodiversity Strategy and Action Plan (NBSAP) of Myanmar.

2.6.4.1 The Protection of Wildlife and Conservation of Natural Areas Law

The policy context for the establishment of protected areas is given by the National Environment Policy, formulated in 1990, with the objective of strengthening wildlife management through the establishment of a network of national parks wildlife reserves and sanctuaries. In addition, a further goal is to increase the coverage of protected areas to 5% in the first instance, and ultimately up to 10% of the area of Myanmar.

Moreover, the Protection of Wildlife, Wild plants and Conservation of Natural Area Law, which dates back to 1994, focuses on protecting wildlife including their habitats and formulating protected areas while stipulating penalties against offenses. The major objectives of the law are to implement the Government policy for wildlife protection as well as for natural areas conservation and to protect endangered species and their habitats.

Article 7 of the law defines the categories of natural area as follows:

- scientific reserve;
- national park;
- nature reserve;
- wildlife sanctuary;
- geo-physically significant reserve;
- other nature reserve determined by the minister.

Article 15 of the Law defines the categories of the protected species as follows:

- completely protected species of wild animals;
- normally protected species of wild animals;
- seasonally protected species of wild animals.

Myanmar is also a party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora and to the Ramsar Convention on Wetlands of International Importance.

2.6.4.2 National Biodiversity Strategy and Action Plan

The National Biodiversity Strategy and Action Plan (NBSAP) of Myanmar were adopted by the Cabinet on 03 May 2012. The strategy contains 10 strategic directions as followings:

- strengthening conservation of priority sites;
- mainstreaming biodiversity into other policy sectors;
- implementing focused conservation actions for priority species;
- supporting local Non-Governmental Organization (NGOs) and academic institutions;
- creating capacity to coordinate conservation investment in Myanmar;
- scaling up implementation of in-situ and ex-situ conservation of agriculture, livestock and fisheries biodiversity and genetic resource management;
- expediting the process of implementing the national bio-safety framework;
- promoting the initiative to manage IAS;
- facilitating the legislative process of environmental protection and environmental impact assessment; and
- enhancing communication, education and public awareness on biodiversity conservation.

2.6.5 Occupational Health and Safety

The Factories Act 1951 provides requirements concerning with working hours, working days, overtime, and certain health and safety measures. The following is a summary:

- working hours - Normal working hour is 8 hours a day for a total maximum 48 hour a week. A worker is entitled to minimum thirty-minute rest period after working continuously for five hours;
- working days - Working days may be up to six days a week (for government services, 5 days a week);
- overtime - Overtime is permissible. Its pay rate is twice the normal pay rate;

- Safety & Health - The employer has an obligation to protect workers from occupational hazards relating to the physical facilities, harmful substances, and environment factors at the workplace;
- the employer has other obligations, depending on the number of workers employed; and
- the workers can also get other rights in accordance with Leave and Holidays Act, 1951, Social Security Act, 1954 and the Worker's Compensation Act, 1923.

2.6.6 Cultural Heritage

The Antiquities Act (enacted in 1957 and revised in 1962) is a law that governs movable and immovable cultural heritage that have archaeological and historical value. The Antiquities section provides stipulations for the movement of antiquities inside and outside the country, the protection and management of antiquities, the protection and restoration obligation and the compulsory acquisition right of the Director of the Burma Archaeological Survey, and penalties for violations of the above.

The Protection and Preservation of Cultural Heritage Regions Law (1998, amended in 2009 and 2011) is the organic law on the protection and preservation of cultural heritage regions and the cultural heritage in Myanmar. It mainly supplements the Antiquities Act with provisions that more widely cover cultural heritage.

In this law, the Ministry of Culture is tasked to issue notifications to designate a site which has one or more zones out of the three indicated as a cultural heritage region (ancient monumental zone, ancient site zone, and protected and preserved zone). The Ministry also carries out acquisition of any land within the cultural heritage region, if necessary.

The objectives of the Protection and Preservation of Cultural Heritage Regions Law are:

- to implement the protection and preservation policy with respect to perpetuation of cultural heritage that has existed for many years;
- to protect and preserve the cultural heritage regions and the cultural heritage therein so as not to deteriorate due to natural disaster or man-made destruction;
- to uplift hereditary pride and to cause dynamism of patriotic spirit of citizens by protecting and preserving the cultural heritage regions;
- to promote public awareness and will as to the high value of the protection and preservation of the cultural heritage regions;
- to protect the cultural heritage regions from destruction; and
- to carry out protection and preservation of the cultural heritage regions in conformity with the International Convention approved by the State.

Relevant excerpts are as follows:

- *"20. No person shall carry out any of the following in the cultural heritage region: (a) destroying an ancient monument; (b) wilfully altering the original ancient form and structure or original ancient workmanship of an ancient monument; (c) excavating to search for antiquities; and (d) exploring for petroleum, natural gas, precious stones or minerals;*
- *21. No person shall, without prior permission granted under this Law, carry out any of the following in the cultural heritage region: (a) carry out renovation and maintenance work on an ancient monument; (b) carrying out archaeological excavation; (c) building road, constructing bridge, irrigation canal, embankment or extending the same; and (d) digging well, pond, fish-breeding pond or extending the same."*

According to Chapter IV of the Law, the Department of Archaeology, National Museum and Library is in charge of the following activities:

- *Article 9. The Department shall carry out works of protection and preservation of the ancient monuments and ancient sites situated in the cultural heritage region;*
- *Article 10. The Department may prohibit any person from ploughing and cultivating within the boundary of the ancient monument or ancient site or from carrying out any activity that may cause damage to the cultural heritage in the cultural heritage region;* and
- *Article 11. The Department shall, with the approval of the Ministry of Culture, carry out the following in the cultural regions: (i) determination of precincts of an ancient monument; and (ii) prescription of conditions to be abided by shops opened within the precinct determined under item.*

For the time being, there are no guidelines for cultural heritage management in Myanmar.

2.7 International Standards

In addition to the applicable host Country Laws, the project Company is required to comply with all relevant national, WBG and IFC guidelines and standards, with the main applicable WBG guidelines summarised below.

2.7.1 Air Emissions Guidelines

The Company shall ensure that the project complies with the combustion emission limits set out in the WBG EHS Guidelines for Thermal Power Plants, as specified in Table 6 (B) Emissions Guidelines for Combustion Turbine.

Combustion Technology/Fuel	**Nitrogen Oxide (NOx)**	**Reference Oxygen Content**
Natural gas (all turbine types of Unit >50MWth)	51 mg/Nm^3 (25 ppm)	15%, dry gas

Source: Table 6(B), WBG EHS Guidelines for Thermal Power Plants.

For the control of NOx, the gas turbines shall be equipped with dry low NOx burners. The required minimum stack height for the Project has been set at 30 meters (HRSG and bypass stack), although this is subject to a stack height determination study, based on air dispersion modelling, that will be undertaken by the Company as part of the EIA/ESIA and could result in an increase to the stack height. As per the WBG EHS General Guidelines, 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. For projects where there are multiple sources of emissions, stack heights should be established with due consideration to emissions from all other project sources, both point and fugitive.

Ambient Air Quality Guidelines

In the absence of national legislated ambient air quality standards in Myanmar, the Company shall demonstrate, through air dispersion modelling, plant compliance with the World Health Organization (WHO) Ambient Air Quality Guidelines as specified in WBG EHS General Guidelines.

Parameter	**Averaging Period**	**Guideline Value in µg/m^3**
Sulphur dioxide (SO_2)	24-hour 10 minutes	20 500
Nitrogen dioxide (NO_2)	1-year 1-hour	40 200

Particulate matter (PM10)	1-year 24-hour	20 50
Particulate matter (PM2.5)	1-year 24-hour	10 25

Source: Table 1.1.1, WBG EHS General Guidelines.

Additional WBG EHS General Guidelines on ambient air quality shall also be applied as required.

While ambient air quality standards may not directly affect the day to day operation of the Facility, they need to be incorporated into the dispersion modelling and stack height determination study. The study shall take into consideration the impact of the adjacent steel plant. The Facility shall be equipped with a Continuous Emission Monitoring System (CEMS).

2.7.2 Noise Levels Guidelines

Working environments (worker exposure): The Facility shall be designed to achieve the noise limits for working environments set out in the WBG EHS General Guidelines.

Location/Activity	**Equivalent Level (LAeq, 8 hour)**
Heavy Industry (no demand for oral communication)	85 dB(A)
Open offices, control rooms, service counters or similar	45-50 dB(A)

Source: Table 2.3.1, WBG EHS General Guidelines.

No employees should be exposed to a noise level greater than the guideline limits detailed above without hearing protection. Noise levels shall be measured according to appropriate International Electrotechnical Commission (IEC) standards.

Ambient conditions (beyond the facility boundary): the Company shall also comply with the background noise level guidelines indicated in the WBG EHS General Guidelines, as set out below.

Receptor	**One Hour LAeq (dBA)**	
	Daytime (07:00 – 22:00)	**Nighttime (22:00 – 07:00)**
Residential, institutional, educational	55	45
Industrial, commercial	70	70

Source: Table 1.7.1, WBG EHS General Guidelines.

The WBG EHS General Guidelines require that noise impacts should not exceed the levels presented in Table 1.7.1 or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site. Measurements are to be taken at noise receptors located outside the site. The actual permissible noise pressure levels will be confirmed in the EIA/ESIA.

2.7.3 Effluent Guidelines

The Company shall ensure that applicable environmental regulations, standards and guidelines for wastewater discharge and re-use are complied with as well as national and international standards for water quality and effluent management. The table below lists the effluent discharge guideline limits applicable to the Facility as per the WBG EHS Guidelines for Thermal Power Plants. These standards apply to the discharge of effluent at the end of the outlet prior to release into the receiving waters. The following table provides indicative values for treated sanitary sewage discharges.

Parameter	**Unit**	**, except pH and temperature**
pH	S.U	6-9
TSS	**mg/L**	50
Oil and grease	**mg/L**	10
Total residual chlorine	**mg/L**	0.2
Chromium – Total (Cr)	**mg/L**	0.5
Copper (Cu)	**mg/L**	0.5
Iron (Fe)	**mg/L**	1.0
Zinc (Zn)	**mg/L**	1.0
Lead (Pb)	**mg/L**	0.5
Cadmium (Cd)	**mg/L**	0.1
Mercury (Hg)	**mg/L**	0.005
Arsenic (As)	**mg/L**	0.5
Temperature increase by thermal discharge from cooling system	˚C	Site specific requirement to be established by the Environmental Assessment (EA). Elevated temperature areas due to discharge of once-through cooling water (e.g., 1 Celsius above, 2 Celsius above, 3 Celsius above ambient water temperature) should be minimised by adjusting intake and outfall design through the project specific EA depending on the sensitive aquatic ecosystem around the discharge point.

Source: Table 5, WBG EHS Guidelines for Thermal Power Plants.

2.7.4 Labor Requirements

The Company will ensure that all relevant Myanmar labor laws are complied with, including but not limited to:

- Employment Restriction Act (1959)
- Employment Statistics Act (1948)
- Factories Act (1951)
- Labour Organization Law (2011)
- Leave and Holidays Act (1951)
- Payment of Wages Act (1936)

- Workmen's Compensation Act (1923)
- Minimum Wage Law (2013)
- Settlement of Labour Dispute Law (2012)
- Social Security Law (2012)
- Employment and Skill Development Law (2013)

Myanmar has been a member of the International Labor Organization (ILO) since 1948, therefore, the Company shall comply with the following ILO conventions:

- C029 - Forced Labour Convention, 1930 (No. 29) - 04 Mar 1955
- C087 - Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87) - 04 Mar 1955
- C001 - Hours of Work (Industry) Convention, 1919 (No. 1) - 14 Jul 1921
- C002 - Unemployment Convention, 1919 (No. 2) - 14 Jul 1921
- C006 - Night Work of Young Persons (Industry) Convention, 1919 (No. 6) - 14 Jul 1921
- C011 - Right of Association (Agriculture) Convention, 1921 (No. 11) - 11 May 1923
- C014 - Weekly Rest (Industry) Convention, 1921 (No. 14) - 11 May 1923
- C015 - Minimum Age (Trimmers and Stokers) Convention, 1921 (No. 15) - 20 Nov 1922
- C016 - Medical Examination of Young Persons (Sea) Convention, 1921 (No. 16) - 20 Nov 1922
- C017 - Workmen's Compensation (Accidents) Convention, 1925 (No. 17) - 16 Feb 1956
- C018 - Workmen's Compensation (Occupational Diseases) Convention, 1925 (No. 18) - 30 Sep 1927
- C019 - Equality of Treatment (Accident Compensation) Convention, 1925 (No. 19) - 30 Sep 1927
- C021 - Inspection of Emigrants Convention, 1926 (No. 21) - 14 Jan 1928
- C022 - Seamen's Articles of Agreement Convention, 1926 (No. 22) - 31 Oct 1932
- C026 - Minimum Wage-Fixing Machinery Convention, 1928 (No. 26) - 21 May 1954
- C027 - Marking of Weight (Packages Transported by Vessels) Convention, 1929 (No. 27) - 07 Sep 1931
- C042 - Workmen's Compensation (Occupational Diseases) Convention (Revised), 1934 (No. 42) - 17 May 1957
- C052 - Holidays with Pay Convention, 1936 (No. 52) - 21 May 1954
- C063 - Convention concerning Statistics of Wages and Hours of Work, 1938 (No. 63) Excluding Parts III and IV -24 Nov 1961

The Company shall also comply with the provisions of IFC Performance Standard 2 Labor and Working Conditions, which includes provisions relating to general working conditions, workers organizations, non-discrimination and equal opportunity, retrenchment, the provision of a grievance mechanism, and the prohibition of child labor and forced labor.

2.7.5 International Finance Corporation Performance Standards

IFC, a member of the WB Group, has published the IFC Performance Standards (PS) on Environmental and Social Sustainability (2012) which defines clients' responsibilities for managing their environmental and social risks.

IFC uses a process of environmental and social categorization to reflect the magnitude of risk and impacts of the Project it finances, as summarized below:

- category A: business activities with potential significant adverse environmental or social risks and/or impacts that are diverse, irreversible, or unprecedented;
- category B: business activities with potential limited adverse environmental or social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures; and
- category C: business activities with minimal or no adverse environmental or social risks and/or impacts.

The IFC PSs on Environmental and Social Sustainability are made of eight components, which provide guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way. The PS establishes standards that the client is to meet throughout the life of an investment. IFC PSs are listed below:

- PS 1: Assessment and Management of Environmental and Social Risks and Impacts;
- PS 2: Labour and Working Conditions;
- PS 3: Resource Efficiency and Pollution Prevention;
- PS 4: Community Health, Safety, and Security;
- PS 5: Land Acquisition and Involuntary Resettlement;
- PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- PS 7: Indigenous Peoples; and
- PS 8: Cultural Heritage.

IFC PSs are in turn supported by Guidance Notes that serve to explain the means to achieve compliance with the PSs. A brief description of each IFC PS is listed below:

- PS 1: Assessment and Management of Social and Environmental Risks and Impacts. The Principle states the importance of managing environmental and social performance throughout the life of a project. PS 1 requires the client to conduct a process of environmental and social assessment and to establish and maintain an Environmental and Social Management System (ESMS), appropriate to the nature and scale of the project and commensurate with the level of its environmental and social risks and impacts. PS1 aims at:
  - identifying and evaluating environmental and social risks and impacts of the project[1],

1 This includes cumulative impacts. The IFC's Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets, published in 2013 provides guidance.

- adopting a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, affected communities, and the environment,
- promoting improved environmental and social performance of clients through the effective use of management systems,
- ensuring that grievances from affected communities and external communications from other stakeholders are responded to and managed appropriately,
- promoting and providing means for adequate engagement with affected communities throughout the project cycle on issues that could potentially affect them, and
- ensuring that relevant environmental and social information is disclosed and disseminated;

- PS 2: Labour and Working Conditions. The Principle recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers. PS2 aims at:
  - promoting fair treatment, non-discrimination and equal opportunity of workers,
  - establishing, maintaining and improving the worker-management relationship,
  - promoting compliance with national employment and labour laws,
  - protecting workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties and workers in the client's supply chain, and
  - promoting safe and healthy working conditions and the health of workers; and avoiding the use of forced labour;
- PS 3: Resource Efficiency and Pollution Prevention. The Principle recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. Thus, PS3 aims at:
  - avoiding or minimizing pollution from project activities,
  - promoting more sustainable use of resources (including energy and water), and
  - reducing project-related Greenhouse Gas (GHG) emissions.
- PS 4: Community Health, Safety and Security. The Principle recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. PS4 aims at:
  - anticipating and avoiding adverse impacts on the health and safety of affected communities during the project life from both routine and non-routine circumstances, and
  - ensuring that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the affected communities.
- PS 5: Land Acquisition and Involuntary Resettlement. The Principle recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. PS5 thus aims at:
  - avoiding, and when avoidance is not possible, minimizing displacement by exploring alternative project designs,

- avoiding forced eviction,
- anticipating and avoiding, or where avoidance is not possible, minimizing adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost, and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation and the informed participation of those affected, and
- improving or restoring, the livelihoods and standards of living of displaced persons;

- PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources. The Principle recognizes that protecting and conserving biodiversity, maintaining ecosystem services and sustainably managing living natural resources are fundamental to sustainable development. PS6 aims at:
  - protecting and conserving biodiversity,
  - maintaining the benefits from ecosystem services, and
  - promoting the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities;
- PS 7: Indigenous Peoples. The Principle recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. PS7 thus aims at:
  - ensuring that the development process fosters full respect for human rights, dignity, aspirations, culture and natural resource-based livelihoods of Indigenous Peoples,
  - anticipating and avoiding adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, minimizing and/or compensating for such impacts,
  - promoting sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner,
  - establishing and maintaining an ongoing relationship based on informed consultation and participation with the Indigenous Peoples affected by a project throughout the project's life-cycle,
  - ensuring the Free, Prior and Informed Consent of the affected communities of Indigenous Peoples when the circumstances described in this Performance Standard are present, and
  - respecting and preserving the culture, knowledge and practices of Indigenous Peoples;
- PS 8: Cultural Heritage. The Principle recognizes the importance of cultural heritage for current and future generations. As such, PS8 aims at:
  - protecting cultural heritage from the adverse impacts of project activities and supporting its preservation, and
  - promoting the equitable sharing of benefits from the use of cultural heritage.

In conclusion, PS 1 thus establishes the importance of:

- integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects;
- effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and

- the client's management of environmental and social performance throughout the life of the project.

IFC PS's 2 through 8 present requirements to avoid, reduce, mitigate or compensate for impacts on people and the environment, and to improve conditions where appropriate. Where social or environmental impacts are anticipated, the client is required to manage them through its ESMS consistent with PS1.

The IFC PS's are matched with corresponding Guidance Notes that provide guidance on the requirements contained in the standards and on good sustainability practices to help clients improve project performance.

2.7.5.1 International Finance Corporation Environmental, Health, and Safety Guidelines

The IFC EHS Guidelines are technical reference documents with general and industry-specific examples of good international industry practice.

The General EHS Guidelines are designed to be used together with the relevant industry sector EHS guidelines that provide guidance to users on EHS issues in specific industry sectors. The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent.

The EHS Guidelines for cement and lime manufacturing include information relevant to cement and lime manufacturing projects. Extraction of raw materials, which is a common activity associated with cement manufacturing projects, is covered in the EHS Guidelines for Construction Materials Extraction. The contents of both sector EHS Guidelines will be described in the following sections, after a brief presentation of the general EHS Guidelines.

2.8 General EHS Guidelines

The General EHS Guidelines are organized as reported in the following Table.

Table 2-5 Organization of the IFC EHS General Guidelines

Main Area	Topic
Environmental	• Air Emissions and Ambient Air Quality • Energy Conservation • Wastewater and Ambient Water Quality • Water Conservation • Hazardous Materials Management • Waste Management • Noise • Contaminated Land
Occupational Health and Safety	• General Facility Design and Operation • Communication and Training • Physical Hazards • Chemical Hazards • Biological Hazards

Main Area	Topic
	• Radiological Hazards • Personal Protective Equipment (PPE) • Special Hazard Environments • Monitoring
Community Health and Safety	• Water Quality and Availability • Structural Safety of Project Infrastructure • Life and Fire Safety • Traffic Safety • Transport of Hazardous Materials • Disease Prevention • Emergency Preparedness and Response
Construction and Decommissioning	• Environment • Occupational Health & Safety • Community Health & Safety

With respect to the environmental issues, IFC Guidelines refer to World Health Organization (WHO) standards that include the following:

- WHO Ambient Air Quality Standards;
- WHO Guidelines for Community Noise;
- WHO Drinking Water Quality; and
- WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater.

In addition, the following guidelines and standards may be applicable:

- Dutch Intervention Values for Soil Quality;
- International Union for Conservation of Nature (IUCN) Red Data Book for protected species (fauna and flora);
- Occupational Health and Safety Administration (OHSA) standards – United States Department of Labor; and
- United Nations Framework Convention on Climate Change (UNFCCC) Baseline and Monitoring Methodologies for Large Scale Clean Development Mechanism (CDM) Project Activities.

According to IFC requirements, air emissions should not result in pollutant concentrations higher than the relevant national ambient quality guidelines and standards. In their absence, the current WHO Air Quality Guidelines or other internationally recognized sources, such as the United State Environmental Protection Agency (USEPA), National Ambient Air Quality Standards (NAAQS) and the relevant European Council Directives can be also referred to.

In the following Table, Ambient Air Quality values outlined in the IFC EHS General Guidelines are reported.

Table 2.8-1 Ambient Air Quality Values – IFC EHS General Guidelines

Pollutant	Averaging Period	Maximum Limit Value ($\mu g/m^3$)
Sulphur Dioxide (SO_2)	10 min	500 (guideline)
	24 hours	125 (interim target 1)
		50 (interim target 2)
	Year	20 (guideline)
Nitrogen Dioxide (NO_2)	1 hour	200 (guideline)
	Year	40 (guideline)
Ozone (O_3)	8 hour daily maximum	160 (interim target 1)
		100 (guideline)
Particular Matter (PM_{10})	24 hours	150 (interim target 1) 100 (interim target 2) 75 (interim target 3) 50 (guideline)
	1 Year	70 (interim target 1) 50 (interim target 2) 30 (interim target 3) 20 (guideline)
Particular Matter ($PM_{2.5}$)	24 hours	75 (interim target 1) 50 (interim target 2) 37.5 (interim target 3) 25 (guideline)
	1 Year	35 (interim target 1) 25 (interim target 2) 15 (interim target 3) 10 (guideline)

In addition, IFC EHS General Guidelines require as a general rule that Project specific ground concentration does not contribute more than 25% of the above mentioned applicable air quality standard to allow additional, future sustainable development in the same airshed.

As outlined in the IFC EHS General Guidelines, noise impacts should be estimated by the use of baseline noise assessments for developments close to local human populations to verify that the levels presented in the following

Table are not exceeded or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

Table 2.8-2 Noise Level Guidelines – IFC EHS General Guidelines

Noise Level Guidelines		
Receptor	**IFC - One Hour L_{Aeq} (dBA)**	
	Day-time 07:00 - 22:00	**Night-time 22:00 – 07:00**
Residential; institutional; educational	55	45
Industrial; commercial	70	70

Noise monitoring programs should be designed and conducted by trained specialists. Typical monitoring periods should be sufficient for statistical analysis and may last 48 hours with the use of noise monitors that should be capable of logging data continuously over this time period, or hourly, or more frequently, as appropriate (or else cover differing time periods within several days, including weekday and weekend workdays). The type of acoustic indices recorded depends on the type of noise being monitored, as established by a noise expert. Monitors should be located approximately 1.5 m above the ground and no closer than 3 m to any reflecting surface (e.g., wall). In general, the noise level limit is represented by the background or ambient noise levels that would be present in the absence of the facility or noise source(s) under investigation.

In terms of Occupational Health and Safety (OHS) aspects, IFC noise limits for different working environments are provided in the following Table.

Table 2.8-3 Noise Limits for Different Working Environments – IFC EHS General Guidelines

Noise Limits for Various Working Environments		
Location / Activity	**Equivalent Level LA_{eq},8h**	**Maximum LA_{max},fast**
Heavy Industry (no demand for oral communication)	85 dB(A)	110 dB(A)
Light industry (decreasing demand for oral communication)	50-65 dB(A)	110 dB(A)
Open offices, control rooms, service counters or similar	45-50 dB(A)	-
Individual officers (no disturbing noise)	40-45 dB(A)	-
Classrooms lecture halls	35-40 dB(A)	-
Hospitals	35-40 dB(A)	B(A)

Discharges of process wastewater, sanitary wastewater, wastewater from utility operations or storm water to surface water should not result in contaminant concentrations in excess of local ambient water quality criteria or, in the absence of local criteria, other sources of ambient water quality. Receiving water use and assimilative capacity, taking other sources of discharges to the receiving water into consideration, should also influence the acceptable pollution loadings and effluent discharge quality.

Waste management should be addressed through a waste management system that addresses issues linked to waste minimization, generation, transport, disposal, and monitoring.

Land is considered contaminated when it contains hazardous materials or oil concentrations above background or naturally occurring levels. Contaminated lands may involve surficial soils or subsurface soils that, through leaching and transport, may affect groundwater, surface water, and adjacent sites. Where subsurface contaminant sources include volatile substances, soil vapor may also become a transport and exposure medium and create potential for contaminant infiltration of indoor air spaces of buildings. Contamination of land should be avoided by preventing or controlling the release of hazardous materials, hazardous waste, or oil to the environment. When contamination of land is suspected or confirmed during any project phase, the cause of the uncontrolled release should be identified and corrected to avoid further releases and associated adverse impacts. Contaminated lands should be managed to avoid the risk to human health and ecological receptors. The preferred strategy for land decontamination is to reduce the level of contamination at the site while preventing the human exposure to contamination.

With respect to the OHS field, the General EHS Guidelines state that employers and supervisors are obliged to implement all reasonable precautions to protect the health and safety of workers. The guidelines provide guidance and examples of reasonable precautions to implement in managing principal risks to occupational health and safety. Although, the focus is placed on the operational phase of projects, much of the guidance also applies to construction and decommissioning activities.

The General EHS Guidelines on Community Health and Safety complement the guidance provided for the environmental and occupational health and safety topics, specifically addressing some aspects of project activities taking place outside of the traditional project boundaries, but nonetheless related to the project operations, as may be applicable on a project basis. These issues may arise at any stage of a project life cycle and can have an impact beyond the life of the Project.

Finally, the General EHS Guidelines provide additional, specific guidance on prevention and control of community health and safety impacts that may occur during new project development, at the end of the project life-cycle, or due to expansion or modification of existing project facilities.

2.9 HSE Policy of U Energy

The followings are the HSE policy of U Energy for the present development project.

U ENERGY

U ENERGY THAKETA POWER CO.,LTD

PROJECT POLICY STATEMENT

The final goal of U Energy 'S HSE philosophy is to ensure the health and safety of personnel, to eliminate property damage and to provide a safe and comfortable working and living environment, during the entire construction period.

U Energy 'S will maintain its own safety philosophy as described below.

2.1 Safety is a paramount consideration in the project.
2.2 All accidents are preventable.
2.3 All tasks shall be planned and performed with concern for HSE.
2.4 HSE is a line management responsibility.
2.5 Identify and eliminate or minimize inherent hazard in the work.
2.6 Closely monitor each steps of the work to detect and promptly eliminate hazards and unsafe practices.
2.7 Provide clear and concise written instruction, rules and plans for the work to be performed.
2.8 Use trained and qualified workers and supervisors.
2.9 Recognize and reward outstanding performance.
3.0 Provide personnel protective equipment.
3.1 Provide mechanically correct tools and equipment.
3.2 Maintain fire prevention and protection program.
3.3 Provide first aid and medical facility.

PROJECT HSE GOAL

Project safety is a primary responsibility of all management and supervision on the project. The Project has a NO ACCIDENT goal. Project Manager has overall responsibility for safety at each respective location.

Specific HSE goals for the project are as follows:

Zero Incident I Accidents achieved through a HSE plan and HSE procedures that are aimed at modifying the behavior of all employees on the project to become safety conscious to prevent.

Provision of medical and first aid facilities to provide immediate treatment and proper management of injuries to prevent it from developing into more serious type of injuries.

No site damage incidents.

Avoidance of off - site damage incidents where the control of Project Management is limited.

Optimization of the site working conditions, leading to the prevention of physical and mental complaints, prevention of occupational sickness disability leave, and prevention of the occupational illnesses of all workers.

Minimum of nuisance (e.g. Noise, light, traffic, odors) to the surrounding community, potentially caused by construction activities.

Maintaining safe working areas and good housekeeping.

Strictly control waste management to avoid environmental impacts.

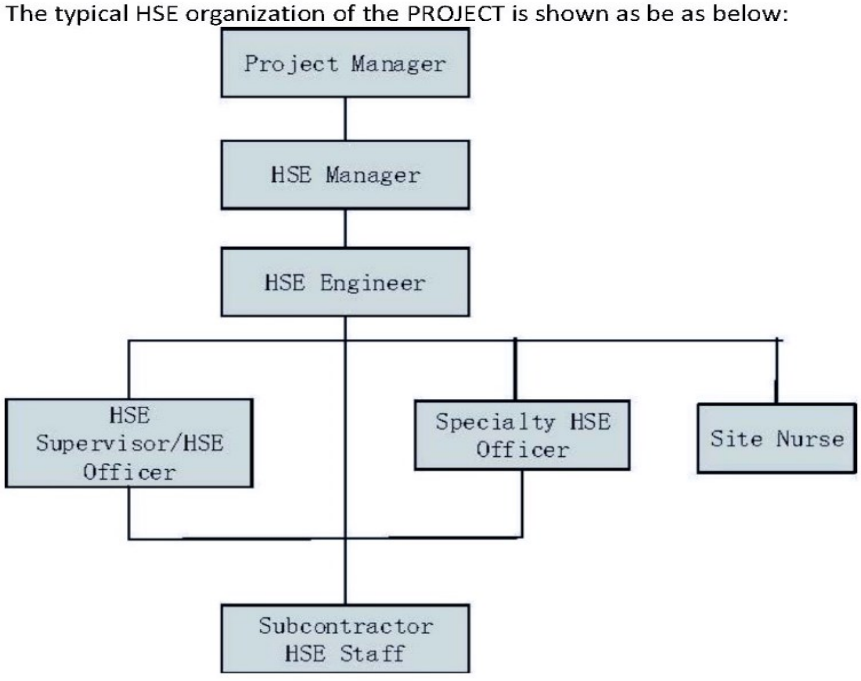
HSE ORGANIZATION & HSE RESPONSIBILITY.

U Energy will appoint a qualified professional HSE Manager and submit his details to Client within 30 days from the effective date of the contract.

CONTRACTOR HSE manager shall be interviewed by Client Representative for evaluation & approval of his competency before being on site.

4.1. Project HSE Organization

The typical HSE organization of the PROJECT is shown as be as below:



Responsibilities

HSE in the work place is everybody's responsibility; however, certain individuals will be required to accept additional responsibilities based on job assignment.

These will include the following:

Project manager

Have the overall accountability for construction SITE HSE.

Be accountable for achieving HSE goals.

Be responsible for ensuring that Subcontractors implement, administer, plan, train, and enforce the HSE plan.

Set up SITE HSE and Security Plan and be responsible for their implementation before starting site activities.

Use only competent personnel to work on SITE.

Issue the written instructions setting out the method of healthy and safe work in accordance with the policy on high - risk activities where necessary.

Plan and maintain housekeeping to high standards.

Inform the management of U Energy , also COMPANY Representative(s) of any accidents, incidents, and mishaps with the potential of injury and illness consequences immediately.

Encourage the reporting by all persons of 'near miss incidents'.

Arrange for thorough investigations to be made of all 'near miss incidents' with lessons learned openly publicized to all persons concerned.

Cease all activities in the area of an identified health and safety problem until it is resolved.

Immediately remove from the SITE any people (staff, Subcontractors, or third parties) who are not willing to comply with the HSE requirements.

Provide HSE training opportunity to all employees.

Perform corrective actions for any identified unsafe conditions.

Be responsible for setting up appropriate training including refresher training, as needed, to enable managers and workers to assess hazards, and to familiarize themselves with the relevant requirements (legislation, regulation and company standards).

Check working methods and precautions for high risk activities with HSE Manager before work starts in accordance with the HSE policy.

Site HSE manager

Assist the Project Manager in the management and execution of health and safety plan.

Conduct regular SITE inspections and prepare reports for Project Manager for corrective actions.

Check and advice on each work plan or procedures for HSE prior to WORK Commencement.

Coordinate with the COMPANY'S section on matters regarding HSE Liaise with Subcontractors HSE Manager on matters regarding the health and safety of all workers under Subcontractors.

Act in the capacity of secretary to HSE Committee.

Provide advice, guidance such as may be needed in accident prevention.

Coordinate with Government Authorities on matters pertaining to legal HSE requirements.

Establish and maintain an adequate HSE administrative system.

Investigate all near misses, incidents and accidents and submit reports complete with remedial actions to HSE team of U Energy head office through Project Manager for corrective action.

Ensure that Safety supervisors conduct their safety activities in a professional manner.

If HSE violations are determined high risk then stop the work as necessary.to co - ordinate and monitor implementation of the requirements of COMPANY HSE manual and arrange continuous and formal daily safety monitoring to ensure compliance and effectiveness.

Prepare regular toolbox safety letters & monitor the appropriate cascading of safety information.

Review completed risk assessments, monitor implementation.

HSE engineer

Provide timely communications on significant issues or developments.

Site inspection of safety facilities

Inspect the construction situation of labor

Inspect safety work of safety staff

Make summary of safety work of last work

Compile safety plan of next week

Organize regular safety meeting with subcontractor

Carry out at least special inspection at least two times per week

Make monthly summary of safety work

Make monthly plan of safety work

Take part in monthly inspection of HSE work

Take part in monthly HSE analysis meeting of subcontractor

Carry out safety training plan

Audit work load of subcontractor

Check various safety measures and safety work permit

Handle letters with subcontractor

Research and handle of safety accident

Carry out all arrangements of meeting

Safety supervisor/officer

Assist HSE Manager and perform the safety activities under the direction of HSE Manager

Check each Subcontractors work plan or work procedures from the view of safety point and report to HSE Manager

Advise the supervisory personnel of each function for HSE activities

Patrol the construction site daily to check that all subcontractors' works are executed in accordance with the HSE Procedures.

Report immediately to the HSE manager any near miss incidents also any safety violations that may require work to be stopped.

Contractors Field Supervisors are responsible for ensuring effective implementation of safety Management Plan in all areas under their direct control.

To anticipate HSE problems in their work areas and take the necessary actions.

To report any incident/accident, unsafe acts/conditions and near misses to their HSE officer.

To ensure work places are kept clean during and at the end of the work.

To carry out or support team talks prior to the work, inform the work crews of the requirements of the Permit to Work Certificates & Risk Assessments.

Nurse

Be on duty at job site during working hours (except when on emergency calls)

Care for an injured or sick person and keep the record.

Hold certification in first aid and Cardiopulmonary Resuscitation (CPR).

Plan and execute the hygiene activity program for all workers at work - site.

Produce a written daily report of all accident/medical treatment provided.

Produce a monthly report listing all types of medical/accident treatment.

Reports to be available at all times to U Energy HSE manager and other interested parties.

Nurse will carry out as necessary premedical screening i.e. Blood pressure checks and glucose level in blood (in case of person's history of hypertension and or diabetes). Special screening will take place on persons whose duties include operating cranes, working at height, in confined spaces and involved with energized equipment.

Specialty HSE officer

Assist safety supervisor in checking each subcontractor work plan or work procedure from the view of safety point and report to HSE manager

To report any incident/accident, unsafe practice/condition and near miss to HSE manager

To identify HSE problem in their work area and take necessary action

Is responsible for ensuring work plan or work procedure is strictly executed

Conduct daily HSE inspection in their work area in compliance with HSE procedure

To identify any safety violation which need work to be stopped immediately

To ensure their work areas are kept clean throughout the duration of the work

Participate in HSE meeting regularly

Organize and conduct tool box meeting with his control of employee and subcontractor's workers

Conduct safety induction prior to commencement of work

Conduct HSE training for their new personnel and subcontractor's workers

Subcontractors construction manager

Provide the HSE Plan that shall at least be comparable to this document.

Exercise good HSE discipline over all personnel.

Participate in U Energy HSE Committee.

Ensure that all levels of supervisors are qualified with appropriate trainings.

Encourage the reporting by all persons of 'near miss incidents'

Arrange for thorough investigations to be made of all 'near miss incidents' with lessons learned openly publicized to all persons concerned.

Subcontractors HSE manager

Assist his Construction Manager in executing and enforcing the work in accordance with the approved HSE plan.

Conduct regular checks of the work areas under his charges for safety violations, unsafe conditions, defective equipment, materials, tools, apparatus and appliances and shall take immediately the corrective actions.

Generally oversee that the work performed by workers under his jurisdiction.

Initiate and assist supervisory personnel in conducting their daily Tool Box

Meetings.

Organize and conduct regular HSE promotion activities with the aim of promoting HSE awareness among workers.

Participate in providing accident prevention program and, take part in reporting I discussion on near misses, dangerous occurrence, injury, and illness and property damage incidents.

Foster good HSE working relationship among Subcontractors.

Keep and maintain all HSE records pertaining to the SITE HSE program

Subcontractors supervisor

Participate in the work site HSE program, especially on safe work procedures with the aim of preventing accidents.

Coordinate all work activities to ensure that they meet the required standards with minimum risks to person, equipment and property.

Conduct regular checks of the site for safety violations, unsafe conditions, defective equipment, materials, tools, apparatus and appliances and shall take immediate and appropriate actions to eliminate the hazards.

Submit written reports with recommendations for corrective actions to prevent recurrences of any

property damage accidents and injury accident at the job site. The reports shall be submitted to HSE Manager.

Submit written reports of any other incidents, violations and unsafe work conditions at the job site. The reports shall be submitted to HSE Manager

Encourage the reporting by all persons of 'near miss incidents'

Arrange for thorough investigations to be made of all 'near miss incidents' with lessons learned openly publicized to all persons concerned.

Ensure all HSE work instructions are clearly understood between workmen.

2.10 Institutional Framework

2.10.1 Institutional Setting of the National Level

Under the 2008 Constitution, the Union of the Republic of Myanmar is organized into seven States and seven Regions (formerly known as Divisions), six Self-Administered Zones and Self-Administered Divisions and one union territory containing the capital Nay Pyi Taw and surrounding townships.41 Ethnic minorities live mostly in the seven States along the border of the country, and the ethnic majority Burman/Bamar people live mostly in the seven Regions which, with the exception of Tanintharyi and Sagaing Regions, mainly run through the middle of the country.

Under the 2008 Constitution the legislative power of the Union is shared among the Pyidaungsu Hluttaw, State and Region Hluttaws. The Pyidaungsu Hluttaw consists of the People's Assembly (Pyithu Hluttaw) elected on the basis of township as well as population, and the House of Nationalities (Amyotha Hluttaw) with on an equal number of representatives elected from Regions and States. The People's Assembly consists of 440 representatives, with 110 being military personnel nominated by the Commander-in-Chief of the Defense Services. The House of Nationalities consists of 224 representatives with 56 being military personnel nominated by the Commander-in-Chief of the Defense Services.

Myanmar is divided into seven regions (previously called divisions) divisions (taing) and seven states (pyi-nè), classified by ethnic composition. The seven regions are Ayeyarwady Region, Bago Region, Magway Region, Mandalay Region, Sagaing Region, Tanintharyi Region and Yangon Region; the seven states are Chin State, Kachin State, Kayin State, Kayah State, Mon State, Rakhine State and Shan State. There are also five Self-administrated zones and a Self-Administrated Division "for National races with suitable population".

The Constitution provides that “the Union is the ultimate owner of all lands and all-natural resources above and below the ground, above and beneath the water and in the atmosphere in the Union” and therefore sets the approach for the Government’s management of Oil and Gas resources.

In 2016, Myanmar has 21 ministries under the President as of May 2016 and later extended to 24 ministries in 2017.

2.10.2 Fundamental Laws and Regulations Related to IEE/EIA

The National Environment Policy of Myanmar 1994 is the basis of Myanmar’s environmental statutory framework. This is supported by the 2008 Constitution that empowers Government to conserve Myanmar’s natural environment and enables Parliament to enact environmental laws. Accordingly, the Ministry of Natural Resources and Environmental Conservation (MONREC) has recently enacted the 2012 Environmental Conservation Law and is charged with assessing compliance (see following Figure).

The 2012 Environmental Conservation (EC) Law is based on the “polluter pays principle”, with compensation for environmental impacts to be paid to a fund to be set up by the MONREC. In addition to the framework Environmental Conservation Law, there are several laws with some form of obligations on operators in respect of pollution, disposal, and other harmful impacts on the environment and local society.

Figure 2.10-1 Myanmar National Environmental Conservation Organization Chart

Source: Sustainable Road Map for Myanmar (Dr. San Oo, Environmental Conservation Department, MONREC, 2015)

Note: (12+36) – the former number is the staffs who are working in each section/department and the latter is the quantity of staff to be appointed.

EC Law Section 13 states that the Ministry shall, under the guidance of the National Environmental Conservation and Climate Change Central Committee (NECCCCC), maintain a comprehensive monitoring system and implement by itself or in co-ordination with relevant Government departments and organizations in the following matters:

- the use of agro-chemicals which cause to impact on the environment significantly;
- transport, Storage, use, treatment and disposal of pollutants and hazardous substances in industries;
- disposal of wastes which come out from exploration, production and treatment of minerals, industrial mineral raw materials and gems;
- carrying out waste disposal and sanitation works;
- carrying out development and constructions; and
- carrying out other necessary matters relating to environmental pollution.

The Environmental Conservation Committee (ECC) is a national inter-ministerial committee composed of 37 members (including representatives of the MONREC, Ministry of Electricity and Energy, Ministry of Industry, Ministry of Home Affairs, Ministry of Labor, Immigration and Population) with the following responsibilities:

- general management: (i) procedures and management systems to identify, control, prevent or minimize all adverse impacts, (ii) procedures to ensure compliance with all environmental commitments, (iii) procedures to implement the measures described in the EMP, Construction Phase EMP, and/or Operational Phase EMP, as the case may be, (iv) procedures to improve the environmental performance of the Project, (v) organization with qualified environmental personnel, v) Documentation and reporting procedures;
- emissions: (i) emissions not allowed, (ii) emission limit values in terms of types, substances, loads, concentrations, rates, timing, duration, frequency, seasons, project phase, (iii) emission points, (iv) form and media, (v) recipients, (vi) contribution to environmental quality standards, (vii) statistical methods for determining compliance;

- use of energy and natural resources: amounts, type, origin of resource, rates, effectiveness of use, waste generation;
- pollution prevention: effectiveness of production or construction methods or waste Storage and treatment facilities to (i) prevent or, where this is not practicable, to minimize pollution, and to (ii) prevent or minimize the risk of pollution;
- nature conservation and management: (i) sites, environments or species, (ii) effectiveness of environmental measures to prevent or minimize adverse impacts on certain environments or species;
- hazardous or toxic materials including waste: (i) limits to the types, categories, and amounts, (ii) methods and systems of collection, Storage, handling, transport, treatment and disposal;
- waste management: (i) limits to the types, categories, and amounts of waste (liquid, solid, atmospheric) generated, (ii) methods and systems of collection, Storage, handling, transport, treatment and disposal, iii) recycling or reuse of waste;
- transport and access: (i) access points, (ii) means of transport of materials and people to and from the Project, (iii) transport routes for products, materials or waste, (iv) access control measures;
- decommissioning, rehabilitation, clean-up and closure: (i) sites, areas /environments and facilities, (ii) objectives and standards, (iii) site conditions and after use, (iv) timing, (v) controls and monitoring;
- control measures: (i) prevention of accidents, (ii) measures and procedures in case of accidents, incidents, and operational irregularities, (iii) control and maintenance of pollution prevention / minimization measures, (iv) safety zones;
- monitoring: i) parameters, ii) methods, iii) sampling and analyses, iv) point of monitoring, v) frequency, vi) timing, vii) data management, viii) maintenance and control of monitoring equipment, ix) documentation and reporting;
- documentation and reporting: (i) parameters and issues that must be documented and reported, (ii) types and methods, (iii) frequency and timing, (iv) quality controls, (v) recipients;
- financial guarantee: (i) type of guarantee, (ii) amount, (iii) timing, (iv) application, (v) type and financial capacity of guarantor; and
- funding of inspection by the Ministry: (i) amounts, (ii) payment procedure, (iii) timing and frequency.

2.10.3 The Implementation Organization for EMMP

The organization chart for implementation for EMMP is shown in Figure 2.10-2. The contractor HSE manager is responsible for implementation of EMMP, support of the community, CSR activities etc.

The Main Tasks for Environmental and Social Consideration in U Energy is shown in the Table 2.10-1.

Thaketa HSE Organization Chart

Figure 2.10-2 Organizational Structure for Implementation of EMMP in UREC

Table 2.10-1 Main Tasks for Environmental and Social Consideration in UREC

Division/ Section	Main Tasks
Environment, safety and health section	1) Monitoring the factory operations according to EMP and EMoP, and; 2) Submitting environmental monitoring reports to ECD.
Community relation division	1) Grievance Adjustment - Handling complains/ claims/ requests from community and its response as necessary - Coordinating between tenant and community for grievance adjustment 2) Planning and implementation of CSR activities 3) Consultation with community relation 4) Job matching and assistance

Source: UREC

Myanmar Investment Commission (MIC) has already issued permission letter (Permit no. 1157/2016) on 19th September 2016 to UREC. So, the institutional arrangement for construction and operation period will be proposed as follows.

During construction and operation stage, UREC will implement environmental mitigation measures and submission of monitoring report biannually in accordance with the commitment in the EMP chapter in ESIA report.

CHAPTER III

DESCRIPTION OF THE PROPOSED PROJECT

3.1 General

The Government of the Republic of the Union of Myanmar has announced the policy of encouraging and promoting the development of independent power producers for generating electricity to meet electricity demands in the Republic of the Union of Myanmar. The Tharketa gas-fired combined cycle power plant project is a joint venture between China's Union Resources and Engineering Co (UREC) and Myanmar's Ministry of Electricity and Energy (MOEE). A memorandum of understanding for the project was first signed in January 2013 and a subsequent agreement inked in November 2014.

After singing the MOU, UREC have conducted feasibility studies and environmental and social impact assessments of the Power Plant (collectively, hereinafter referred to as the "FSR"). The project is to be developed in two phases:

Phase I: 106MW

Phase II: 380MW

On November 14 of 2014, DEPP and UREC-EI have entered into a Memorandum of Agreement for the Build, Operate and Transfer of the 500 MW Combined Cycle Power Plant in Yangon (Tharketa), Myanmar.

DEPP and UREC-EI, pursuant to the MOA, entered into a Joint Venture Agreement to incorporate a private limited liability company named U-Energy Tharketa Power Company Limited in accordance with the Myanmar Companies Act, 1914 and the Special Company Act, 1950 for the purpose of jointly developing the Project.

The Project Phase I is planned to be put into commercial operation at the beginning of 2018. Up to December of 2015, the development Phase I Project is keeping going. However, the gas supply can just meet the gas consumption requirement of the 109MW unit of Phase I Project. Yangon General Station of Natural Gas presently has no margin to supply natural gas for the 380MW unit of Project Phase II. Therefore, the Phase I Project should be developed firstly. When there is enough natural gas can be supplied to Project Phase II, it will be developed at once.

Phase I power plant is connected to the Tharketa substation through two-circuit 230/66kV line. For this substation and transmission project, the MOEP is the executing agency (EA), while the Myanmar Electric Power Enterprise (MEPE) is the implementing agency (IA).

The JV received an operating license in January 2016.

The 106-megawatt (MW) Tharketa gas-fired combined cycle power plant is located in Yangon Region. The plant, about 10 kilometers from Yangon and 16 kilometers from Thilawa Special Economic Zone, is the largest power plant in Myanmar.

The 106 MW project is the first phase of the about 500 MW's joint venture project named U Energy Tharketa Power Co. Ltd. established by the department of electric power management of Myanmar and UREC and will be operated under build-operate-transfer (BOT) system. JVA (Joint Venture Agreement) was signed on 22-9-16 and MOEE can get 3% free share for this project. U Energy Co., will perform 30 years for generation and concession period, after that Tharketa power station would be transferred to MOEE.

3.2 Project Location

The plant site locates at Tharketa Township that is 10km east of urban area of Yangon. It is 1.1 kilometers in straight-line distance away from Ngamoeyeik River that is in the north and it is 1.1 kilometers in straight-line distance away from Thanlyin River that is in the south. North of the plant site is closely adjacent to road of urban area of Yangon. Existing Tharketa natural gas power plant is just on another side of the road across the north of the plant site. South

of the plant site is closely adjacent to railway of which the south is residential area. Both east and west of the plant site are dense residential areas.

The location of the Phase I 106 MW power plant is shown in Figure 3.2-1 and the coordinate of plant boundary is shown in Table 3.2-1.

The present project site is relatively flat but levels across the site to the south east of the existing power station. As the area is part of the flood plain built by the Pazundaung (Ngamoeyeik) Creek and the Bago River. The land is generally flat and low. The entire area is less than 10 meters above sea level. The summary of project description of Yangon Tharketa Combined Cycle Power Plant is presented in the following paragraph.

Table 3.2-1 The Coordinate of the Power Plant Boundary

No.	Longitude	Latitude
A	96º13'34.56"E	16º48'39.65"N
B	96º13'44.81"E	16º48'44.91"N
C	96º13'49.68"E	16º48'43.38"N
D	96º13'38.39"E	16º48'37.91"N
E	96º13'38.12"E	16º48'38.51"N
F	96º13'37.00"E	16º48'38.61"N
G	96º13'36.54"E	16º48'38.11"N

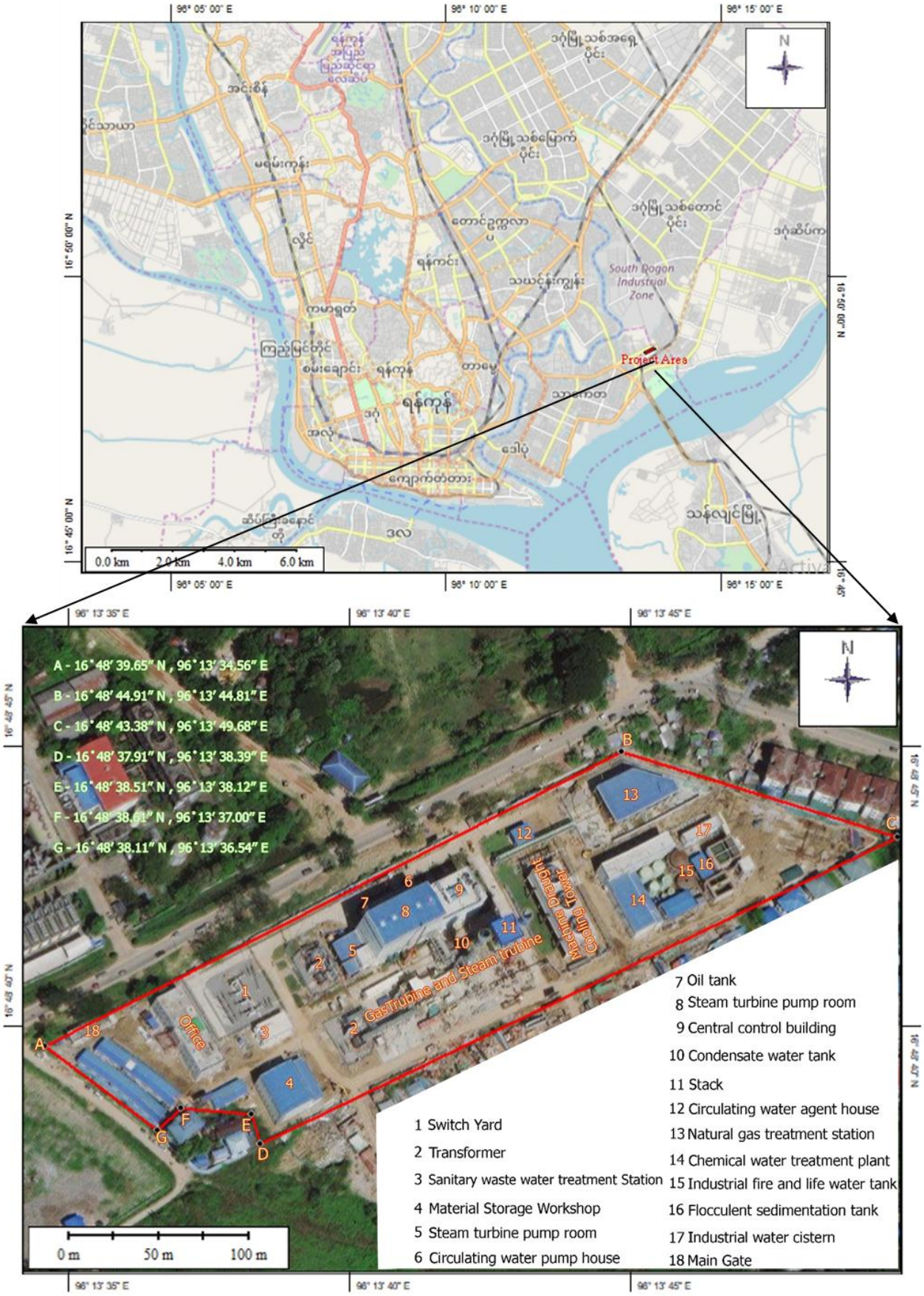


Figure 3.2-1 Location of the Phase I 106MW Power Plant

3.3 Project Profile

Yangon is the economic, industrial center and the transportation hub of the Union of Myanmar. At present, with continuous expanding of economy, fast development of industry and improvement on people's living standard in Yangon, its electric power demand also keeps rising and the imbalance between supply and demand becomes increasingly conspicuous. The construction of a power plant near Yangon can fill the gap between power supply and demand. Therefore, ***Union Resources & Engineering Company Limited*** proposed to invest in construction of a gas-steam combined cycle power plant in Tharketa Yangon.

3.3.1 Source of Fund

30% equity fund and 70% of financing loan from bank.

3.3.2 Construction Scale

The Project falls into two phases and the final power capacity is 500MW. Phase I will be built with **installed capacity of 72MW+34MW=106MW**, which consist of one 6FA Gas Turbine & Generator and one Steam Turbine & Generator, using one-drive-one combined cycle. Besides, under the local environment condition and present available natural gas, the actual output shall be **62MW+31MW=93MW at natural gas available volume of 18mmcf/d**.

The construction period for the 106 MW plant is lasted two years and power production has already started in March 2018. According to the agreement, the company will operate the plant for 30 years with 20 million cubic feet of gas to be supplied per day from Zawtika offshore gas field. After completion of the project of 500 MW plant, it will meet Yangon's power demand of 720 million kW annually, according to the company. The power consumption of Yangon region, which constitutes half of the country's total, stands high annually and is expected to reach about 1250 MW in this 2016-2017 fiscal year compared with the fiscal year 2011-2012 when the figure was 690 MW. At present, the total production of the power plants in Yangon cannot meet the demand as the four state-owned power plants in the commercial city had been used for 20 years.

A combined-cycle gas power plant in Tharketa Township will begin operations as scheduled in the first quarter of 2018, according to a statement released by General Electric (GE) earlier this month. The plant will be powered by GE's renowned F-class gas turbines, producing 106 megawatts of energy when complete in 2018. A joint venture between China and Myanmar, the plant is currently being constructed by China's SEPCOIII Electric Power Construction Corp.

SEPCOIII will use GE's 6F.03 gas turbines for the combined-cycle system. A combined-cycle power plant uses both a gas and a steam turbine together to produce up to 50 percent more electricity from the same fuel than a traditional simple-cycle plant. The waste heat from the gas turbine is routed to the nearby steam turbine, which generates extra power.

Table 3.3-1 shows the project timeline of the Tharketa gas-fired combine cycle power plant. Figure 3.3-1 shows the present condition of the Tharketa Power Plant.

Table 3.3-1 The Project Timeline of the Tharketa Gas-Fired Combine Cycle Power Plant (Phase I)

No.	Date	Description
1.	January 2013	A memorandum of understanding signing date
2.	November 2014	A memorandum of agreement signing date
3.	25 January 2016	Power Purchase Agreement signing date
4.	May 2016	Construction commencement date
5.	22 September 2016	Joint Venture Agreement date

6.	19 December 2016	MIC Permit Issued Date
7.	February 2018	Construction completion date
8.	28 February 2018	Commercial operation date

Figure 3.3-1 A Full View of the Tharketa Power Plant

Tharketa substation located at the north-west of The Tharketa Gas-Fired Combined Cycle Power Plant, about 500m away with a city road between them. There are 11kV, 33kV, 66kV, 230kV power system within the Tharketa substation which is an important substation in Yangon.

According to the site investigation, the connection of 66kV system in Tharketa substation is double-busbar, outdoor AIS. There are twelve (12) incoming/feeder bays in this 66kV system. At the extension side of 66kV bus-bar, there are more than three (3) spare-bay rooms. Now, some equipment supports and equipment is installed on the spare bays which are not in operation.

UREC will build three (3) incoming bays at the extension side of the existed 66kV busbars right on the area of spare bays. The newly built bays will be connected to the 66kV GIS in the Tharketa Gas-Fired Combined Cycle Power Plant. The newly built bays will be outdoor GIS that bus-bar will be connected to the existed busbar in Tharketa substation.

3.3.3 Land Ownership and Acquisition

The plant site can be divided into west land and east land (See in Figure 3.2-1 and 3.3-1). The latter is dominated by refuse landfills, while the former is made of farmlands and wastelands with a few trees and crops as well as ponds partially at present. The land is owned by Ministry of Electricity and Energy.

3.3.4 Geotechnical Engineering Condition

The plant site is heavily affected by Sagaing fracture zone, but the construction site is more than 20km away from Sagaing fracture zone. Therefore, it meets requirement of anti-collision distance for construction site specified in the relevant regulations and standards and the plant site is proved to be suitable for construction.

3.3.5 Site Clearance

Site clearance activities include clearing the land of vegetation, fencing the project boundary and site levelling. Internal site roads will be constructed as the site levelling will require a number of heavy trucks to bring infill to the site and remove unnecessary material.

3.3.6 Site Development and Construction

One plan shall be adopted for the project which is divided into two phases. Project Phase I shall be planned and arranged in the place which is not a garbage yard as much as possible and be away from residential areas and water pool. Project Phase II will occupy a relatively large area, and most of the existing garbage yards will be used. The garbage in the planned plant site shall be cleaned out completely.

According to the status quo of plant site and the surrounding situation, the electrical outlet can be directly connected to the booster station of Tharketa Power Plant on the north side of the planned plant. The incoming road shall be connected from the adjacent municipal road. The outlet and transport conditions are good.

The natural gas needed for the power plant shall be connected form the nearby natural gas station. The route of the natural gas pipe shall be the same with the gas supply pipe of Tharketa Power Plant, and the natural gas pipe can be laid based on the corridor of the original pipe.

Water supply of the plant area shall be carried out temporarily according to the municipal water supply system. Chemical water treatment system and circulating cooling water treatment system shall be set in the plant area.

General Layout Plan of Plan Area (Scheme I):

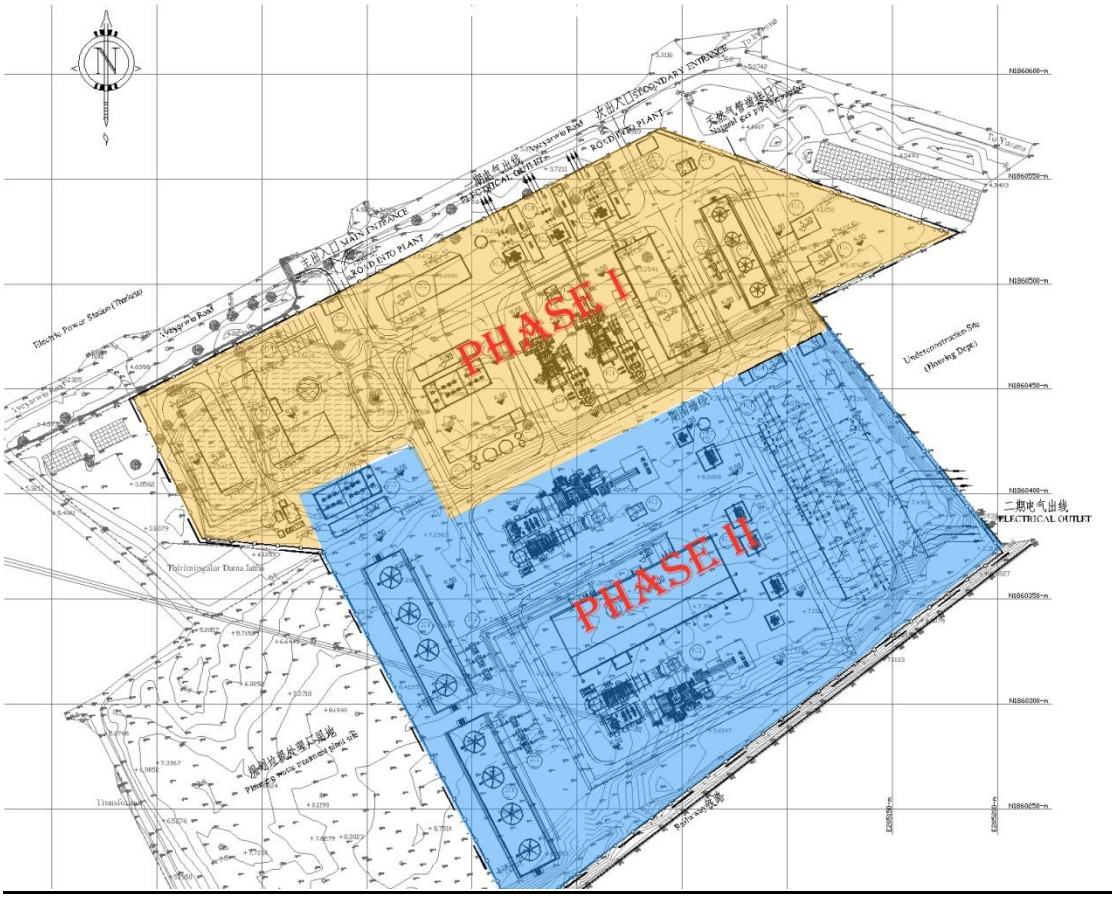


Figure 3.3-2: Layout Plan of Plant Area

3.3.6.1 Construction Site Conditions and Site Planning (Phase I)

The construction site in Phase I is mainly arranged on the garbage yard on the southeast side of the plant area. The available area of the garbage yard is about 4.50hm^2. The area of construction production land is 3.60 hm^2, and the area of construction living quarters is 0.42hm^2. According to the principle of optimized layout, construction production and installation area shall be arranged at the expansion end side of the project plant area. The area of planned land is 3.60 hm^2, the construction living quarters arranged in the planned land of Project Phase I is 0.42hm^2 in area, and the construction organization shall rent the nearby land to make up for the insufficient land of construction living quarters.

The number and area of each buildings that constructed during phase I is shown in the Table 3.3-2.

Table 3.3-2 Number of Buildings and Land Area for Phase I

NO.	Name of buildings and constructions	Number of floor levels	Area (m^2)	Story height (m)	Construction type
1	Steam turbine hall	1	935.5	24.4	Steel Frame
2	Central control building	3	1560	13.5	Reinforced concrete structure
3	Natural gas treatment station	1	600	6	Steel Frame

NO.	Name of buildings and constructions	Number of floor levels	Area (m^2)	Story height (m)	Construction type
4	Supercharged transducer room & natural gas regulating station control room	1	114	5	Reinforced concrete structure
5	Chemical water treatment plant	2	2299.2	7/5/9.6	Steel Frame
6	Dormitory	5	2200	16.65	Reinforced concrete frame-shear wall structure
7	Material storage and workshop	1	600	9/4	Steel Frame
8	Administration office building	2	1612.8	9.25	Reinforced concrete structure
9	66kV switchyard electric building	1	126	5	Reinforced concrete structure
10	Main guard house	1	50	4	masonry structure
11	Side guard house	1	20	4	masonry structure

3.3.6.2 Structural System and Structural Type Selection

In Phase I, the length of steam turbine room is 57m, the span is 18m, and chemical water and electrical equipment room is arranged in steam turbine room; in Phase II, the length of steam turbine room is 85m, the span is 21m, the span of chemical water and electrical equipment room is 9m. Steel structure is adopted for all the above.

Mass reinforced concrete foundation or non-reinforced concrete foundation shall be adopted as the foundation of condensate pump and other auxiliary apparatus.

Mass reinforced concrete foundation shall be adopted as the foundation of gas turbine, heat recovery steam generator, bypass chimney and tail chimney.

Steel structure shall be adopted as the supports of steam generators, bypass chimneys and tail chimneys, and the supports shall be designed and supplied by the manufacturers.

Galvanized anti-corrosive steel pipe truss column structure, triangular lattice steel girder and reinforced concrete cup foundation shall be adopted for the outdoor power distribution device and booster station framework. Galvanized anti-corrosive steel pipe supports shall be adopted as the supports of equipment. Reinforced concrete mat foundation shall be adopted as the foundation of main transformer and station transformer. Chemical water workshop shall be arranged outdoors, and the light steel-structure canopy shall be adopted on the ground. The project shall be phased. Cast-in-situ reinforced concrete structure shall be adopted for outdoor structures. Underground reinforced concrete water pool shall be adopted as wastewater pool. The light steel-structure canopy shall be adopted on the ground.

Cast-in-situ reinforced concrete structure shall be adopted for Production Office Building, Material Building, Comprehensive Maintenance Building and other ancillary buildings.

The detailed plan of construction and operation of the phase 1 and phase 2 are presented in Appendix 1 and 2. The business plan of the Phase II is presented in Appendix- 3.

3.3.7 Seismic Design of Main Buildings and Structures

Under general (medium-hard) site conditions, the seismic peak ground acceleration of the site exceeding the probability 10% in 50 years is 0.30g, the corresponding basic seismic intensity is VIII, and the design seismic group belongs to Group II. According to the topography and stratum lithology, and based on relevant provisions in GB50011-2010 *Code for Seismic Design of Buildings*, the site soil is of medium-hard type, the building site is of Category III and is located in the area adverse to building seismic resistance.

The Project shall conform to *Code for Seismic Design of Electrical Installations* and the Project belongs to a general power plant. The seismic design of each building and structure in the corresponding plant area has been adjusted as below according to *Technical Stipulation for the Design of Civil Structure of Thermal Power Plant.*

Table 3.3-3 List of Seismic Design for Structures of Main Buildings

S/N	Name of Building	Structure Type Anti-seismic Class	Seismic Fortification Category Seismic Design	Foundation Type
1	Steam turbine room	Horizontal steel frame bent support structure Longitudinal steel frame support structure Anti-seismic Class III	Category C Magnitude-8 seismic fortification intensity calculation Magnitude-8 seismic fortification measures	Pile foundation
2	Steam turbine foundation	Frame structure Anti-seismic Class II	Category C Magnitude-8 seismic fortification intensity calculation Magnitude-8 seismic fortification measures	Pile foundation
3	Gas turbine foundation	Large plate foundation	Category C Magnitude-8 seismic fortification intensity calculation Magnitude-8 seismic fortification measures	Pile foundation
4	Foundation of supports of steam generators, bypass chimney and tail chimney	Large plate foundation	Category C Magnitude-8 seismic fortification intensity calculation Magnitude-8 seismic fortification measures	Pile foundation
5	Chemical water building	Light steel structure Anti-seismic Class III	Category D Magnitude-8 seismic fortification intensity calculation Magnitude-8 seismic fortification measures	Natural foundation
6	Production office building	Reinforced concrete frame structure Anti-seismic Class II	Category C Magnitude-8 seismic fortification intensity calculation Magnitude-8 seismic fortification measures	Pile foundation

7	Material warehouse and comprehensive maintenance building	Reinforced concrete frame structure Anti-seismic Class II	Category C Magnitude-8 seismic fortification intensity calculation Magnitude-8 seismic fortification measures	Pile foundation
8	Power distribution room	Steel frame structure Anti-seismic Class II	Category C Magnitude-8 seismic fortification intensity calculation Magnitude-8 seismic fortification measures	Pile foundation

3.3.8 Foundation and Base

With the influence of liquefied sand layer on the site, for steam turbine room, gas turbine units, power distribution room, main transformer and booster station, production office building, material warehouse and comprehensive maintenance building and other important buildings (structures) which are of relatively large concentrated load and relatively high requirement of deformation, it is recommended to adopt pre-stress high-strength concrete pipe pile. The outer diameter of the pile can be Φ600 and Φ400 for foundation treatment, and the average pile length is 25m. The fine sand layers ③-5 shall be bearing stratum of pile foundation, and the pile shall be relatively deep into the sand, so as to eliminate the adverse influence of liquefied sand. Based on consideration of influence of sand liquefaction, the suitability of natural foundation shall be fully considered. Natural foundation can be adopted as the foundation of the canopy of chemical water workshop, the canopy of industrial wastewater, reception office and the buildings (structures) with small toilet load and low deformation requirements. Filled ground, which has been tested and compacted and meets the design requirements, can be adopted as the foundation of ditches in the plant and some light equipment.

3.3.9 Labour and Machinery Information

Table 3.3-4 List of Main Construction Mechanical Equipment for Proposed Project

Sl. No	Item name	Specification	Max Qty	Remark
1	Excavator	220hp	2	Construction Period
2	Mixing machine	/	2	Construction Period
3	Static pressure machine	800t	2	Construction Period
4	Hydraulic static probe	/	2	Construction Period
5	Truck crane	25t/50t	5	Construction Period
6	Crawler crane	50t/65t/120t/250t	4	Construction Period
7	Transportation truck	/	6	Construction Period
8	Bulldozer	/	3	Construction Period
9	Air compressor	/	2	Construction Period
10	Electric Power generator	/	6	Construction Period

Developer and all subcontractors work force included:

S/N	Type of Work	Number of People	Remarks
1	Site Manager	10	
2	Supervisor	22	
3	Helper	43	

4	Welder	36
5	Carpenter	52
6	Operator	40
7	Bar Setter	38
8	Concrete Worker	14
9	Others	32
	Subtotal	**287**

S/N	Type of Work	Number of People	Remarks
1	Leadership members	3	
2	Administration	4	
3	Financial	2	
4	Commercial	2	
5	Procurement	5	
6	Engineering	103	
7	QA/QC	7	
8	LAB	2	
9	Others	16	
	Subtotal	**144**	

3.3.10 Accommodation Plan for workers

Temporary dormitories were built for workers during construction period. There are 44 rooms, and each room can live 8 persons. The local workers who live nearby also can come to worksite in the morning and go back home after duty.

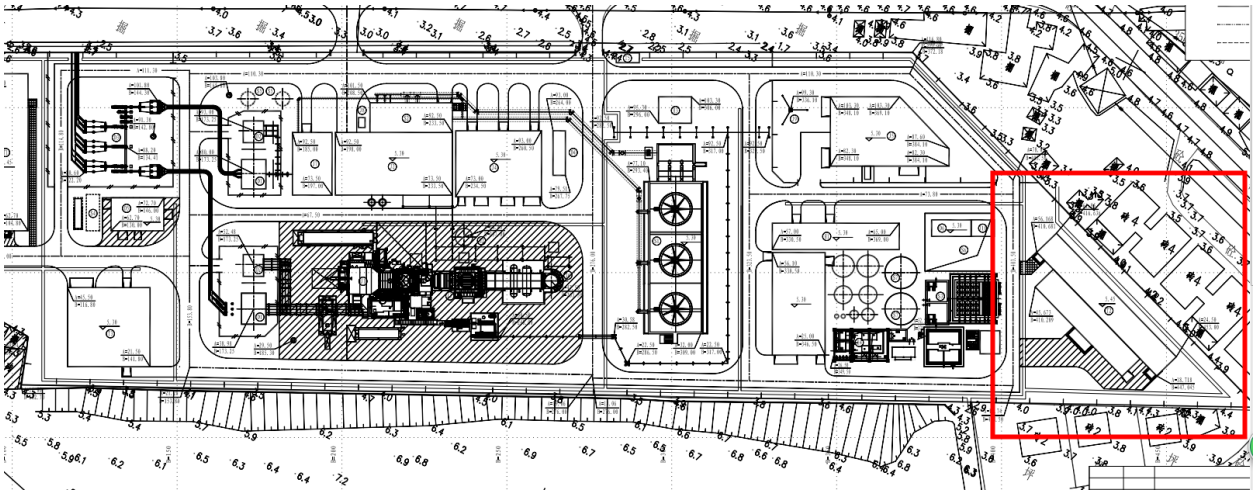
Temporary Dormitory Inspection

The number of workers on site during operations will be about 60 operational employees. These will include plant management and maintenance staff, skilled mechanical and electrical technicians, drivers, medical, quality control, and cleaning staff and a number of experienced plant operators who will operate and maintain the plant, and who are expected to be a mix of expatriate and local staff.

Description	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**…**	**Year 30**
Foreigner staff	35	35	35	30	15	15	…	15
Local staff	25	25	25	30	45	45	…	45

3.3.11 Dormitories for Worker in Operation Phase

Dormitories were built for 60 operational employees in operation phase.



Location of Canteen and Dormitory in Project Layout Plan

Figure 3.3-3 Construction Records of Canteen and Dormitory

3.4 General Layout of Plant Area

Phase I will be built with installed capacity of 106MW (93MW at 18mmcf/d), which consist of one 6FA Gas Turbine & Generator and one Steam Turbine & Generator, using one to one combined cycle. The used plant site land is northwest to southeast direction, and it is slim narrow type area. The length from southwest to northeast is about 400m while southeast to northwest is about 110m away and the total used land area is about 3.33ha.

The main function subarea of Phase I is divided into administrative and service area, auxiliary production facilities area, the main power plant area, switchgear area and the regulator station area.

3.4.1 Technical Conditions of Principal Machine

According to the gas source, Phase I will be built with installed capacity of 106MW (93MW at 18mmcf/d) using Gas-steam combined cycle, class 'F' combined cycle unit is recommended to be used in Phase I. The installed proposal shall adopt one to one multiple-shaft scheme, that is one class '6FA' Gas Turbine & Generator, one Heat Recovery Steam Generator, one Condensing Turbine.

Dual pressure and horizontal waste heat boiler and Dual pressure, simplex condensing steam turbine will be used in Phase I.

3.4.2 Technical Specifications of Principal Machine

Phase I is designed using multiple-shaft combined cycle unit, which is consist of Type 6FA Gas Turbines fabricated by GE corporation. The installed proposal shall adopt one to one multiple-shaft scheme, that is one class '6FA' Gas Turbine & Generator, one Heat recovery steam Generator, one Condensing Turbine. The unit equipment parameters that under ISO condition and site actual annual mean meteorological condition are listed separately as follows.

Gas Turbine adopts uniaxial, heavy industry, its type is 6FA with 79MW ISO outlet and 74MW actual outlet.

Waste Heat Boiler adopts dual pressure, horizontal boiler with steam bypass system and T-type arrangement with Gas Turbine.

Steam Turbine adopts dual pressure, single cylinder, two-layer, condensing steam turbine. The actual outlet is 35MW with rotate speed of 3000rpm.

S/N	Item	Total of Phase I
1	Single cycle generated output of the single gas turbine (MW)	72
2	Generated output of the steam turbine (MW)	34
3	Installed Capacity (Combine Cycle, MW)	106
4	Actual Output at available natural gas volume of 18mmcf/d (Combine Cycle, MW)	93
5	Heat Rate (LHV) @ full load (kj/kW·h)	10174
6	Heat Rate (LHV) @ 85% load (kj/kW·h)	10640
7	Natural gas LHV (Btu/scf)	840
8	LHV Gross Electric Eff (at 93MW)	51.6%

Notes: 1) Low heating value (LHV) of the supplied natural gas is 840 BTU/SCF (31289kJ/Nm^3);

2) On-site average annual meteorological conditions: average annual temperature is 27.5°C; humidity is 83%; and atmospheric pressure is 101320Pa.

3.4.3 Electrical Scheme

In Phase I, two-circuit 66kV outgoing line will be considered, one circuit connects Gas Generator outlet busbar to Tharketa substation through one 90MVA step-up transformer, and the other one connects Turbine generator outlet busbar to Tharketa substation through one 40MVA step-up transformer. There will be circuit breakers for each generator outlet.

The Gas Turbine starting system power supply shall use 66kV system power source, which is obtained from main transformer step-down. When the 66kV system power source is unavailable, diesel generator set is used for black starting.

Phase I generator outlet voltage is 11kV, the Non-Segregated Phase Bus Duct is used for connecting from generator to outlet busbar section and outlet busbar section to main transformer LV side.

HV Auxiliary Transformer will not be set in Phase I, there shall be one 11kV busbar at Gas Turbine Generator and Turbine generator separately. HV and LV load shall supply power by unit separately. Besides, bus coupler is used to connect 11kV busbar sections.

Phase I will supply power by unit separately, each unit has one LV work transformer, HV side of LV work transformer is connected with 11kV busbar of corresponding unit. Local MCC power is supplied by LV work PV section of turbine.

The main transformer is placed outside Main Power House in Phase I and HV side of main transformer shall connect step-up switchyard by HV cables.

3.4.4 Thermal Automation

Central control manners are adopted in Phase I. Distributed central system (DCS) is adopted for the unit, digital electro-hydraulic control system (DEH) for the steam turbine, and centralized control room (CCR) for startup, stoppage, monitoring and controlling, and accident handling and management of combined cycle units.

Gas Turbine control system shall be designed and supplied by Gas Turbine manufacturer. Operator cab, engineer station and its control cabinets will be set in local control room. And the control system access to the DCS network by the means of communication. Besides, there is remote operator cab in centralized control room for remote monitoring.

3.4.5 66kV Transmission System

The 66kv transmission system (including two 66KV transmission lines) will be constructed by Union Resources & Engineering Company Limited (UREC) with the approval by Ministry of Electricity and Energy (MOEE).

Tharketa substation 66kV bays which are about 350 m away from Tharketa Gas-Fired Combined Cycle Power Plant will be built outside the project area for the connection of the new plant. Raw water intake pipe be built outside the project area connection to the Ngamoeyeik (Pazundaung) Creek which is about 2km to the northeast of the plant. Nature gas intake pipe be built outside the project area connection to the government MOGE gas station which is about 235m to the northeast of the plant.

Figure 3.4-1: 66kV Transmission Line and Gas Intake Pipeline

3.4.5.1 Main Electrical Connection and Selection of Equipment

The selection of equipment will be based on the EPC Contract Attachment 20-Transmission Facilities.

66kV CB 1600A, 40kA

66kV DS 1600A, 100kA (peak)

66kV Main bus-bar 1600A, 40kA

MOA: Y10W5-90/224 (Outside of GIS)

The creeping distance of outdoor 66kV switchgear shall be equal to 31mm/kV (minimum of creepage resistance) × maximum operating voltage of 66kV system (72.5 kV).

3.4.5.2 Layout of 66kv GIS Extension of Tharketa Substation

Three (3) incoming bays will be arranged one by one at the extension side of the 66kV busbars. The busbar of GIS will be led out through bushing. The aluminum cable steel reinforced (ACSR) will be used to connect the GIS busbar bushing and the Tube-Busbar existed.

3.4.5.3 Cable Layout between Tharketa CCPP and Tharketa Substation

The 66kV power cables shall be of XLPE insulated, copper core, 800mm^2.

At the Tharketa CCPP, cable trench will be used to layout the 66kV cable.

Cable conduits (non-magnetic) will used to cross the city road.

Directly buried cable will be used in the area of Tharketa substation.

3.4.6 Natural Gas Supply

3.4.6.1 Fuel Source

Phase I is planned to use natural gas from the existing gas pipeline (the length of pipeline is 235m) of MOGE Tharketa Gas Station that was produced by Zaw-Ti-ka Gas Field of Myanmar.

3.4.6.2 Fuel Analysis

Low heating value (LHV) of the supplied natural gas is 840 BTU/SCF (31289kJ/Nm^3).

3.4.6.3 Fuel Consumption

The natural gas consumption of Phase I project analyzed and calculated on the basis of mentioned natural gas composition is listed below:

Natural Gas Consumption

Energy (Natural Gas) Consumption and Greenhouse gas emission

Unit Size	Daily Gas Consumption (24h)	Annual Gas Consumption (7,000h)	Greenhouse gas emission
Phase I	19.85mmcf/d	5789mmcf/y	300,000t/y
Phase II	79.4mmcf/d	23154mmcf/y	1,200,000t/y

Notes: The calculation principles of unit gas consumption based on Low heating value (LHV) of the supplied natural gas is 840 BTU/SCF (31289kJ/Nm^3

3.4.7 Gas Pipeline Route

The natural gas pipeline from gas transmission station to power plant is to be buried underground. The minimum earth cover is no less than 1.4 meters. The design of natural gas pipe is according to ASME B31.8 gas transmission and distribution piping systems. The design pressure and temperature of natural gas pipe from gas transmission

station to power plant are 4.0 MPa (g) and 60°C respectively. The outside of natural gas pipe above ground painted with primer and finish paints for anticorrosion purposes.

Figure 3.4-2 Gas Pipeline

3.4.8 Emergency Oil System

Two emergency oil ponds will be set at transformers area, oil of transformer and oil tank will be discharged into the emergency oil pond when fire happens, in order that the fire can be controlled. Effective volume for each emergency oil pond is $50m^3$, so that it is able to accommodate the largest transformer oil.

3.4.8.1 Emergency Oil Pond (2 sets)

The volume of the emergency oil ponds will be $50m^3$ and the pond is a round reinforced concrete structure. The diameter is 5.4m and the height is 3.25m. The thickness of the side wall is 0.4m, while the thickness of the bottom slab is 0.5m. The thickness of the top slab is 0.2m. Constructing in open pit.

3.4.9 Transportation

The plant is located at city outskirts of Yangon, characterized by rich surrounding road networks and docks. The nearest dock road is about 5 kilometers away from the plant. In addition, the plant is about 30 kilometers away from Yangon International Airport so that the transportation condition is favorable.

Yangon is the general sea and land traffic hub of Myanmar, both inbound and outbound. There are twelve inland river routes leading to all parts of the delta and the midstream and upstream of Irrawaddy. The Yangon Port is only 34km to the seaport and with the largest throughput of Myanmar. 80% of the freight for the import and export trades of Myanmar around the year passes the port. All railway and highway trunk lines of the country converge here.

Located at the junction of the Inland River and sea transportation, the inland river navigation of Yangon is developed. The Yangon River is 37km long and is deep and wide. There is the Twante Canal westward connected to the trunk flow of Irrawaddy and the Sittaung River system, constituting the busiest inland navigation network of the whole Myanmar centered at Yangon. The Yangon port is deep and broad. It is the largest commercial port of the country and is capable of berthing the 10,000t large oceangoing vessel. It is the seaport of the largest throughput of Myanmar. Yangon is also the intersection of the national railway and highway with also 34 flight courses leading to the main cities of the country. The Mingaladon Airport 21km away in the north suburb is an important domestic and international airport, also one of the best civil airports of Asia.

At this stage, it is planned to import the equipment from China. After careful investigation, Yangon port has the capacity to anchor and crane the heavy cargos of this project. The distance from port to plant site is short, and there is no proper rail discharging station near the plant site, so it is suggested to transport them by truck. According to onsite path investigation, roads and bridges in Yangon can basically satisfy the requirements.

3.5 Water Supply and Drainage System

3.5.1 Design Principles

1) All hydraulic structures are designed to meet the requirements for the 106F Combine Cycle Gas Turbine Power Plant.
2) The source of make-up water is Ngamoeyeik (Pazundaung River) water.
3) The circulating water system shall be designed as secondary circulating water supply system with mechanical draft cooling tower.
4) Potable and drinking water are from reverse osmosis water.
5) In the design process of water management and water balance, some principles just as water conservation, multi-purpose use, comprehensive utilization and water reuse must be implemented.
6) Main circulating water of the plant is Ngamoeyeik (Pazundaung River) water after treatment; auxiliary equipment are cooled by demineralized water, using Plate Heat Exchanger for heat exchange, open cooling water is Ngamoeyeik (Pazundaung River) water after treatment.

7) Rain water system and sanitary sewage water system are designed as independent pipeline (or trench) system. The rain water is discharged to the drainage trench near the plant by channel.

3.5.2 Design Scope

1) Design of circulating water system

2) Design of raw water treatment system

3) Design of service, potable and drinking, firefighting, reuse water system

4) Design of sanitary sewage water system

5) Design of CW drainage system

6) Design of emergency oil system

3.5.3 Raw Water Source

The plant uses secondary circulating water supply system with mechanical draft cooling tower, make-up water is blind side of the Ngamoeyeik (Pazundaung River) which is about 2km to the northeast of the plant.

3.5.3.1 Make-up Water System

Makeup water supply system consists of pumps, supply pipes (valves) and the treated water pond.

Make-up water is blind side of the Ngamoeyeik (Pazundaung River), make-up water pontoon will be set beside the river.

3.5.3.1.1 Make-up Water Pontoon

The pier of floating pontoon (1 set) will be a reinforced concrete structure. The dimension is L×B×H= 10.4m×8m×(2.3~4.2)m (net values). Constructing in open pit.

A floating pontoon will be designed to lift the Ngamoeyeik (Pazundaung River) water to raw water treatment plant in the plant. Two intake lift pumps are provided (One work and the other standby), each pump flow is: q=400 m^3/h, H=20m, motor power is 45 kW.

The floating pontoon will be steel structure and assembled on site. The main data of the pontoon are listed in the following schedule:

ITEM	DATA	REMARKES
Length of pontoon	29.50 m	
Width of pontoon	11.50 m	
Height of board	1.70 m	
Water line	0.85 m	
Tonnage of pontoon	239 t	

The intakes will be equipped with screen and pump suction pipe will be installed with filter to exclude waterborne debris from entering the system. Universal joints will be provided to allow for variations in the water level at the site will connect the pumping equipment to riverbank pipes. A crane with capacity of 2t will be provided also to convenience installation and maintenance.

The floating pontoon will be securely anchored and equipped with navigation mark for marine requirement.

Figure 3.5-1: Floating Water Pontoon

3.5.3.1.2 Intake Water Pipeline

Make-up water will be supplied by make-up water pumps to the raw water basin and then lift to the raw water treatment plant. After treatment， the water will drain to the cooling water pond and chemical raw water basin.

We will set two DN300 steel reinforced HDPE pipe with the length of about 1.5-2 km, flow rate of each pipe is about 1.18 m/s.

Figure 3.5-2: Raw Water Pipeline

3.5.3.2 Municipal Water

The boiler make-up water and Turbine Condenser circulating cooling water are both supplied from Yangon municipal water pipe network.

Reverse osmosis desalination treatment process is used in boiler make-up water treatment system, that is two-stage reverse osmosis desalination system, each system will use parallel header operation mode.

Two 150m^3 Desalted water tank are used in Phase I to satisfy water demand during unit startup and accident conditions.

3.5.3.3 Water Quality Data

Water quality data of the Ngamoeyeik (Pazundaung) River blind-side is shown in Table 3.5-1 (currently no detailed analysis of water quality data, the following data is only for reference).

Table 3.5-1 Water Analysis Data

Item	Unit	Reference values
Na^+	mg/L	779
Ca^{2+}	mg/L	50.7
Mg^{2+}	mg/L	79.58
pH(24℃)	mg/L	7.26
Suspension	mg/L	205.40
Cl^-	mg/L	1277.26
HCO_3^-	mg/L	139.12
Carbonate hardness	mg/L	2.28
Conductivity（25℃）	US/cm	7690
Dissolved solids	mg/L	2370.40

3.5.3.4 Raw Water Basin (1 Set)

The raw water basin will be a reinforced concrete structure. The dimension for each is L×B×H= 27.4m×19.7m×4m (net values). The thickness of the side wall is 0.4m, while the thickness of the bottom slab is 0.7m. The thickness of the top slab is 0.2m. Constructing in open pit.

In order to improve the reliability of water supply, in accordance with contract requirements, a 2000m^3 rectangular reinforced concrete reservoir will be set as raw water basin that can satisfy the demand of the unit operation for 6.5 hours.

3.5.3.5 Raw Water Pretreatment System

Make-up water will be conveyed into raw water treatment plant directly when it is supplied to the power plant and lifted by the pump in the raw water basin， treated water can meet water quality requirements of circulating cooling water.

Flocculation and sedimentation pond consists of mixing equipment, flocculation strengthening process equipment, precipitation process equipment and structure, it is divided into cohesion area, precipitation area, concentrated areas, and sludge disposal systems, turbidity is generally stable at 3NTU below, water quality is good. Its main process ： Inline mixer—star type flocculation. Treated water flow into raw water basin and cooling tower basin by gravity.

Design water quantity of make-up water for the project is 299m^3/h， there are one set of flocculation and sedimentation basin, capacity of the basin is 150m^3/h.

3.5.3.5.1 Water Treatment System

Because water source and quality are basically in good condition and can satisfy industrial water requirement of entire plant, pre-treatment of plant supplementary water is not considered in this stage. The following procedure is considered to be adopted for steam generator feed water:

Water supply: inflow from special industrial water pool → ultra-filtration device → Class I reverse osmosis device → reverse osmosis water tank → Class II reverse osmosis device → sweet-water tank → main power house.

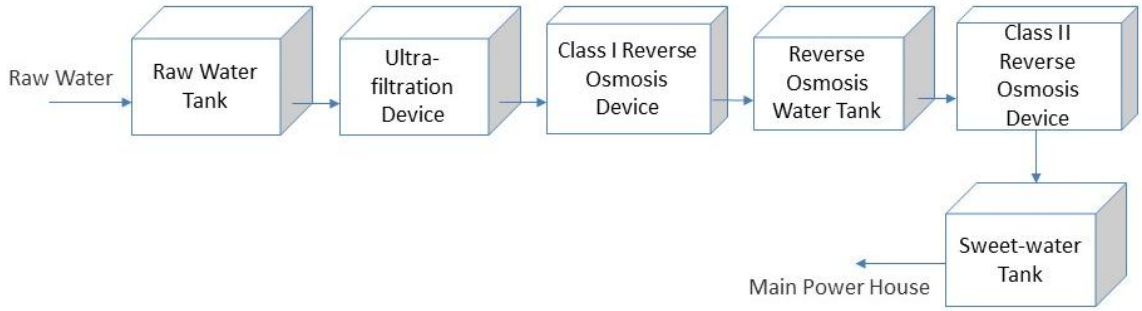


Figure 3.5-3: Water Treatment System

In consideration of high silica content in water inflow, recovery rate of reverse osmosis should be properly reduced as for treatment system of steam generator feed water to prevent silica scale formed at concentrate side. Recovery rate is considered as 70% for Level I RO, 85% for Level II RO and 90% for UF.

Normal output of Project Phase I system is 16t/h. Set a row of device with output of 20t/h. The system is set with two high-capacity sweet-water tanks (V=150m^3) to supply start and emergency water demand.

The system is adopted with PLC program control to reduce labor intensity of operators.

3.5.3.5.2 Chemical Dosimeters System

Ammonification is adopted for supplied water to adjust pH value and the dosing point is set on outlet main pipe of deaerator. Hydrazine is added in condensed water for treatment and the dosing point is set on outlet main pipe of deaerator. Phosphate is added in steam generator water for treatment and the dosing point is set on steam pocket.

In Project Phase I, one ammonification device, one hydrazine-dosing device for condensed water and one phosphate-dosing device are set. The devices above are arranged in sampling and dosing room at front end of steam turbine. Meanwhile, chemical water and test room is also set.

3.5.4 Water Consumption of the Plant

Table 3.5-2 Make-Up Water Quantity

NO	Item	Unit (m^3/h)	Remarks
1	Evaporation of the cooling power	120.9	
2	Drift of the cooling power	9.6	
3	Blowdown of the cooling power	111.3	
4	Service（For chemical）water	16	
5	Potable water	5	
6	Self-water consumption of raw water treatment station	16.2	
7	Unforeseen loss water	20	
8	Total	299	

After calculation, the average make-up water consumption under the design working conditions is about 299 m^3/h, water balance of the whole plant see 40-FA09082C-S-03. The total quantity of make-up water is $215.28x10^4$ m^3 for a year for the plant.

3.5.5 Measure of Saving Water

The cooling water system of auxiliary equipment in the main building will be adopted the closed circulating water system with Dem water. The heat will be exchanged by the CW water through the closed heat exchanger. Examine and control will be adopted at different water supply system and discharged system. The measure facility will be installed such as meter, control valve of water level to convenient manage and monitor, and to avoid polluting the water.

3.5.6 Circulating Water System

3.5.6.1 System Description

The plant use secondary circulating water supply system with mechanical draft cooling tower, make-up water is from the Ngamoeyeik (Pazundaung) River which is after treatment, cooling water for condenser and water-heat exchanger is supplied by CW system, so that it can run correctly in the design of the assessment conditions（Dry bulb temperature –27.5℃, Relative humidity --77%, Atmospheric pressure--1.0129 bar）.

CW system includes cooling tower, CW pump, CW pipeline (ditch), its process is as follows：

Outlet of the cooling tower basin——Trash rack——Absorbent forebay——Brush screen cleaner——CW pump——CW pressure steel pipe——Condenser/ water-heat exchanger——CW drainage pipe——Cooling tower.

Dosing system for circulating water sees chemistry chapter.

Water supply system sees40- FA09082C-S-02.

3.5.7 Circulating Water Quantity

Cooling water for condenser and auxiliary equipment use secondary circulating water supply system with mechanical draft cooling tower, cooling multiple is 60, and total cooling water quantity sees Table 3.5-3.

Table 3.5-3 Circulating water quantity

Condenser Steam t/h	Cooling multiple	Condenser t/h	Auxiliary equipment t/h	Total cooling water Quantity t/h
133.5	60	8010	1630	9640

3.5.8 Cooling Water Equipment and Pipelines

3.5.8.1 CW Pump

The CW system shall be provided 2 x 50％CW pumps， vertical mixed flow water pumps.

Capacity：1.34 m^3/s

Delivery head: 20 m H_2O

Pump motor power: 400 kW

3.5.8.2 Mechanical Draft Cooling Tower

There will be 3 sets of mechanical draft cooling towers for the 106F combined cycle unit， cooling tower design conditions is rated conditions：

Dry bulb temperature： 27.5°C

Relative humidity： 77%

Atmospheric pressure： 1.0129 bar

Cooling multiple： 60

The total capacity of the cooling tower for the 106F combined cycle unit is 9640 m^3/h， and capacity of each cooling tower is about 3300 m^3/h. Each cooling tower includes fan, drive motor, drive shaft, transmission, fillers, reinforced concrete structure, pool and lifting device for maintenance. The main parameters of the cooling tower is as follows:

Capacity of all cells： 9640 m^3/h

Capacity of each cell： 3300 m^3/h

Inlet water temperature： 38℃

Outlet water temperature： 29.5℃

Fan power： 185 kw

Number of cells： 6 sets

Arrangement of cells： In a line

Tower length (one cell inside) ： 18.4 m

Tower width (one cell inside)： 18.4 m

A basin is provided for 6 cooling tower cells. The basin's height is 2.3m (the effective water depth is 2.0m).

The water level in the cooling tower and make-up water system will be automatically controlled by ball float valve. An overflow pipe with sufficient size will be set to prevent site flooding and connected to circulating water drainage drains system.

Blow-down valves are provided for circulating water drainage system, and it can be controlled from the General Control Room. The blow-down pipe will from the circulating water main supply pipe.

Stairway, platform and access with steel structure are provided to allow safe maintenance access to all areas of cooling tower.

The maximum noise level of cooling tower is 85 db (one meter outside of cooling tower).

The mechanical draft flow cooling tower for each set is 16.8m long by 16.8m wide, and 10.7m high (axes values), reinforced concrete structure.

The underground water basin of cooling tower is 50.4m long by 20.1m wide by 2.3m high (net values), reinforced concrete structure. The thickness of the side wall is 0.3m, while the thickness of the bottom slab is 0.7m. Constructing in open pit.

3.5.8.3 CW Pipe

The inlet and outlet main pipe for CW system will be 1xDN1200 steel pipe independently. The pipes will be laid under the ground with overburdening soil about 2~3m. The material of the pipe is Q235B.The antisepsis will be designed and will be the coating antisepsis and cathodic protection.

3.5.8.4 Crane and Hoist

i) A double girder overhead travelling crane will be provided for maintenance of the equipment in the CW pumphouse.

Lifting weight: 10/5t

Span: 9.5m

Lifting height: 10/12m

ii) One electric hoist is provided for repair and maintenance of the flat steel gate outside the CW pumphouse.

Lifting weight: 5t

Lifting height: 8m

3.5.8.5 Clean and Maintenance Equipment

Circulating water after cooled by cooling towers flow to the forebay of the CW pump station through the CW channel, there are trash racks (size are B×H=2.5×2.0m).In the forebay of the CW pumphouse, there are brush screen cleaners(size are B×H=3.0×5.3m), flat steel gate(size is B×H=3.0×2.0m), and so on, there is also one electric hoist provided for repair and maintenance. Quantity (Containing guides) for the 106F combined cycle unit is as follows：trash rack—2 sets， brush screen cleaner—2sets， flat steel gate—1 set （For maintenance)

3.5.8.6 Outlet Valves of CW Pumps

A DN900 hydraulic butterfly valve is provided at each CW pump discharge pipe; it can also consider as a check valve purpose to stop the water back to pumps to damage the pump.

3.5.9 Design of Hydraulic Structures

3.5.9.1 Circulating Water Pump House (1 set)

The Circulating water pump house is divided into superstructure and underground structure. The superstructure is a reinforced concrete frame structure, which is measured as 16m long by 12m wide by 10.5m high (net values). The structure will be reinforced concrete roof and without enclosures.

The underground structure will be a reinforced concrete structure which is measured as 11m long by 7m wide by 5m deep (net values). The thickness of the side wall is 0.5m, while the thickness of the bottom slab is 0.7m. The thickness of the top slab is 0.2m. Constructing in open pit.

3.5.9.2 Circulating Water Pipe

The main pipe DN1200, in the condition of burial depth of 2.4m, is 160m in length. The material is Q235B and the thickness of the pipe is 12mm with [12a stiffening ring. Strengthened anticorrosive coating will be used for both exterior and interior walls of steel pipe. The pipes will be laid underground with sand cushion and constructing in open pit is adopted.

The branch pipe DN900, in the condition of burial depth of 2.5m, is 70m in length. The material is Q235B and the thickness of the pipe is 10mm without stiffening ring. Strengthened anticorrosive coating will be used for both exterior and interior walls of steel pipe. The pipes will be laid underground with sand cushion and constructing in open pit is adopted.

3.5.9.3 Circulating Water Culvert

The circulating water culvert shall be reinforced concrete structure with section of B×H= (7~7.5m) × 2.0m (net values) in size, length 22m, in the condition of burial depth of 0~2.0m. Constructing in open pit is adopted.

3.5.9.4 Flocculating and Sedimentation Pond (2 sets)

The flocculating and sedimentation pond will be reinforced concrete structure with dimension of L×B×H= 11.9m×7.0m×6.5m (net values). The thickness of the side wall is 0.6m, while the thickness of the bottom slab is 0.75m. Constructing in open pit.

3.5.9.5 Sludge Equalization Pond and Water Recycle Pond (1 set)

The sludge equalization pond and water recycle pond will be reinforced concrete structure. The dimension for each is L×B×H= 2m×2m×4m (net values) and L×B×H= 2m×3m×4m (net values). The two ponds will share one wall. The thickness of the side wall is 0.4m, while the thickness of the bottom slab is 0.5m. The thickness of the top slab is 0.2m. Constructing in open pit.

3.5.9.6 Sludge Concentration Basin (1 set)

The sludge concentration basin will be reinforced concrete structure. The diameter of which is D=5m (net values) and the height is 4.5m (net values). The thickness of the side wall is 0.4m, while the thickness of the bottom slab is 0.5m. Constructing in open pit.

3.5.9.7 Foundations for Steel Water Tank

There will be 2 foundations of industry and firefighting water steel tank. The diameter for each is 10.5m, and the thickness is 0.8m. Reinforced concrete structure, constructing in open pit.

There will be 1 foundation of potable water steel tank. The diameter is 6.3m, and the thickness is 0.8m. Reinforced concrete structure, constructing in open pit.

3.5.9.8 Foundations for Pumps

There will be plain concrete foundations for industry water pump, electric firefighting pump, diesel engine firefighting pump, firefighting voltage regulated device, dehydration and so on. The foundation s will be lay in the open air. Constructing in open pit.

3.5.10 Potable Water System

The potable water system will be set to offer potable water for the whole plant. Potable water will be come from chemical water treatment plant, and then supplied to each consumption point for washing or drinking after chlorination and re-mineralization filter. The system consists of the following processes:

Ngamoeyeik (Pazundaung River)（Brackish Water）—raw water treatment plant—booster pump—RO by chemistry Major—Re-mineralization filter—disinfection equipment—potable water tank—frequency of water supply equipment—users

There is a frequency water supply equipment, including two pumps, technical parameters is as follows :

Q=10m^3/h H=50m

Q=10m^3/h H=50m

In accordance with contract requirements, one 50m3 steel water tank need to be set.

3.5.11 Service Water System

The service water system will be set to offer service water for the whole plant, it mainly consists of water consumption for chemical water treatment plant. The system consists of the following processes:

Ngamoeyeik (Pazundaung River) Brackish Water）——raw water basin—raw water treatment plant —chemical raw water basin—chemical water treatment plant

There will be 2×100% booster pumps in the chemical raw water basin， technical parameters is as follows：Q=27 m^3/h H=20m。

3.5.12 Reused Water System

The reuse water system will be set to offer reuse water for the whole plant, it mainly consists of miscellaneous water for turbine and boiler house, road spraying water, greening water, and the system is operated interrupted. The system consists of the following processes:

Service/Fire Fighting water tank—frequency reuse water supply equipment—users.

There is a frequency reuse water supply equipment, including two pumps and pressure tank, technical parameters is as follows：Q=30m^3/h H=50m.

3.5.13 CW Drainage System

To ensure safe and stable operation of the CW system, circulating water needs to discharge a little regularly. The quantity of circulating water drainage is 111.3 m^3/h， which is discharged to Ngamoeyeik (Pazundaung) River where is near by the pontoon, and diameter of discharged pipe is DN200， steel reinforced HDPE pipe.

3.5.14 Treatment of Domestic Sewage and Industrial Wastewater

(1) Industrial wastewater treatment system

System Function

This system can meet the requirement to treat the chemical back wash and cleaning wastewater of the membranes, boiler acid washing, etc. It can make them all reaching the discharge standards.

The designed capacity of the system is 30t/h.

The Main Process of the Wastewater Treatment System

The main process will be as follows : wastewater storage basin⇒wastewater pump⇒wastewater precipitation tank⇒wastewater monitoring basin⇒clarified water pump⇒ self-cleaning filter⇒discharge to the reused water pond.

The process of the sludge discharge : sludge from the wastewater precipitation tank⇒ sludge dehydrator⇒transported by truck.

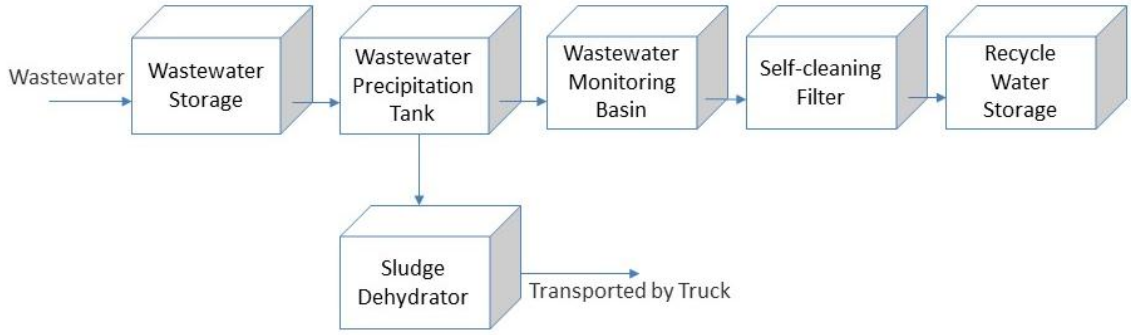


Figure 3.5-4: Main Process of Wastewater Treatment System

Figure 3.5-5: Wastewater Treatment System

Different kind of industry wastewater will be treated according to the characteristic of wastewater. For the water treatment system wastewater, it only needs neutralization. For boiler chemical cleaning wastewater, it will be discharged into unit drainage pit and then sent to the industry wastewater treatment plant by pumps. Through processing of neutralization, aeration, oxidation, condensation and clarification, the harmful substances will be removed and make the water reaching the discharge standards.

This process can ensure final waste drained to river is 3 °C lower than river water.

The industrial wastewater system will be laid together with the water treatment plant, The wastewater precipitation tank, self-cleaning filter, discharge pump, clarified water pump, etc. are arranged in outdoor of the plant, Wastewater pumps and roots blowers are above the wastewater basin.

3.5.15 Condense and Cooling Tower

3.5.15.1 Circulating Cooling System in Phase I

In Project Phase I, 1×42.742MW steam turbine set is configured with one tower system constituted by 4 reverse-flow mechanical draft cooling towers (cooling water volume per set: 2,200m^3) and three circulating water pumps. Circulating water pump is set in the open air between cooling tower and steam turbine room.

After being pressurized by circulating water pump, water in cooling tower collecting tank will be sent through one DN1400 circulating water inlet main pipe to vicinity of main power house and then be sent through two DN1000 circulating water pipes respectively to main power house for supply for steam turbine set, condenser, cooling device of auxiliary apparatus and industrial water. Hot drain water from condenser will be sent through two DN1000 circulating water pipes to DN1400 circulating water return main pipe which is near to the main power house and then be set to cooling tower through such man pipe for cooling and recycling. Hot drain water from auxiliary apparatus and industrial return water will be sent directly to collecting tank of cooling tower for recycling. The DN1400 circulating water pipe in Project Phase I is 120m in length in total.

In Project Phase I, 1×42.742MW steam turbine set is configured with one tower system constituted by 4 reverse-flow mechanical draft cooling towers (cooling water volume per set: 2,200m^3).Dimension of cooling tower: length × width = 52.8m×13.2m, and dimension of collecting tank: length × width × depth =52.8m×16.5m×2.50m.The cooling tower is of concrete frame structure and glass fiber reinforced plastics wall. Total cooling water volume is 8,800 m^3/h; diameter of each cooling tower fan is 8m; power of motor configured for fan is 132kW.Temperature of outlet water from cooling tower is ≤32ºC under climate condition with mean annual highest temperature of 33.3ºC, mean annual relative humidity of 80% and mean annual atmospheric pressure of 1,013.9hPa.

Horizontal centrifugal pump is proposed to be adopted in Project Phase I as circulating water pump. Through calculation, main technical parameters and motor specifications of circulating water pump are shown below:

Circulating water pump:	Q=4100m^3/h
	H=23mH_2o
Configured motor:	N=355Kw
	V=6000v

3.5.16 Treated Wastewater Discharge

Main industrial wastewater of the project: cooling tower discharge, strong brine of membrane treatment system, drainage from chemical cleaning of set and steam turbine drainage. All wastewater are discharged into the river through from discharge pipeline.

Drainage from chemical cleaning of unit and turbine drainage are discharged to a wastewater pool (V=100m^3) set at main powerhouse area. Upon aeration and being pH-adjusted, the wastewater is drained after being coagulated, settled and filtrated by integrated wastewater treatment equipment.

After being treated, the industrial wastewater will reach the following standard:

pH	6~9
Total suspended solids	≤50ppm
Turbidity	≤50NTU

Figure 3.5-6: Location of Effluent Discharge Point and Pipeline

3.5.17 Sanitary Sewage System

The sanitary sewage water will be collected by pipe at various trapping points and then flow into sanitary wastewater lift station. It will be pumped into the sanitary sewage treatment equipment， through sand filtration system and then discharged into the reuse water system.

The material of sanitary sewage water pipe is concrete drainage pipe， and diameter of main pipe is DN300.

The quantity of the sewage water in the plant is about 3m^3/h and the capacity of the treatment plant will be3 m^3/h.

The sanitary sewage water treatment plant will include equalization tank, sewage water lift pumps, sewage water treatment device, air blowers and control equipment.

The Quality of Sewage water is regulated in the equalization tank, and then shall the sewage water shall be transfer to uniform sewage water treatment device by the sewage lift pumps. This set of sewage treatment equipment used A / O treatment process.

3.5.17.1 Sewage Regulation Tank

Sanitary sewage water regulation tank is reinforced concrete structure. Bar screen shall be provided at the inlet of sewage water to hold of large dregs. Size of regulation tank: LxBxH=3mx5mx5m, effective capacity: about 60m^3.

3.5.17.2 Sanitary Sewage Tank and Sanitary Wastewater Treatment Equipment Foundation

Sanitary sewage water tank (1 set) will be an underground reinforced concrete which is measured as 3m long by 5m wide by 5m deep(net values). The thickness of the side wall is 0.5m, while the thickness of the bottom slab is 0.6m. The thickness of the top slab is 0.2m. Constructing in open pit.

The whole equipment foundation (for two sets equipment) will be reinforced concrete structure measured as 8.0long by 3.5m wide, with 0.5m thick in bottom plate. Constructing in open pit is adopted.

3.5.17.3 Main Process of Sewage Treatment Plant

Two set of sewage water treatment devices are provided. Each one is 2m³/h. The device treatment process is as following:

Sanitary sewage water——bar screen——sewage regulation tank——Anoxic tank——I oxidation pond——II oxidation pond—— sedimentation tank—— disinfection tank——rain water system.

Aeration fan: three sets (3x100%) in total, capacity of one ： 78 m³ / h， H=40kpa.

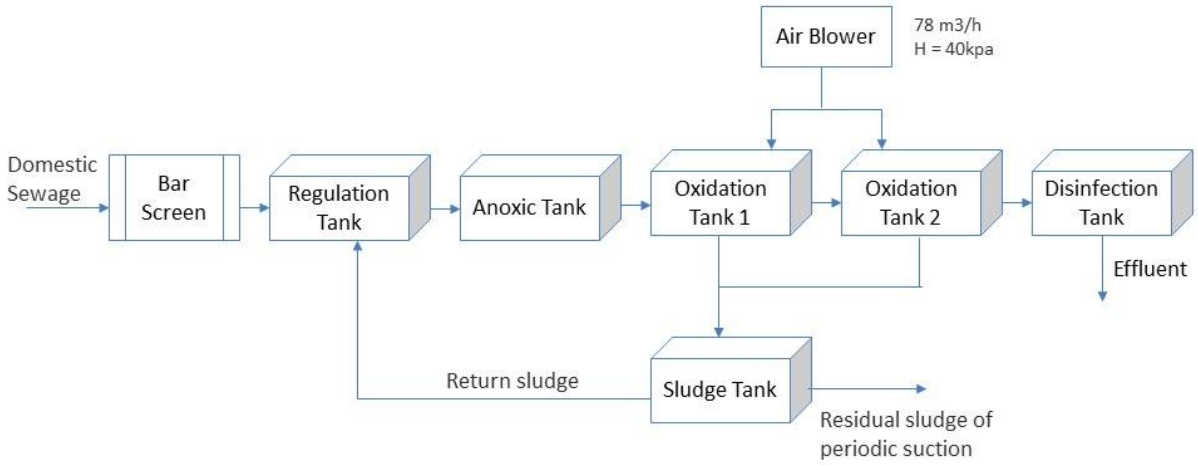


Figure 3.5-7: Sewage Water Treatment System Flow Diagram

Figure 3.5-8: Sewage Water Treatment System

3.6 HVAC System

Turbine house shall use ventilation system with natural wind inlet and mechanical exhaust ventilation. Rain-proof modulating shutters are used as wind inlet and roof fan are used as ventilation equipment.

Constant temperature and humidity air-cooled air conditioners are used in centralized control room, electronic equipment room of main power house in order to satisfy the operation requirement of equipment and operators. There are also independent accident exhaust system in centralized control room and electronic equipment room. The exhaust equipment shall use high temperature exhaust fan.

Wall-mounted air-cooled air conditioners or air-cooled cabinet air conditioners are used in offices, meeting rooms, dining rooms and dormitories.

3.7 Architecture and Structure

The main powerhouse is steel structure, which is consist of turbine house and electronic room. Reinforced concrete foundation is used for gas turbine foundation, heat recover steam generator and chimney.

Boiler frame and chimney frame are all used steel structure and they are all designed and supplied by manufacturer.

Concrete tubular piles or composite foundation is used for turbine house and gas turbine unit, which required to bear heavy load and have high deformation requirement, while natural foundation is used for structures that bear small load and have low deformation requirement.

3.8 Steam turbine design and type

Manufacturer: Hangzhou Steam Turbine Co., Ltd (HTC)

Type: Single-casing, non-reheat, condensing steam turbine (HNK63/3.2)

Quantity: 1 set

No.	Item	Unit	Parameters (Performance guarantee condition, Z gas source)
1	Output	MW	39.43
2	HP Steam Flow	t/h	122.3
3	HP Steam Pressure	MPa(a)	6.53
4	HP Steam Temp	°C	513
5	LP Steam Flow	t/h	11.21
6	LP Steam Pressure	MPa(a)	0.69
7	LP Steam Temp	°C	199.7
9	Back Pressure	kPa(a)	8.2

3.9 Ultra-Low Carbon Burner and DLN Combustion Technology

Manufacturer: General Electric (GE)

Type: GE6F03, heavy duty, 18-stage compressor, Three-stage turbine featuring air-cooled design, cold end output, axial exhaust, DLN 2.6 combustion, SFC startup

Quantity: 1 set

No.	Item	Unit	Parameters (Performance guarantee condition, Z gas source)
1	Model		6F.03

No.	Item	Unit	Parameters (Performance guarantee condition, Z gas source)
2	Rated RPM	r/min	3000
3	SC Output	MW	75.14
4	SC Gross Heat Rate	kJ/kWh	10106
5	Exhaust Temp	℃	620.8
6	Exhaust Flow	t/h	722.7
7	Exhaust Draft Loss	mmH_2O	290
8	NOx Emission	ppmvd @ 15% O2	25

Emission Level

Item	Unit	Values
NO_x	ppmvd@15%O_2 or mg/Nm^3, dry@15O_2	25
CO	ppmvd@15%O_2 or mg/Nm^3, dry@15O_2	25

For the control of NOx the gas turbines shall be equipped with dry low NOx burners. The required minimum stack height for the Project has been set at 40 meters (HRSG and bypass stack), although this is subject to a stack height determination study, that will be undertaken by the Contractor as part of the EIA/ESIA and could result in an increase to the stack height. As per the WBG EHS General Guidelines, 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. For projects where there are multiple sources of emissions, stack heights should be established with due consideration to emissions from all other project sources, both point and fugitive.

3.10 Electric Generation Process by Turbine Type

External air will be sucked into filter and muffler. Here it will be delivered to air compressor on the gas turbine for compressing, and then will transmitted to the combustor for combustion. High speed flue gas will drive gas turbine to rotate continuously, then GT generator will be running at the same time. Electric power will be generated and transmitted to power grid through GT transformer.

The flue gas will be exhausted from the exhaust chamber of the gas turbine, by way of transitive pass, tee damper, bypass chimney, and blind plate, into HRSG. After heated the feed water and steam, it will be exhausted into the atmosphere. Overheating steam will be delivered into steam turbine by high pressure steam pipe, its flow will drive steam turbine to rotate and ST generator will run at the same time. Electric power will be generated and transmitted to power grid through ST transformer.

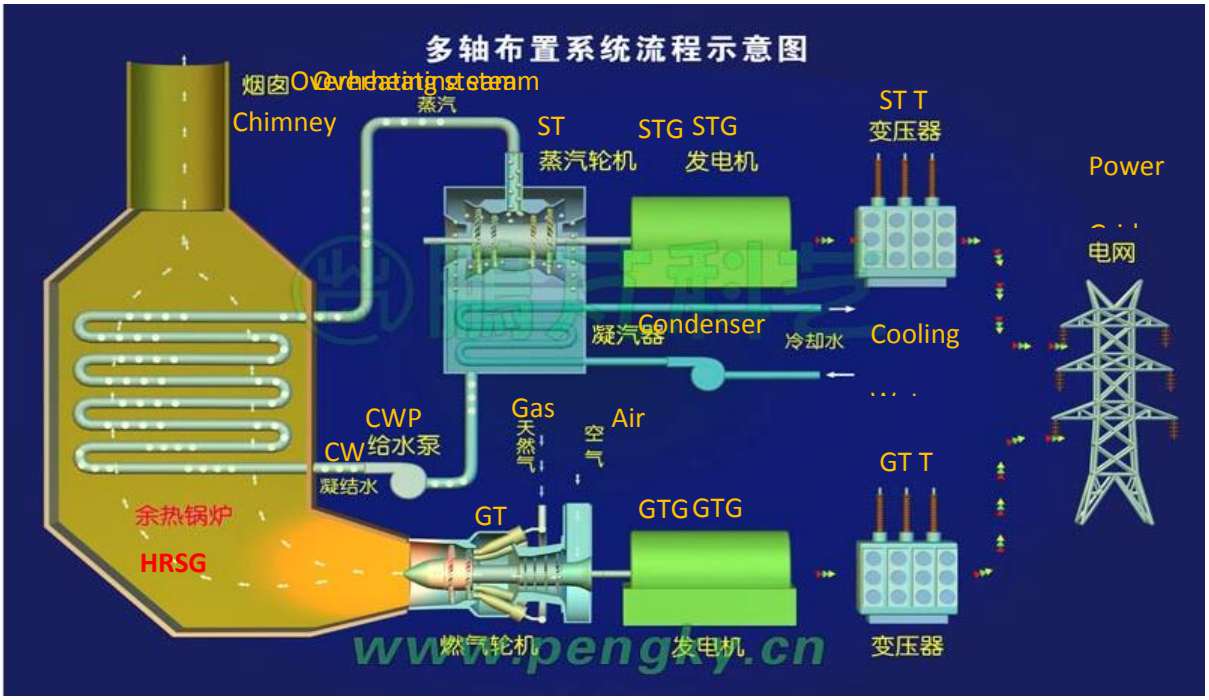


Figure 3.10-1: Combined Cycle Power Plant Flow Diagram

3.11 Emissions Control (Environmental Protection)

3.11.1 Control Measure of Smoke Pollution

According to analysis on components of fuel gas, there is almost no sulphur content and ash content in natural gas, and the main pollutant in smoke is NOx.

(1) Control of sulfur dioxide pollution

In this project, hydrogen sulfide content is relatively low (2x10-5mol/mol) and the sulfur dioxide emission generated is in small amount. Therefore, gas desulphurization system may not be set.

(2) Control of smoke pollution

The project utilizes natural gas that flows into gas turbine after purification and does not generate smoke after combustion. Therefore, flue gas dust removal system may not be set.

(3) Control measure of NO_X pollution

The project adopts ultra-low carbon burner and DLN combustion technology, and NOx emission concentration does not exceed 15 ppm while combusting natural gas.

(4) Chimney stack is adopted for emission of air pollutant

Pollutant emission by chimney stack is an important measure to reduce ground pollution; chimney for Project Phase I is temporarily determined as 40m in height and bypass chimney as 40m in height.

After adopting the above-mentioned control measures of air pollution, the emission of smoke pollutant in this Project can meet requirements of Emission Standard of Air Pollutants for Thermal Power Plants (GB13223-2011).

3.11.2 HRSG system (Stack included in the system)

Type: dual-pressure, non-reheat, without duct burner, integral deaerator, horizontal, natural circulation

Main parameters of the HRSG

No.	Item	Unit	Parameters (Performance Guarantee Condition)
1	HP Steam Flow	t/h	122.3
2	HP Steam Pressure	MPa(a)	6.726
3	HP Steam Temp	℃	514.5
4	LP Steam Flow	t/h	11.21
5	LP Steam Pressure	MPa(a)	0.76
6	LP Steam Temp	℃	201.8
7	Exhaust Temp	℃	86.2
8	Stack Height	M	40

According to Good International Industry Practice (GIIP)

Stack Height Calculation ：

H_G= H + 1.5L; where

H_G = 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.

Based on the section drawing show stack height as follow.

HG= H + 1.5L=17.1m+1.5 x 12m=35.1m

So final selected stack height is 40m.

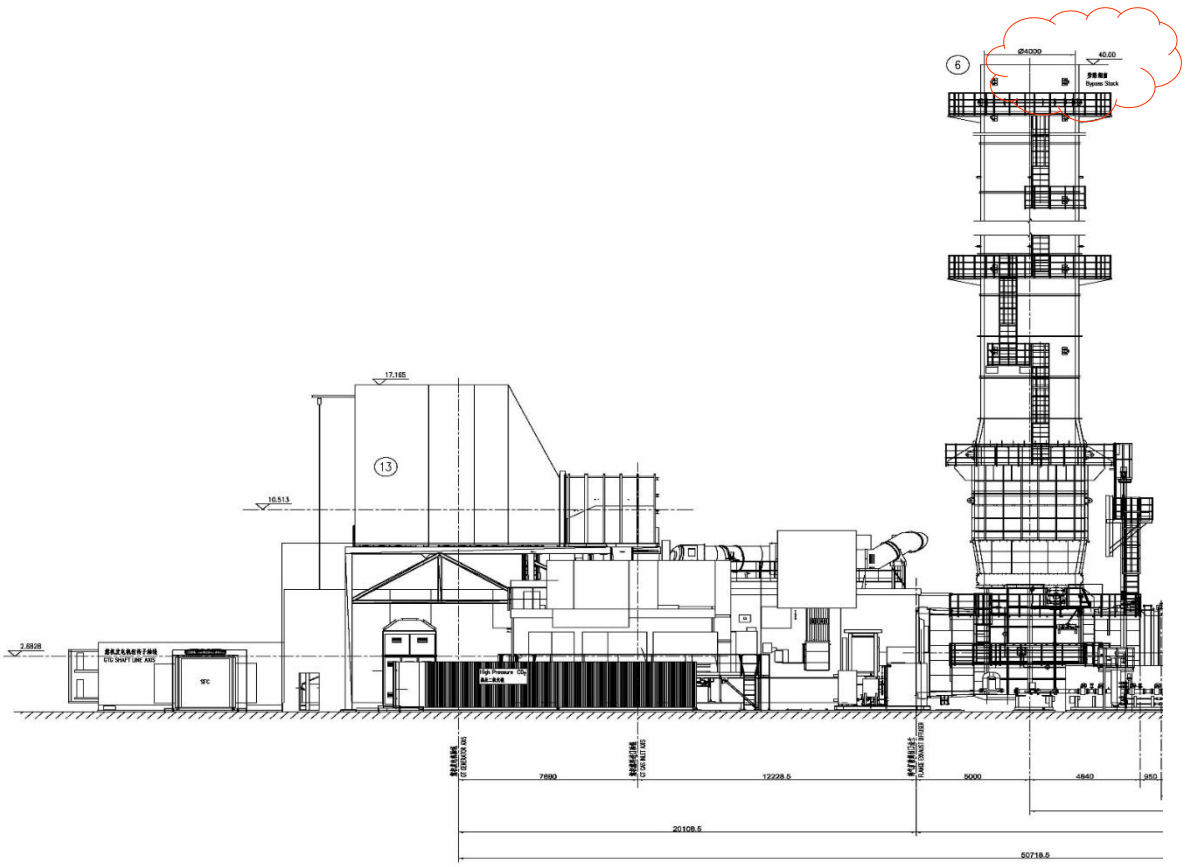


Figure 3.11-1: Layout Stack Drawing

3.11.3 Emission Load and Limit Value of Smoke Pollutant

In the absence of national legislated ambient air quality standards in Myanmar, the UREC shall demonstrate, through air dispersion modelling, plant compliance with the World Health Organization (WHO) Ambient Air Quality Guidelines as specified in WBG EHS General Guidelines.

Phase I will use the same Nature gas to generation. The air emission data are same, and list as follows.

Total Emission and Limit Value of Air Pollutant in Project

Parameter	Averaging Period	Guideline Value	Tharketa Gas Emission Data
Sulphur dioxide (SO_2)	24-hour	20μg/m3	0
	10 minute	500μg/m3	0
Nitrogen dioxide (NO_2)	1-year	40μg/m3	-
	1-hour	200μg/m3	50μg/m3
Particulate matter (PM10)	1-year	20μg/m3	-
	24-hour	50μg/m3	25μg/m3
Particulate matter (PM2.5)	1-year	10μg/m3	-
	24-hour	25μg/m3	10μg/m3

NOx	-	51 mg/m3	35 mg/Nm3
CO	-	51 mg/Nm3	35 mg/Nm3
Greenhouse gas emission	-	-	Phase I：300,000t/y

3.11.4 Ash Content

The Project adopts clean natural gas for combustion, which does not generate ash.

3.12 Decommissioning Phase

The proposed Project is planned to implement on BOT basis. The BOT scope shall comprise design, engineering, inspection, testing, supervision, commissioning and carrying out performance test at the Site of the plant and/or equipment, in accordance with the specification requirements, conditions, as specified, followed by operation and transfer of the Plant to Government of the Republic of the Union of Myanmar, in accordance with BOT Contract.

The period of private operation is 30 years from 28th February 2018. The project will be transferred to the Government on 28th February 2048.

CHAPTER IV

EXISTING ENVIRONMENT: PHYSICAL

4.1 Introduction

As part of the Environmental Impact Assessment (EIA) of the preset Combined Cycle Power Plant project, an environmental baseline study was carried out in areas surrounding the project site. The specific objectives of the baseline study were to gather information on the existing physical environment, biological-ecological environment, and socio-economic environment of the areas in and around the project site; to gather and assess peoples' perception on different aspects of the proposed project. The data and information gathered during the baseline study provide a detailed description of the existing conditions of physical, biological as well as socio-economic environment in and around the project area.

This Chapter describes the existing physical environment of areas in and around the project site based on the baseline survey and other studies (e.g., water quality, air and noise level measurements) carried out as a part of the present study. Relevant information on climate, topography and drainage, geology and soils, hydrology and water resources, air quality, noise level, and water quality have been described in this Chapter. The possible environmental impacts of the project activities will be evaluated against these baseline environmental conditions.

4.2 Climate

Yangon has a tropical monsoon climate under the Köppen climate classification system. The city features a lengthy rainy season from April through November where a substantial amount of rainfall is received and a relatively short, dry season from December through March, where little rainfall is seen. It's primarily due to the heavy precipitation received during the rainy season that Yangon falls under the tropical monsoon climate category. During the course of the year, average temperatures show little variance, with average highs ranging from 29 to 36 °C (84 to 97 °F) and average lows ranging from 18 to 25 °C (64 to 77 °F). The hottest time of year in Yangon is in April when it is 30.65°C / 87.2°F on average but could get up to 37°C / 98.6°F maximum. On the other hand, the coldest time of year in Yangon is in January when it is 25.05°C / 77.1°F on average but could get down to 17.9°C / 77.1°F minimum.

Yangon Kabaaye Weather Station is located northwest of the proposed plant site, with a straight-line distance of 15km. As there are no high mountains to block the view between the two locations, the observation data from the station would serve as a better representative for the plant location.

Meteorological station and site relative location is shown on FIGURE 4-1.

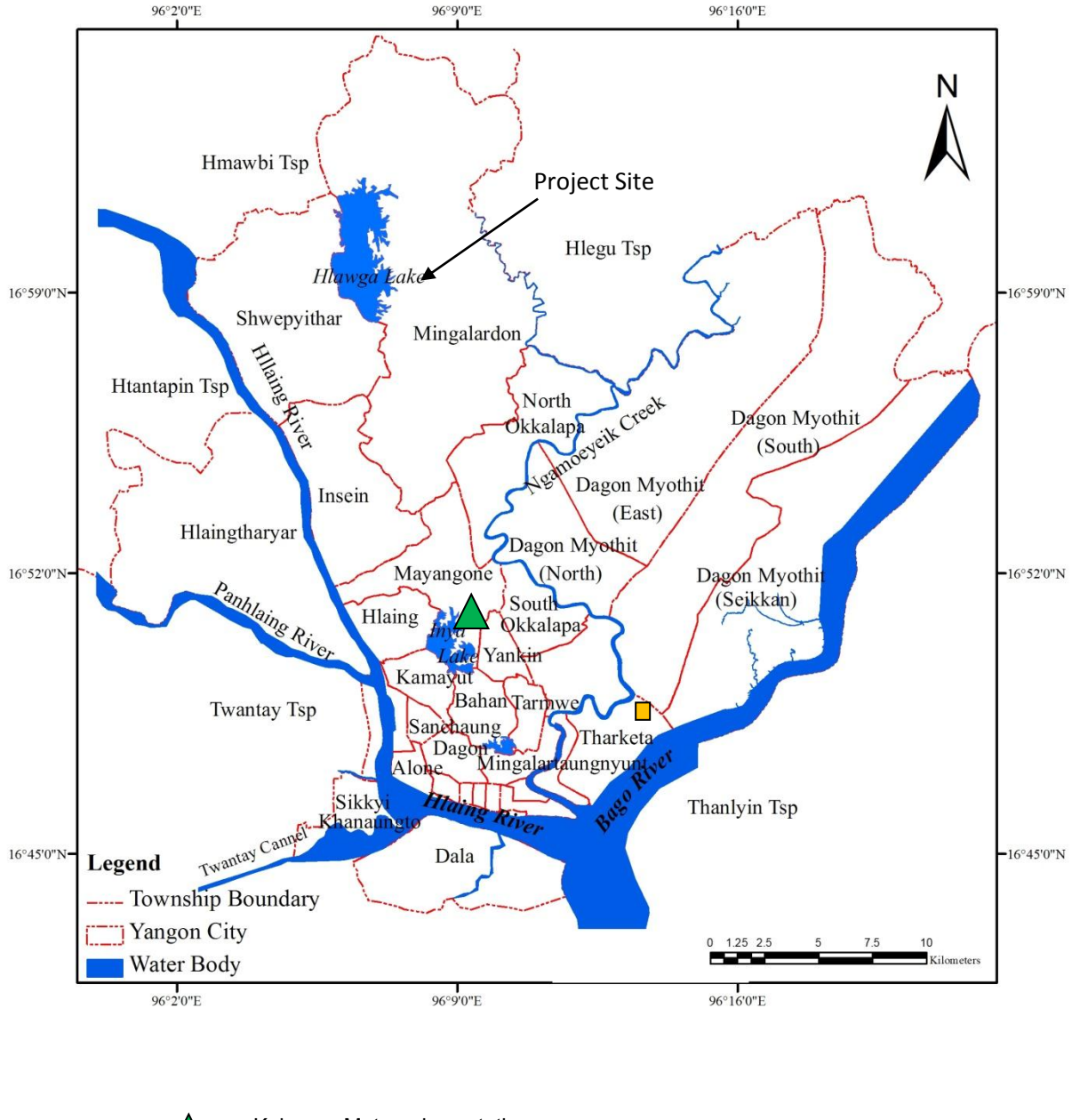
Thus, climatic data from Kabaraye station is mainly used in this study. It has definite wet period during late May to October that is followed by a dry period from November to early May. The proposed project site has a relatively hot summer and a comparatively warm cool season. Generally, the climate can be divided into three seasons as follow:

- Hot and dry season (from March to end of May)
- Rainy season (from end of May to Mid-October) and
- Cool and dry season (from Mid-October to end of February)

According to TABLE 4-1, the mean monthly temperature is 27.4˚C. The average monthly maximum temperature is 33.1˚C. The average monthly minimum temperature is 21.6˚C. Seasonally, the highest temperature is found in summer. The hottest month is April. The maximum temperature is 37.5˚C and minimum temperature is 23.8˚C in April and May. The mean temperature is 30.7˚C in April. Due to its location near Gulf of Mottama, the area has slightly moderate temperature.

It usually has high rainfall not only because of south-west monsoon but also affected by easterly waves that use to come during early post monsoon period. Yangon receives its rainfalls mainly from the Southwest Monsoon during

May to October. According to TABLE 4-1, the total rainfall is 2787 mm. The highest rainfall occurred in July, having 608 mm.



Kabaaye Meteorology station

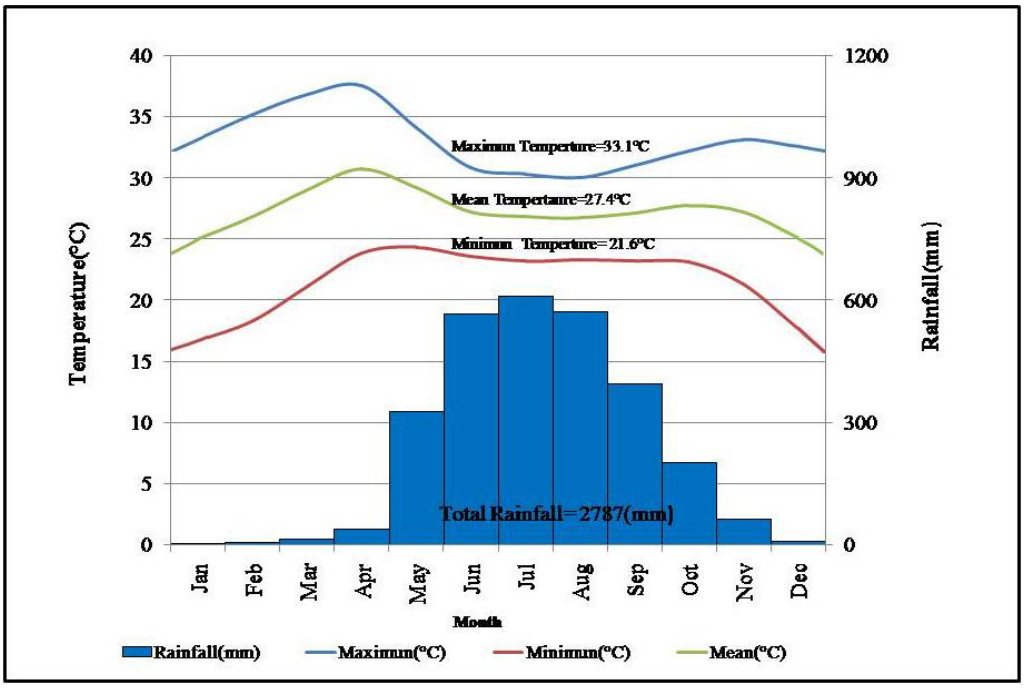
Proposed Project Site

Figure 4.2-1 Location of Meteorology Department in Yangon Area

Table 4.2-1 Monthly Average Maximum, Minimum, Mean Temperatures and Rainfall of Kabaaye Station in Yangon City (1981-2011)

No	1	2	3	4	5	6	7	8	9	10	11	12	Average/ Total
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Max Temp (°C)	33.2	35.2	36.8	37.5	34.1	30.8	30.3	30	31	32.2	33.1	32.5	33.1
Min Temp (°C)	16.7	18.3	21.1	23.8	24.3	23.6	23.2	23.3	23.2	23.1	21.3	17.7	21.6
Mean Temp (°C)	25	26.8	29	30.7	29.2	27.2	26.8	26.7	27.1	27.7	27.2	25.1	27.4
Rainfall (mm)	1	4	12	38	325	566	608	571	393	201	61	7	2787

Source: Meteorology and Hydrology Department, Kabaaye Station, Yangon



Source: Based on TABLE

Figure 4.2-2 Climograph of Kabaaye Station in Yangon City (1981-2010)

4.2.1 Ambient Air Temperature

Temperature is high throughout the year, because the township is in tropical climate region. The maximum temperature is high from February to May. The highest monthly maximum temperature is 37.4°C in April. From June to September, the temperature is slightly lower, because of the rain. The lowest monthly minimum temperature of

17.8°C was recorded in January. The cool season is from December to February. Although temperatures are relatively high throughout the year, the range of temperature is low because of its location (nearness to the sea).

4.2.2 Rainfall

The station receives its rainfall during the middle of May to October. August is the wettest month of the year. The highest rainfall is 559 mm. The period of June to October is known as wet season. During the dry season the amount of rainfall is 104.9 mm which is about 4 percent of the annual rainfall. November receives 58.2 mm which is the highest rainfall in the dry season. This is due to the post monsoon storms in the Bay of Bengal which occurs once every 4 to 6 years. The bulk of the rainfall of the wet season is caused by the south west monsoon.

4.2.3 Wind Speed

The wind speed was mostly between 1.2 – 3.7 m/sec for all the months.

The wind speed during summer season was mostly between 1.2 - 3 m/sec, during rainy season it was between 1.2-3.7 m/sec and in winter months wind speed ranges between 1.2-2 m/sec.

4.2.4 Wind Direction

The predominant wind direction during rainy season is from north east and south west direction during monsoon season. During post monsoon and winter season the wind flows from north and north east direction. The wind direction (dominant) during three years study period was from west, south west and south direction.

4.2.5 Relative Humidity

Average and lowest relative humidity values recorded in Kabaaye Meteorology Station between 2009-2011 are shown on TABLE 4-2 and relative humidity variations are shown on FIGURE. Annual average relative humidity amount is 76.79%, lowest relative humidity amount is 56.1%.

Table 4.2-2 Kabaaye Meteorology Station Relative Humidity Values.

Months	Jan	Feb	March	April	May	June	July	Aug	Sept.	Oct.	Nov.	Dec	Annual
Average Relative Humidity %	66.74	62.31	67.79	65.31	78.29	87.89	89.31	89.26	88.70	84.83	72.61	68.49	76.79
Lowest Relative Humidity %	61.61	56.10	58.00	54.03	69.83	83.03	84.80	86.25	83.26	80.29	68.30	63.19	56.1

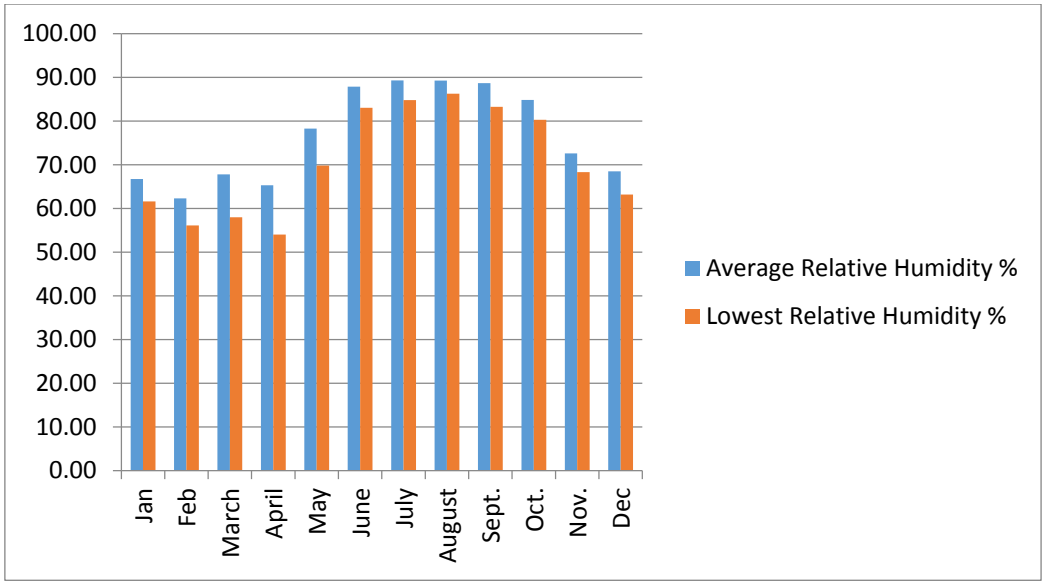


Figure 4.2-3 Kabaaye Meteorology Station Relative Humidity Variations As per Months.

Cloud Cover – In the study area, clear weather prevails in most of the time during post monsoon, winter and summer seasons.

The daily temperature, rainfall, humidity, wind speed and direction, and cloud cover data (2009 – 2011) are shown in Appendix.

4.3 Topography and Drainage

Topographic condition is important for the evaluation of environmental impact in order to understand the existing topography prior to any development. The development project activities may include land leveling, excavation and others, which may cause alteration in the topographic conditions. Therefore, the baseline information needs to be established prior to any development.

The general topography of the site is generally flat and average elevation is 10 meters above mean sea level. As the project area is located about 0.7 km from the bank of Bago River. The half of project area is predominantly covered up by rubbish which was thickly dumped during the several years. The remaining half is covered with vegetable beds, pond and small bushes and there is scarcely found few tall trees. The elevation of this project area is about 1.0 to 8.0 m from the mean sea level. The level of ground is naturally broadly descending from south to north.

The major streams are the Bago River in the southeast and Pazundaung (Ngamoeyeik) Creek in the west generally flowing southward into the Yangon river. The Pazundaung (Ngamoeyeik) creek is a tidal river and has created swamp areas along the river bank. Boat and small ships should be able to navigate into the river at high tide periods. The Pazundaung (Ngamoeyeik) Creek flows meandering with a series of bends through the middle portion of the city and enters the Yangon River near Dawbon.

4.4 Geology and Soil

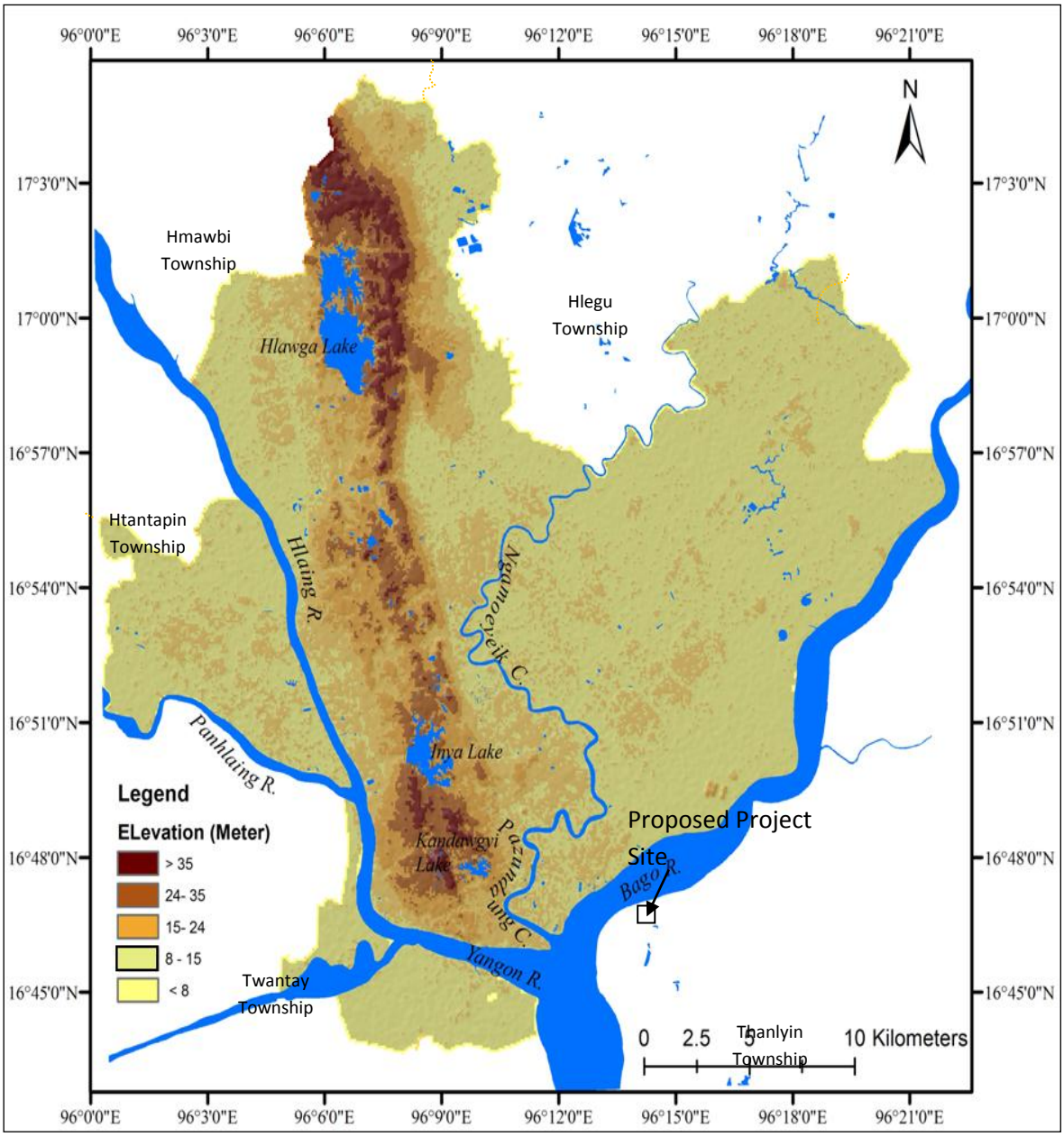
The proposed plant site is located at just east bank of Ngamoeyeik Creek and west bank of Bago River in Thaketa Township containing in the eastern part of Yangon City. Yangon is geomorphically situated between Hlaing River in the west and Bago River in the east and it is also the southern extensional rolling region of Bago Yoma (FIGURE 4-4). Yangon area can be topographically recognized as; (i) *rolling and hilly area* in the central part with the ridges; (ii) *flat rolling area* especially within the Mingaladone and along the eastern and western limbs of Thanlyin-Kyauktan Ridge; (iii) *lake area* occupied by Hlawga Lake, Inya Lake and Kandawgyi Lake which lies nearly N-S that parallel to the trend of ridges and regional geological structures; (iv) *swampy* area occupied at Dala and Thilawa in the south, at the vicinity of Panhlaing River in the southwest, around Pazundaung Chaung in the southeast and tidal influent area

of Nagmoeyeik Chaung; and (v) *alluvial area* covered at west of Yangon-Mingaladon Ridge and Hlaing River, and at some parts in Insein, Gyogon, Kamayut, Kyeemyindine, Alone.

Geology of the project area is generally dominated by poorly consolidated sediments deposit over the past 10,000 to 15,000 years (Holocene age) FIGURE 4-5. The geology of the study area consists of Quaternary deltaic sediments, which have been strongly influenced by tectonic movements on deep seated faults.

According to Win Naing (1972), the general succession of rocks underlying at the Yangon area is as follows:

Formation		**Age**
Younger Alluvium		Recent
Valley Filled Deposits		Pleistocene
Unconformity		
Irrawaddy Formation	(Danyingon Clays)	Pliocene
	(Arzanigone Sandrocks)	Pliocene



Source: Department of Geography, University of Yangon **Figure 4-4**

Relief and Drainage of Yangon City

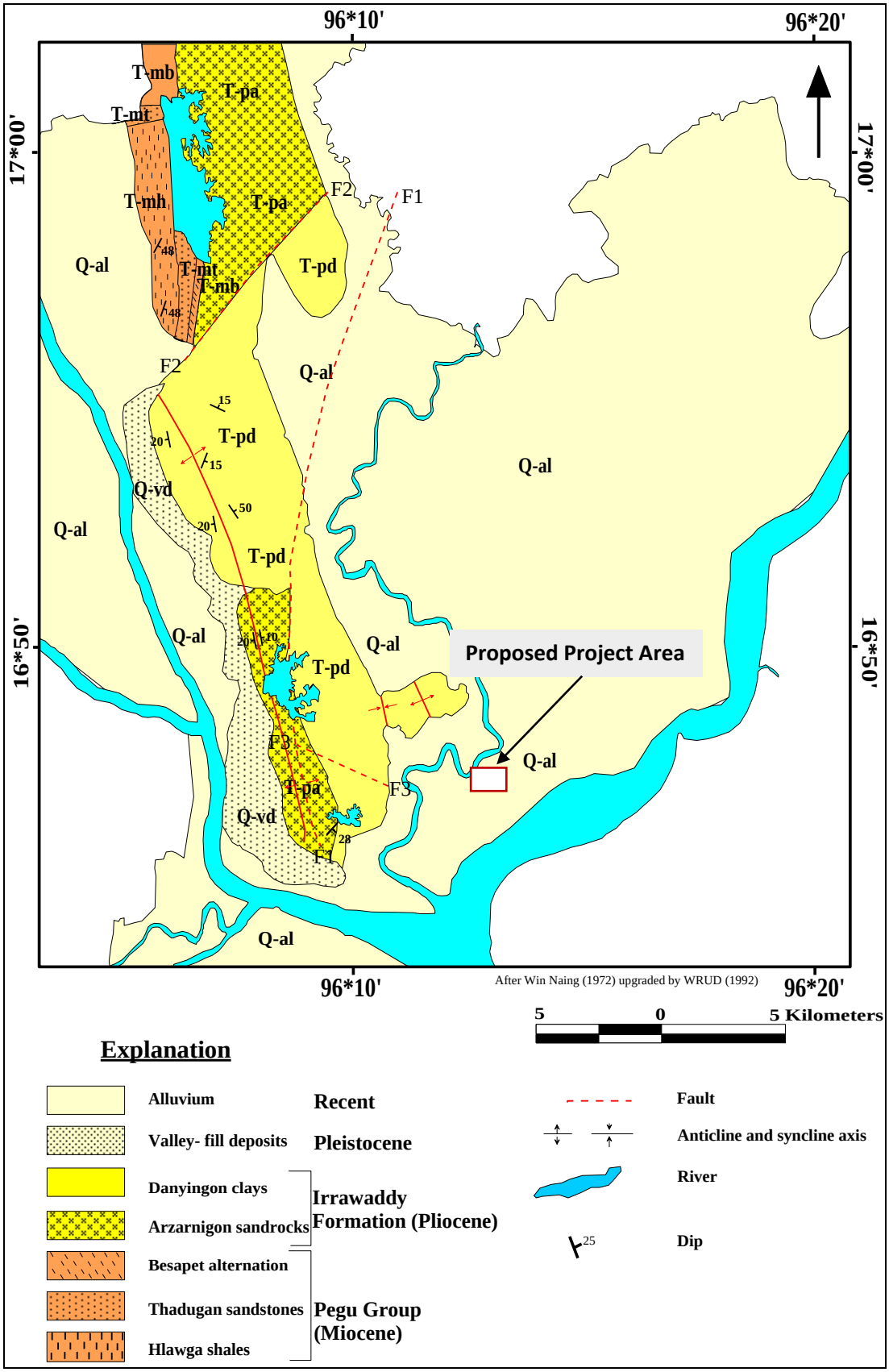


Figure 4.4-1 Geological map of greater Yangon area.

The brief general geological history of the Yangon area is as follows:

At the end of Pliocene period, the southern part of Bago Yoma (including Yangon area) appears to have continued to rise in the form of an anticline. Following the lowering of the sea level and Valley Filled Deposit of mainly gravels and gravelly sand was deposited in the area.

Because of the requirement of a cool dry climate to provide the necessary detritus, it appears that the thick gravels must have been deposited rapidly in the flank of rising anticline at the end of Pliocene time.

According to soil investigation results, eight different soil layers have been identified in this area (TABLE 4-3). The soil layer that can be used as reliable bearing layer should generally have N-value of over 5 in light load structures (<50kN/m^2) and that of N-value over 10 in heavy load structures (>50kN/m^2). The thickness of garbage (mostly solid waste and plastic rubbish) is 1 to 6 meter depth over the original soil.

Table 4.4-1 Range of N-value (Measured) from Different Soil Layers in Project Area

Sr No.	Soil layer	N value (Measured)					Minimum	Maximum	Average
		10	20	30	40	50 or >50			
1	Sandy CLAY-I						6	2	4
2	CLAY-I						23	3	10
3	Sandy SILT						20	4	9
4	Silty SAND-I						30	5	16
5	Silty SAND-II						68	10	33
6	Sandy CLAY-II						58	12	29
7	SILT						37	10	18
8	CLAY-II						49	8	20

Total of five locations of soil samples were collected at the vicinity of project site in 2012. The soil sampling locations are shown in FIGURE 4-6.

Location of soil sampling

Name	Longitude	Latitude
Soil 1	96°13'32.56"E	16°48'51.07"N
Soil 2	96°13'29.53"E	16°49'5.57"N
Soil 3	96°13'16.65"E	16°48'57.54"N
Soil 4	96°13'21.89"E	16°48'48.56"N
Soil 5	96°13'24.56"E	16°48'38.09"N

Figure 4.4-2 Location of soil sample nearby the project site in 2012.

Table 4.4-2 (a) Soil Quality (Physical Parameter)

Parameters	Units	Soil 1		Soil 2		Soil 3	
Depth		(0.5-1m)	(0.5-1m)	(1-1.5m)	(1.5-2m)	(0.5-1m)	(1-1.3m)
Physical Parameters							
Particle Size							
Gravel	%	0	0	0	0	0	0
Sand	%	6	1	1	1	1	0
Silt	%	70	65	62	64	59	60
Clay	%	24	34	37	35	40	40

Parameters	Units	Soil 4		Soil 5	
Depth		(0.5-1m)	(1-1.5m)	(1.5-2m)	(0.5-1m)
Physical Parameters					
Particle Size					
Gravel	%	0	0	0	0
Sand	%	1	0	2	8
Silt	%	63	59	56	59
Clay	%	36	41	42	23

Table 4.4-2(b) Soil Quality (chemicals) 2012 result

Parameters	Units	Soil 1	Soil 2	Soil 3	Soil 4	Soil5
Chemical Characters						
Arsenic as As (Top)	ppm	0.004	0.003	0.004	0.003	0.003
(Bottom)			0.005	0.005	0.006	
Cadmium as Cd (Top)	ppm	0.19	0.021	0.018	0.024	0.029
(Bottom)		0.018	0.021	0.027		
Copper as Cu (Top)	ppm	25	28	31	29	32
(Bottom)		27	35	30		
Lead as Pb (Top) ppm	42	45	45	47	52	
(Bottom)			28	43	49	
Mercury as Hg (Top)	ppm	0.002	0.004	0.004	0.002	0.005
(Bottom)		0.005	0.005	0.005		
Iron as Fe (Top)	ppm	8550	8750	9200	9250	9350
			9150	9300	9340	

The major soil texture is sandy SILT to SILT around the project site. The physical and chemical soil data are presented in TABLE 4-4 (a) and (b).

Additional Soil Data

Three additional soil samples were collected from the “original soil” layer located about 1.5 m below the surface in April 2013 (FIGURE 4-7). Then parts of the samples were stored in small plastic container for testing in the laboratory. The sample containers were properly labeled with the information on the sampling location, depth of sample, date and time of collection. TABLE 4-5 shows the chemical contents of soil samples collected from the proposed site.

Table 4.4-3 (a) Soil Quality (Chemicals) 2013 Results

Parameters	Units	Soil 1	Soil 2	Soil 3
Chemical Characters				
Arsenic as As	ppm	0.004	0.004	ND
Cadmium as Cd	ppm	0.012	0.009	0.007
Copper as Cu	ppm	85	95	98
Lead as Pb	ppm	95	90	93
Mercury as Hg	ppm	0.007	0.005	0.005
Iron as Fe	ppm	2850	2200	2950
Chromium as Cr	ppm	ND	ND	ND
Nickel as Ni	ppm	15	10	10
Zinc as Zn	ppm	120	105	110

Table 4.4-3 (b) Sediment Quality (Chemicals) 2013 Results

Parameters	Units	SB 1	SB 2
Chemical Characters			
Arsenic as As	ppm	0.004	0.003
Cadmium as Cd	ppm	0.009	0.008
Copper as Cu	ppm	110	115
Lead as Pb	ppm	125	130
Mercury as Hg	ppm	0.005	0.005
Chromium as Cr	ppm	12	10
Nickel as Ni	ppm	15	9
Zinc as Zn	ppm	130	138

Metal concentration in soil

Metal concentrations were observed as follows.

- Arsenic contents vary from 0.003 to 0.006 ppm.

- Cadmium concentration is consistently observed all samples and it ranges from 0.018 to 0.19 ppm.

- Concentration of Cu was observed to be range from 25 to 35 ppm.

- Concentration of Lead varied from 28 to 49 ppm.

- Concentration of Iron ranges from 8550 to 9350 ppm and

- Concentration of Mercury varied from 0.002 to 0.005 ppm.

Metal concentration in sediment of Ngamoeyeik Creek is shown in TABLE 4-5 (b) and the results are normal occurrence in common sediments.

Figure 4-4-3 Location of Soil Sample nearby the Project Site in 2013

4.4.1 Seismicity

The seismic hazard assessment for Thaketa Project area is carried out by using the probabilistic seismic hazard assessment (PSHA) proposed by Cornell (1968) and the seismic hazard maps of the project area are developed. The seismic hazards are represented in terms of peak ground acceleration (PGA), spectral acceleration (SA) at the periods of 0.2 s, 0.3 s and 1.0 s, in which all of the ground motion parameters are in *g*. The seismic hazards are calculated for 2 % and 10 % probability of exceedance in 50 years with the corresponding recurrence interval of 2475 years and 475 years, respectively.

If the seismicity and the records of the previous earthquakes happened at around Yangon region is looked back, it can be assumed as medium seismicity region (FIGURE 4-8). The most significant event is the magnitude 7.3, earthquake that struck on May 5, 1930 and December 3, 1930 earthquake with the same magnitude (FIGURE 4-9). The former earthquake, well-known Bago earthquake, caused 50 deaths and great damages in Yangon while 500 casualties were resulted in Bago. The other significant earthquakes are Yangon earthquakes of September 10, 1927 and December 17, 1927. These events also resulted in a certain amount of damage in Yangon.

Based on the above-mentioned information, for the major project cited in Yangon City it is necessary to carry out the seismic hazard assessment, if possible the detailed site specific seismic response analysis should be conducted.

4.4.2 Seismotectonic

The subduction of Indian Plate beneath Burma Plate in the west of Myanmar with the subducted rate of 37 mm/yr and the collision of Indian Plate and Eurasia Plate in the North-East with the collision rate of 50 mm/yr, both in the direction of NE to NNE, are the major tectonics of Myanmar. The other is the Andaman spreading center in the south of Myanmar, with the strike of East-Northeast direction. The seismicity pattern in the western part of Myanmar reflects the nature of subduction zone of Indian Plate under Burma Plate, increasing the focal depth from the west to east (shallow focus events in the west and deep focus events in the east). However, the foci of the earthquakes happened at Andaman basin represents the shallow depth and normal faulting mechanisms with some of transform characteristics.

The other major structures present within Myanmar are the major fault systems of well-known Sagaing fault, Kyaukkyan fault, Gwegyo thrust, and West Bago Yoma fault (FIGURE 4-10). Most of the earthquakes which occurred in the central region of Myanmar are related with Sagaing fault. Not only these events but also those in the eastern part are not greater than 40 km in focal depth. All of these shallow focus events indicate their correspondence with the crustal faults.

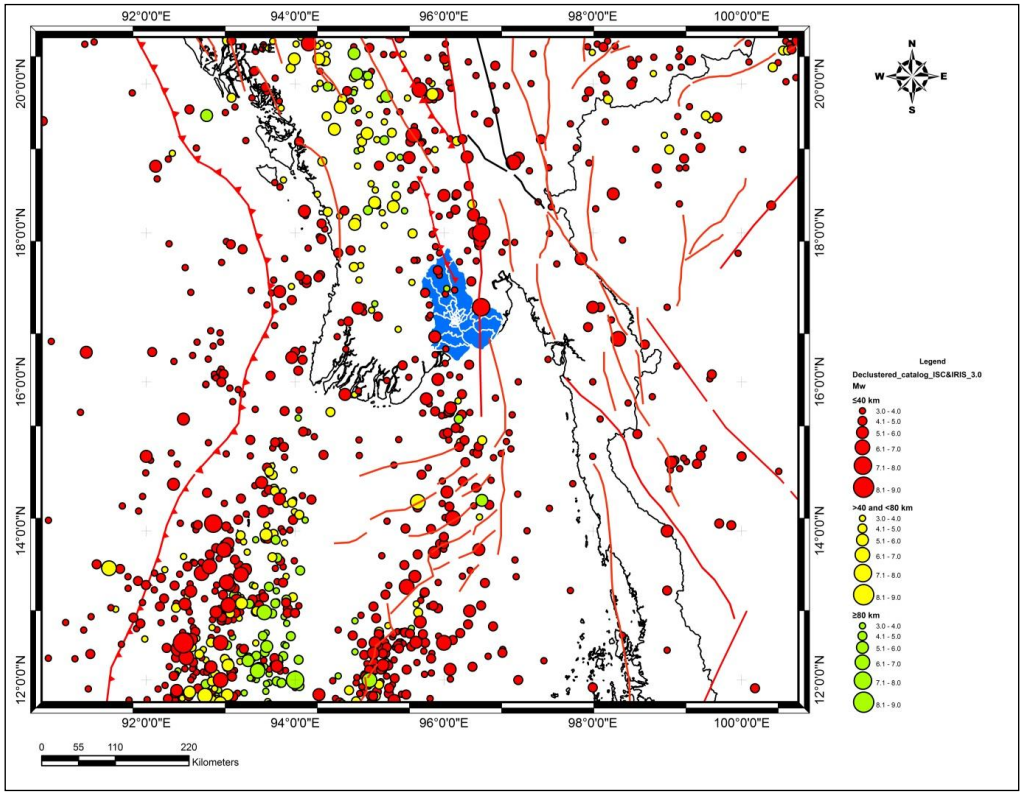


Figure 4.4-4 Seismicity Map of Yangon Region (ISC earthquake catalog, 2012)

In the seismicity records, two major events happened in and around Yangon Region and these are the 5th July 1917 earthquake and Magnitude 7.3, 5th May 1930 Bago earthquake. All of these events are originated from the well-known, right-lateral, strike-slip Sagaing fault which run through the central part of the country with the length of more than 1,000 km.

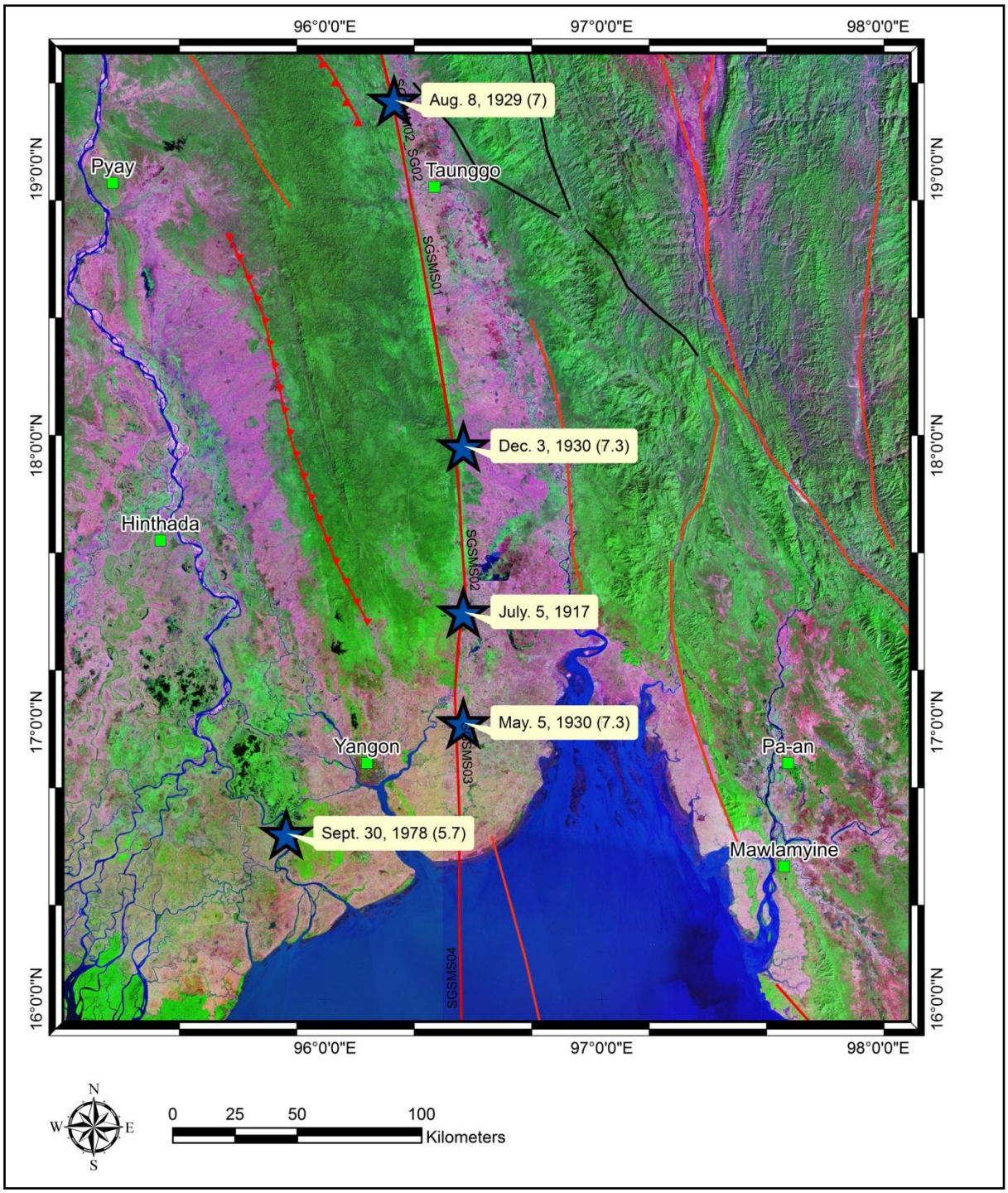


Figure 4.4-5 Milestones of High Magnitude Earthquake in and around Yangon Region

The records of the previous strong earthquakes showed that some destructive earthquakes with the magnitudes ≥ 7 originated from this fault. The focal mechanisms of the previous earthquakes happened along the Sagaing fault represents the strike-slip mechanisms, confirming the compressional force in NE-SW direction and extensional force in NW-SE direction. However, the events that are located in the northernmost part of Sagaing fault, i.e. northern segments, show strike-slip mechanism with the dominant trust mechanism. The slip rate of Sagaing fault is about 20 mm/yr. This character corresponds to the gradual changes or influence of the collision of Eurasia and Burma Plates on the Sagaing fault system.

The second-most significant fault system is the right-lateral, strike-slip Kyaukkyan fault that strikes nearly N-S in direction and it extends southward from Pyin Oo Lwin – Naungcho area through Taunggyi – Innle Lake with a length of > 450 km and the slip rate is about 1 mm/yr. The largest earthquake on this fault is the Richter magnitude 8.1 on 23 May, 1912. However, very few (about 5 small events) have been recorded around this fault subsequently.

Yangon Region in which Yangon city where the current project site is located is tectonically bounded by the Indian-Burma plates subduction in the west, Sagaing fault in the east, West Bago Yoma fault in the north, Kyaykkyan fault in the north-east, and the Andaman rift zone in the south. The earthquakes observed in the Andaman sea region are shallow focus earthquakes that show not only the normal fault mechanisms but also the strike-slip fault mechanisms.

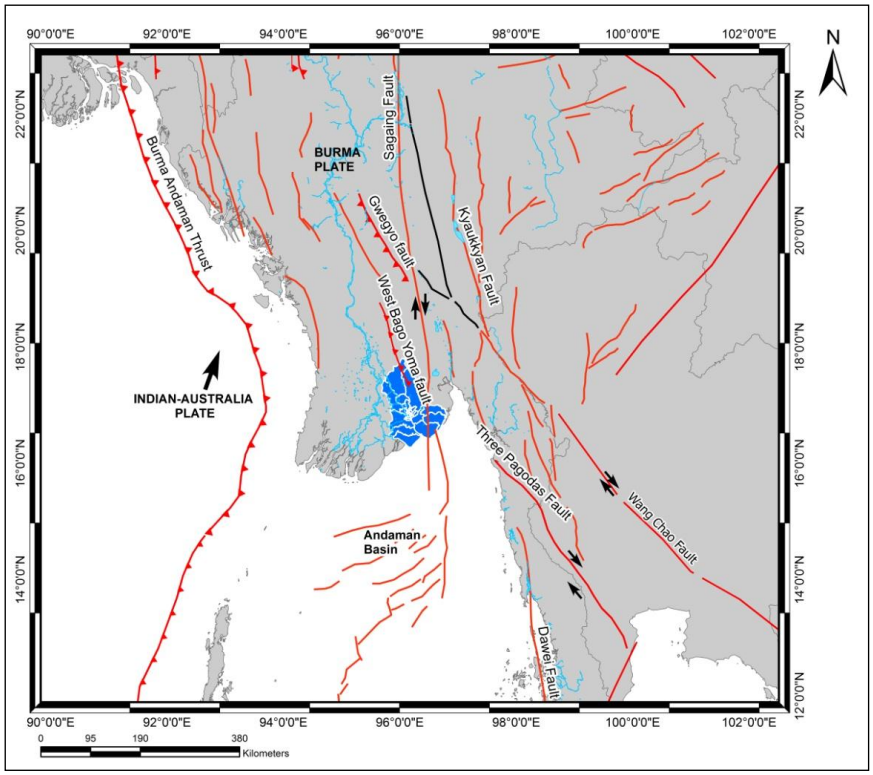


Figure 4.4-6 Tectonic Map of Yangon Region

In and around Yangon Region, most of the earthquakes happened are shallow focus earthquakes, especially within about 250 km in radius. Most are related with Sagaing fault, some corresponds to the blind faults located under Yangon Region and subduction zone of Indian and Burma Plate (Part of Eurasian Plate), and the Andaman Rift Zone. Moreover, some other faults whose geometry and other parameters are not well-known in and around this region also generated some earthquakes. Small numbers of intermediate and deep focus earthquakes can be seen in this region and those are caused by the subduction zone of Indian-Burma Plates.

4.4.3 Calculating the Seismic Hazards

Methodology

The seismic hazard analysis for Tharketa area is by using the Probabilistic Seismic Hazard Analysis (PSHA), which includes four steps: (1) Identification and characterization of the possible seismic sources, (2) Characterization of the spatial and temporal distribution of the earthquake recurrence, (3) Determination of the ground motion using the ground motion predictive relationship, and (4) Estimation of the probability that the ground motion parameter will be exceeded during the particular time period . The seismic hazards are calculated by applying the EQRISK.

4.4.4 Earthquake Sources Identification and Characterization

According to the geology (tectonics), seismicity and focal mechanisms study of the previous earthquakes four areal seismic sources are identified as TKT_01, TKT_02, TKT_03 and TKT_04. While the first one represents the area where Gwegyo thrust and West Bago Yoma thrust is included and the last three comprises the corresponding the tectonic regions such as the subduction zone and the extension zone, etc. (FIGURE 4-11). It should be noted in here that the information related with Gwegyo thrust and West Bago Yoma thrust are not complete enough to identify as the fault sources.

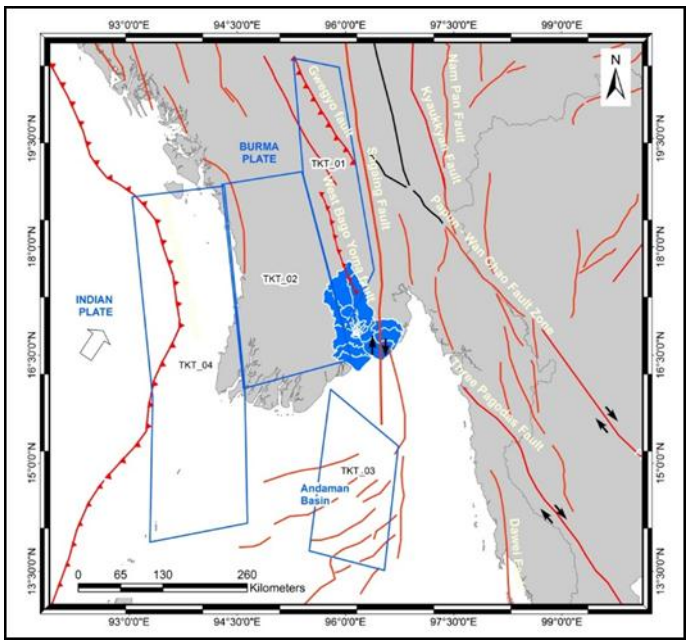


Figure 4.4-7 Areal Seismic Sources Model for Estimating the Seismic Hazards for the Project Site and Area

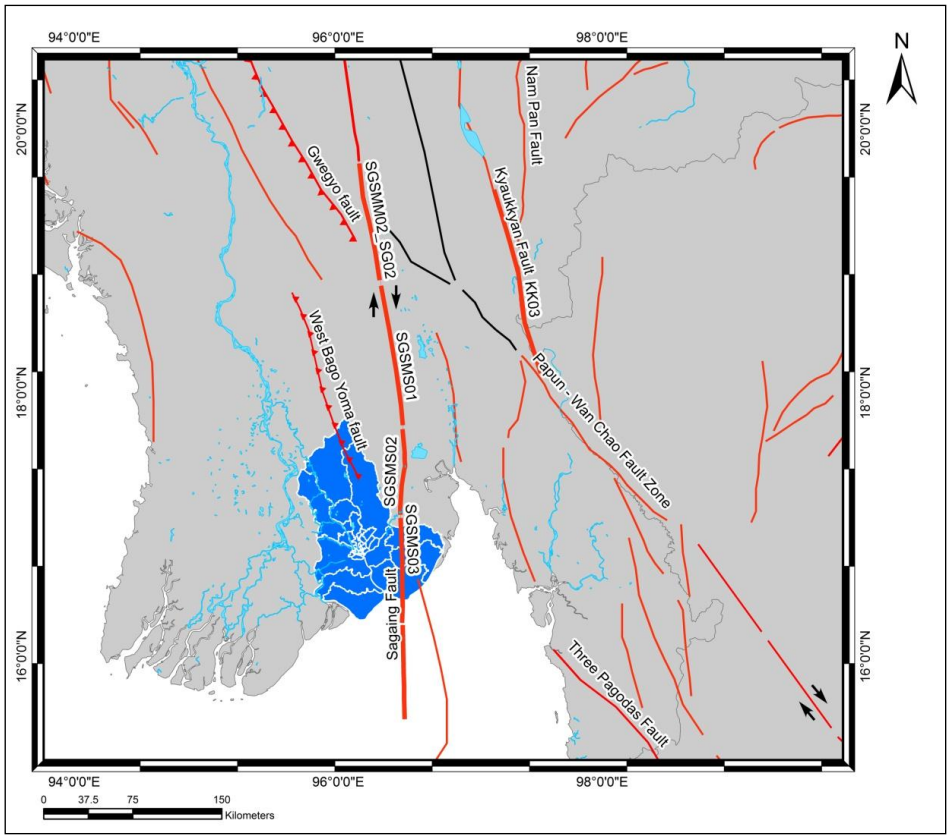


Figure 4.4-8 Fault Seismic Sources Model for Estimating the Seismic Hazards for the Project Site and Area

Two significant faults can be observed in the surroundings of this region and they are Sagaing fault and Kyaukkyan fault. The fault segmentation of those faults was done and three major segments for Sagaing fault as SGSMN in the northern portion of that fault, SGSMM in the middle portion and SGSMS in the southern portion. The Kyaukkyan fault was also segmented as three segments from north to south as KK01, KK02 and KK03. For this region, the most influence segments from those two fault sources are SGSMM02_02, SGSMS01, SGSMS02, SGSMS03 and SGSMS04 which are of Sagaing fault and KK03, the southernmost segment of Kyaukkyan fault (FIGURE 4-12 and TABLE 4-6). Others are Papun – Wan Chao fault and Three Pagodas fault.

The characterization of the seismic sources includes the determination of the seismic source parameters of each seismic source such as seismicity parameters; ***a***- and ***b***- values, the maximum magnitude of the earthquake potentials (M_{max}), and the recurrence rate of certain earthquakes ≥ M, especially for lower bound events. The seismicity parameters of *a*- and *b*- values are estimated by applying the classical Gutenberg-Richter recurrence law (*Log Nm = a – bm*, in which *Nm* is the cumulative number of earthquakes having magnitude *m*, *a* is the measure of seismic activity and *b* is a parameter of the ratio of larger to smaller earthquakes). Moreover, the maximum likelihood method was also applied as a complementary.

Another seismic source parameter is the maximum earthquake potential (M_{max}) for each seismic source. For areal seismic source, the maximum likelihood method of Kijko (2004) is used and the empirical relationships of the fault (rupture) length and earthquake magnitude such as Inoue et al. (1993), and Papazachos et al. (2004) are used for fault specific seismic sources. The seismic source parameters are depicted in TABLE 4-6.

Table 4.4-4 Seismic Source Parameters of each Seismic Sources; Fault Specific Sources and Areal Seismic Sources (M_0 = 5 for all Seismic Sources)

No	Region	Code	M_{max}	b	β	λ
1	Some crustal faults	TKT_01	7.4	0.5917	1.3624	0.0709
2		TKT_02	7	0.6119	1.4090	0.0742
3	Subduction zone of Indian plate beneath Burma microplate	TKT_03	9.3	0.7629	1.7566	0.0930
4	Andaman Basin	TKT_04	7	0.7515	1.7304	0.3914
5	Sagaing Fault	SGSMM02_SG02	7.7	0.6812	1.5685	0.2535
6		SGSMS_01	7.8	0.6335	1.4587	0.1112
7		SGSMS_02	7.6	0.6335	1.4587	0.1112
8		SGSMS_03	7.6	0.6335	1.4587	0.1112
9		SGSMS_04	7.6	0.6335	1.4587	0.1112
10	Kyaukkyan fault	KK03	8.2	0.7879	1.8142	0.0885
11	Papun – Wan Chao fault	PW	7.5	0.6156	1.4175	0.1490
12	Three Pagodas fault	TP	7.5	0.6156	1.4175	0.1490

Ground motion prediction equation

The ground motion prediction equation of Boore et al. (1997) which is described in below is used.

$$\ln Y = b_1 + b_2 (M_w - 6) + b_3 (M_w - 6)^2 + b_5 \ln r + b_v \ln(V_s / V_A)$$

where, $r = \sqrt{r_{jb}^2 + h^2}$, Y is peak ground acceleration or spectral acceleration in g, M_w is the moment magnitude, r_{jb} is closest horizontal distance to the surface projection of the rupture plane (km), V_S is the average shear – wave velocity to 30m (m/s), and b_1, b_2, b_3, b_5, and b_V are the constants. The site conditions are defined based on the average shear-wave velocity to upper 30 m (S_v^{30}, ms^{-1}). In this case the seismic hazards are calculated by assuming the average shear-wave velocity to upper 30 m is 760 ms^{-1} as the rock condition.

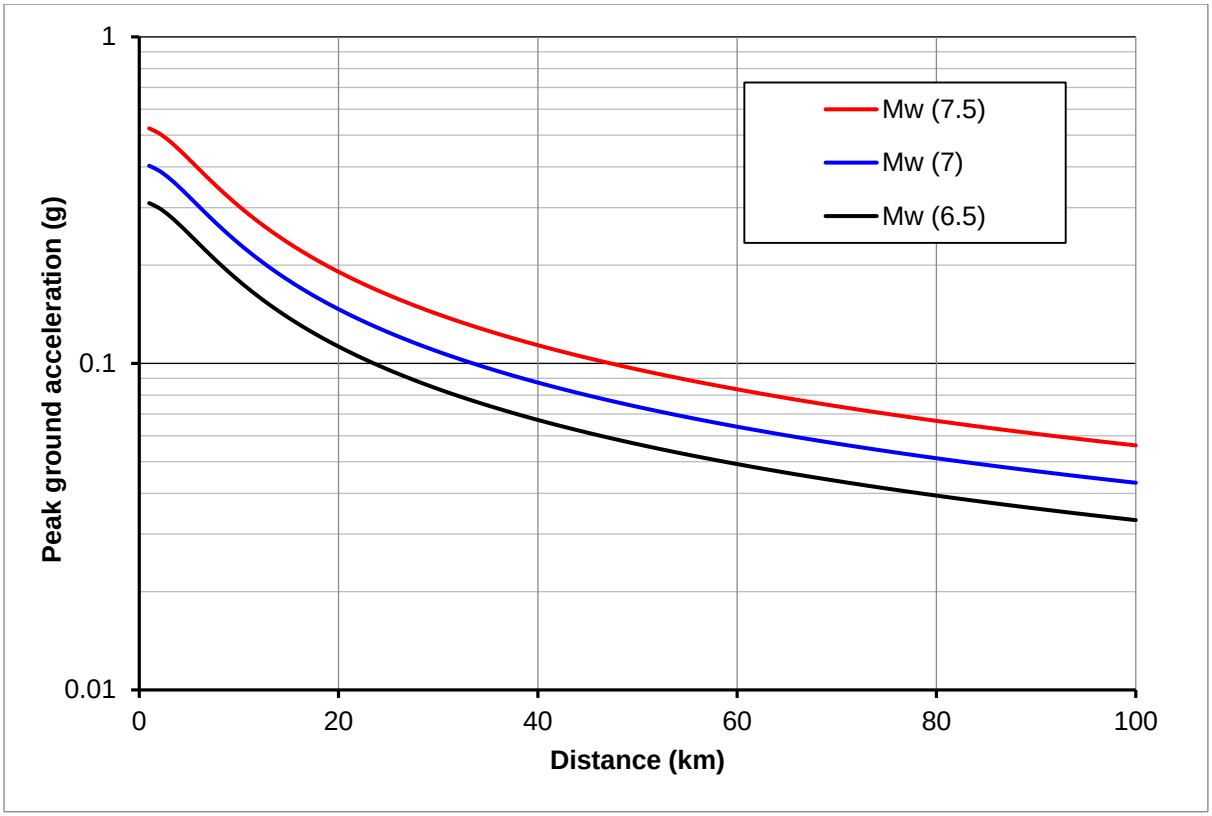


Figure 4.4-9 Variation of Peak Ground Acceleration with Source-To-Site Distance for the Ground Motion Prediction Equation of Booreetal (1997)

4.4.5 Seismic Hazard Results

As mentioned above the seismic hazard estimation is carried out by using the probabilistic way that was firstly proposed by Cornell (1968) and the Fortran computer program of EQRISK developed by McGuire (1976) after modifying for the present works. The seismic hazards are calculated for the Project area at the sites with the interval of 0.002˚ x 0.002˚ in which the site condition is assumed as the rock with the average shear-wave velocity (V_s^{30}) of 760 m/s. The seismic hazards are expressed in terms of peak ground acceleration (PGA) and spectral acceleration (SA) at the periods of 0.2 s, 0.3 s and 1.0 s, and all of the ground motion parameters in g. The seismic hazards are calculated for 2 % and 10 % probability of exceedance in 50 years for all.

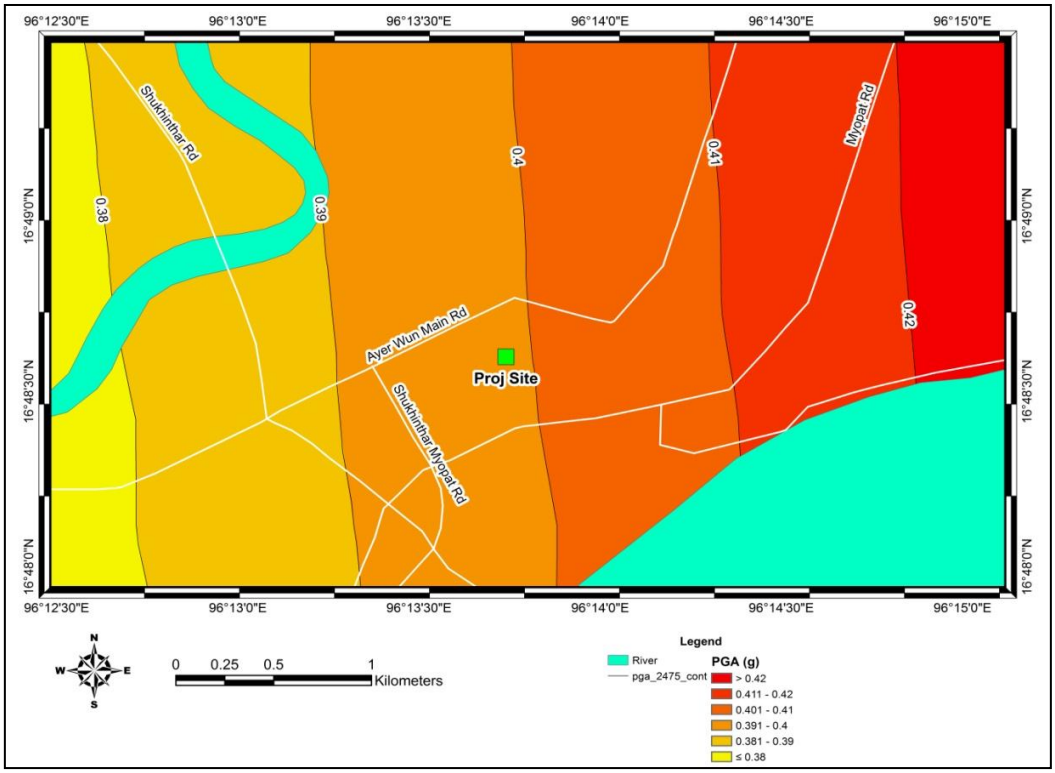
The seismic hazard, the ground motion parameter (PGA) calculated for 2 % probability of exceedance in 50 years is illustrated in FIGURE 4-14 (a). The minimum seismic hazard zone belongs to the western part of the Project area with the PGA value of ≤ 0.38 g and the maximum hazard zone is in the eastern part of the area in which the PGA value is of > 0.42 g. The ground motion parameter, PGA value for the Project site is 0.39 – 0.40 g.

FIGURE 4-14 (b) show the seismic hazard map for 10 % probability of exceedance in 50 years, in terms of PGA. The seismic hazard (PGA) values range from ≤ 0.245 g to > 0.265 g. While the highest seismic zone is in the eastern part of the area, the lowest is in the west. For the Project site, the PGA value is 0.25 – 0.255 g.

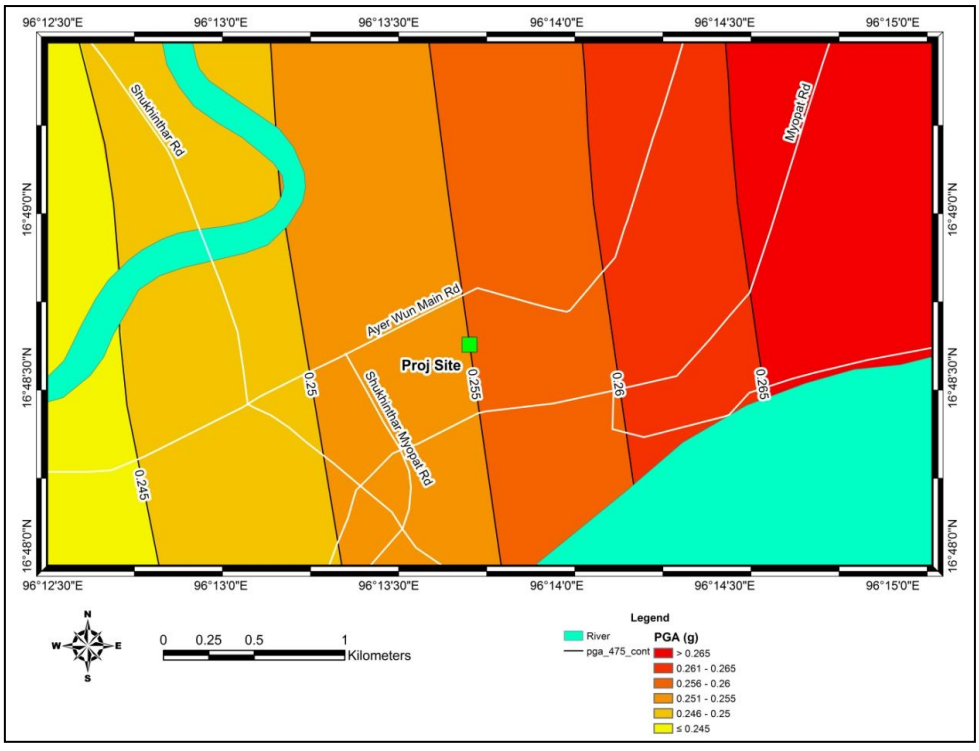
The seismic hazard maps in terms of SA at the periods of 0.2 s, 0.3 s and 1.0 s for 2 % probability of exceedance in 50 years for the Project area are illustrated in FIGURE 4-15. The maximum SA at the period of 0.2 s is > 0.82 g and the minimum SA is < 0.72 g, and the maximum SA value for the period of 0.3 s is > 0.84 g and the minimum is 0.76 g. The SA values for 1.0 s period range from < 0.45 g to > 0.5 g. While the eastern part of the area is in the maximum hazard zone, the minimum zone is of the western part of the area. For the Project site, SA values for 0.2 s, 0.3 s and 1.0 s for 2 % probability of exceedance in 50 years are 0.76 – 0.78 g, 0.78 – 0.8 g, and 0.47 – 0.48 g, respectively.

The SA values calculated for 10 % probability of exceedance in 50 years are depicted in FIGURE 4-16. The SA values for 0.2 s, 0.3 s and 1.0 s for the Project area are < 0.49 - > 0.54 g, < 0.49 - > 0.55 g, and < 0.27 - > 0.3 g,

respectively. The SA values for the Project site is 0.25 – 0.51 g for 0.52 s period, 0.51 – 0.52 g for the period of 0.3 s and 0.28 – 0.285 g for 1.0 s. The seismic hazard distribution patterns are nearly the same with others, i.e. the distribution patterns of PGA (both for 2 % and 10 % probability of exceedance in 50 years), and SA (both recurrence intervals).

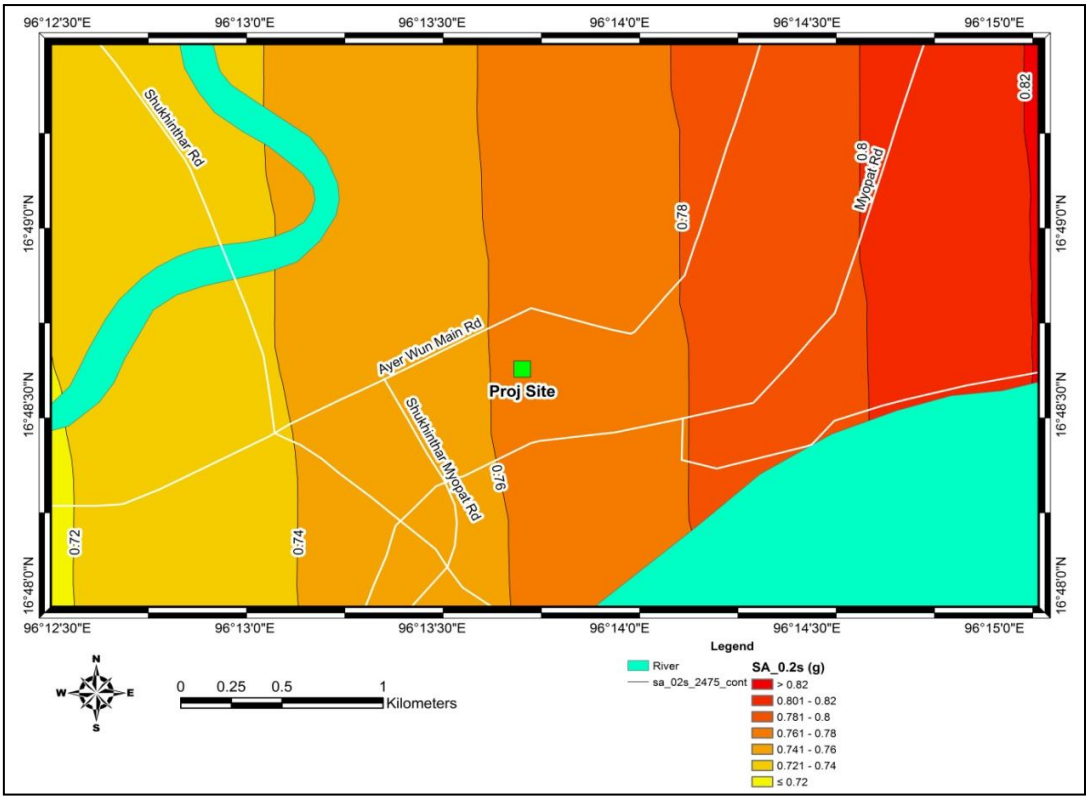


(a)

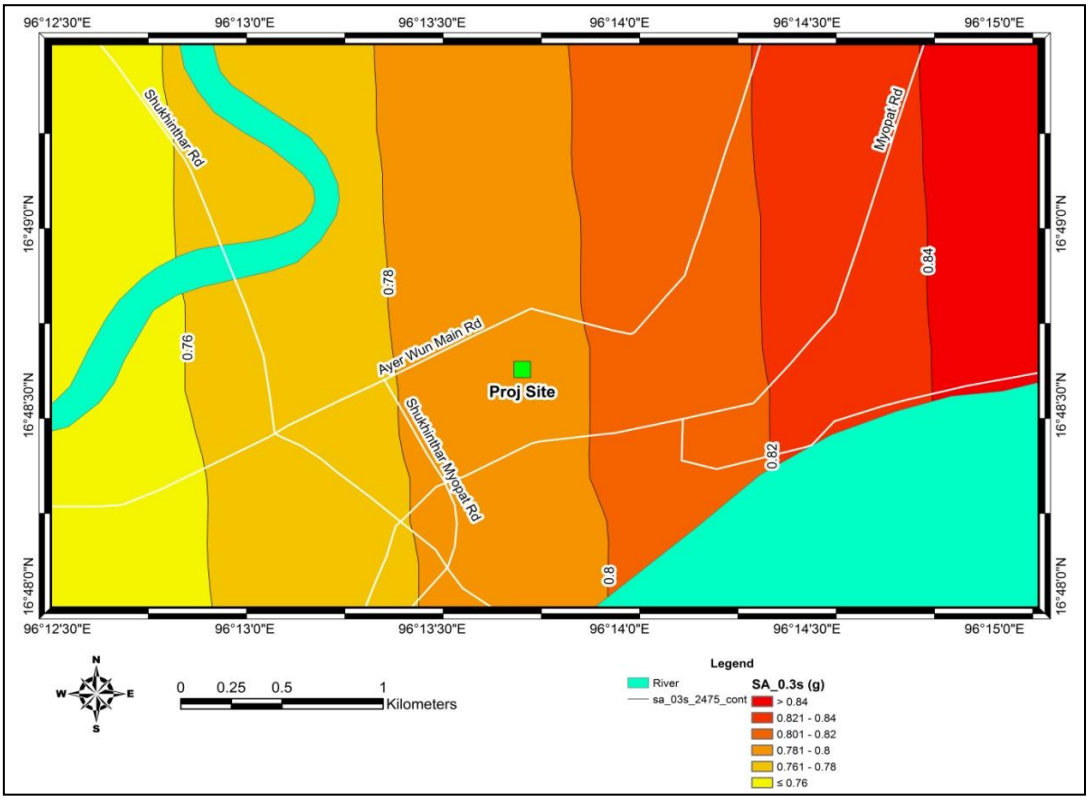


(b)

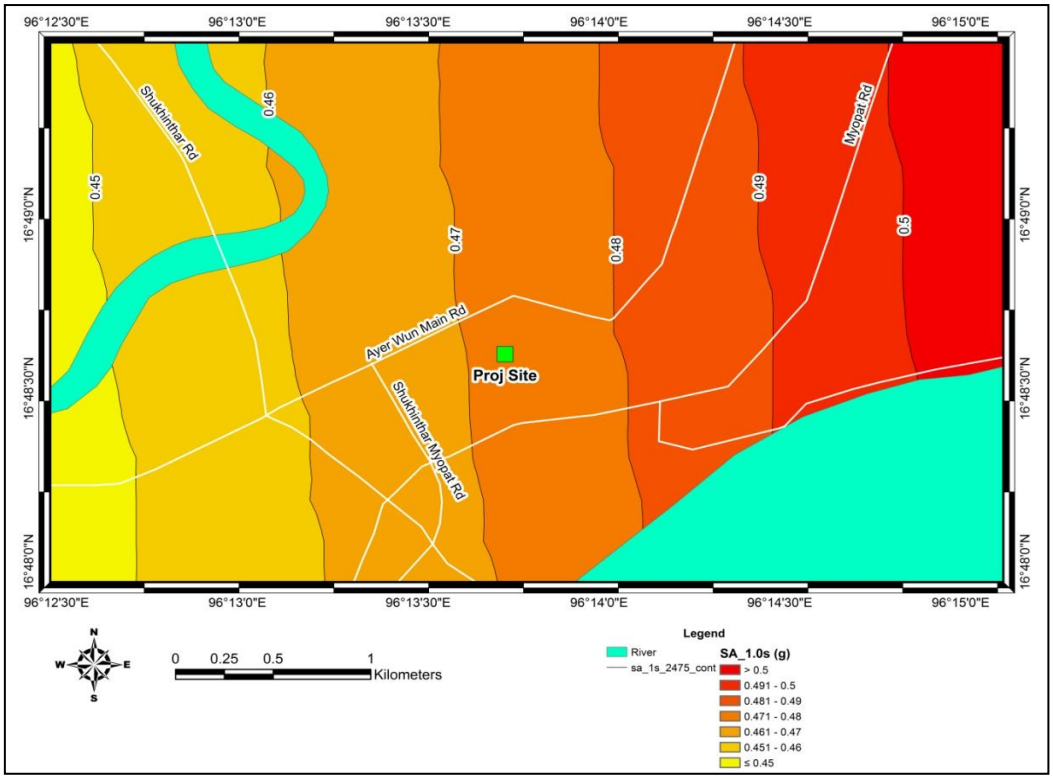
Figure 4.4-10 Seismic Hazard Map of the Project Area in terms of PGA for (a) 2 %, and (b) 10 % Probability of Exceedance in 50 Years


96°12'30"E
96°13'0"E
96°13'30"E
96°14'0"E
96°14'30"E
96°15'0"E
16°49'0"N
16°48'30"N
16°48'0"N
Shukhinthar Rd
Ayer Wun Main Rd
Shukhinthar Myopat Rd
Myopat Rd
Proj Site
0.72
0.74
0.76
0.78
0.8
0.82
N
W
E
S
0 0.25 0.5 1
Kilometers
Legend
River
sa_02s_2475_cont
SA_0.2s (g)
> 0.82
0.801 - 0.82
0.781 - 0.8
0.761 - 0.78
0.741 - 0.76
0.721 - 0.74
≤ 0.72

(a)

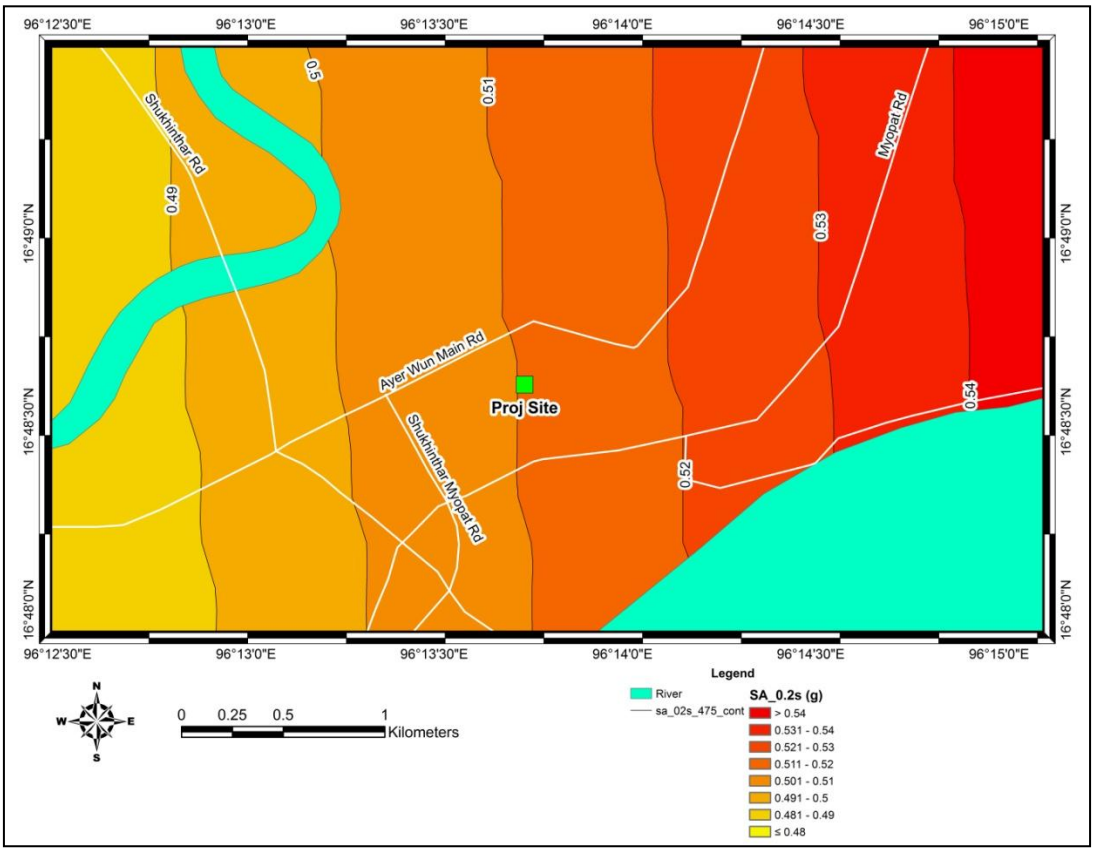

96°12'30"E
96°13'0"E
96°13'30"E
96°14'0"E
96°14'30"E
96°15'0"E
16°49'0"N
16°48'30"N
16°48'0"N
Shukhinthar Rd
Ayer Wun Main Rd
Shukhinthar Myopat Rd
Myopat Rd
Proj Site
0.76
0.78
0.8
0.82
0.84
N
W
E
S
0 0.25 0.5 1
Kilometers
Legend
River
sa_03s_2475_cont
SA_0.3s (g)
> 0.84
0.821 - 0.84
0.801 - 0.82
0.781 - 0.8
0.761 - 0.78
≤ 0.76

(b)

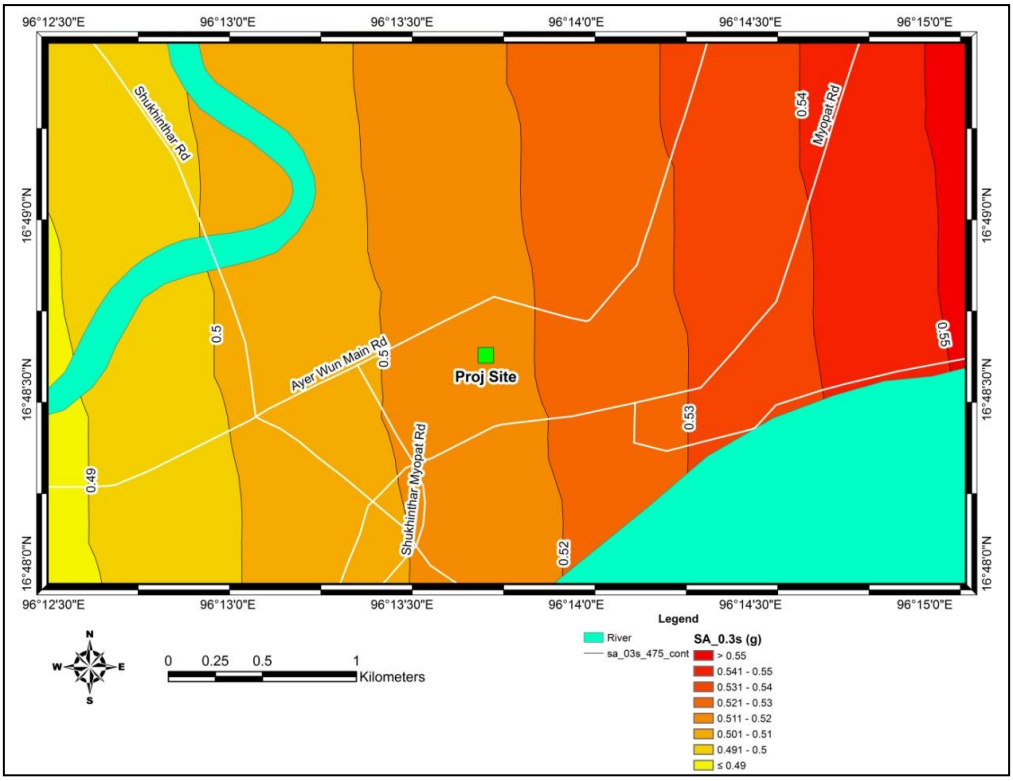


(c)

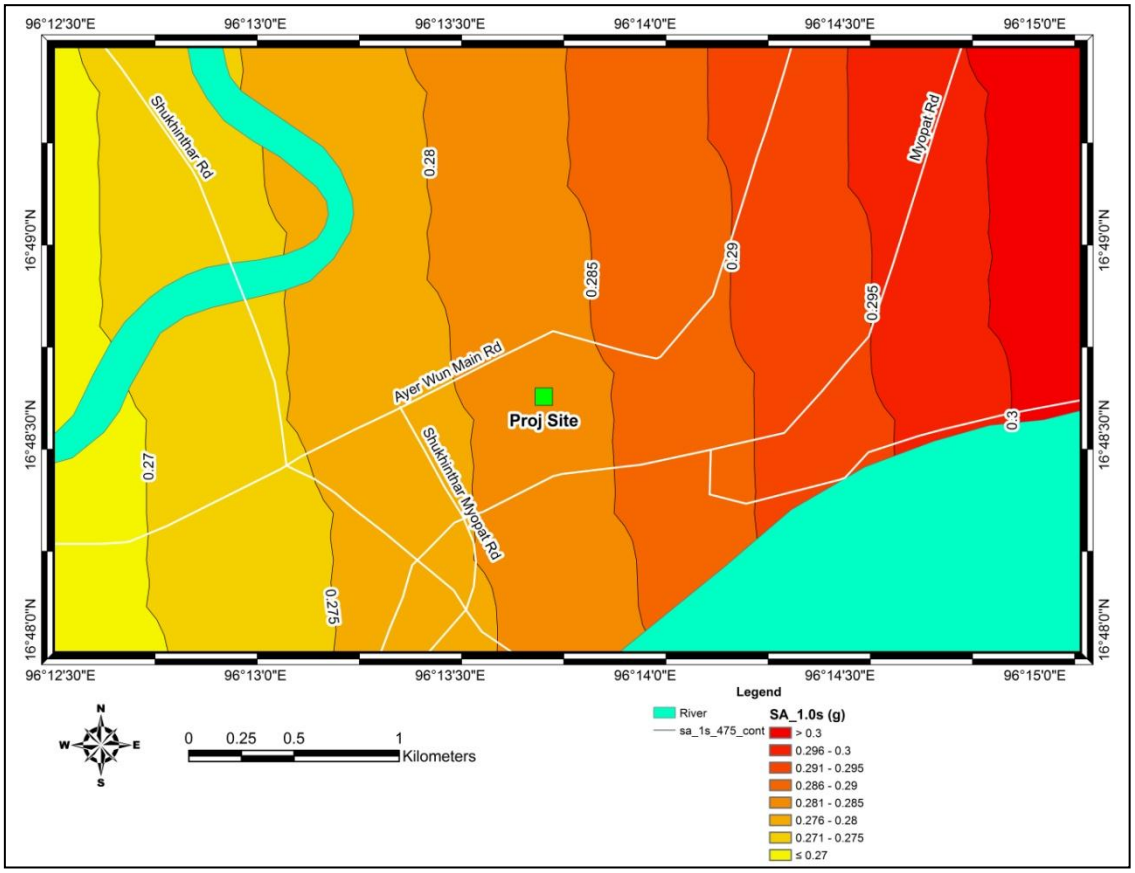
Figure 4.4-11 Seismic Hazard Map of the Project Area in terms of SA at the Period of (a) 0.2 s, (b) 0.3 s, and (c) 1.0 s for 2 % Probability of Exceedance in 50 Years



(a)



(b)



(c)

Figure 4.4-12 Seismic Hazard Map of the Project Area in terms of SA at The Period of (a) 0.2 s, (b) 0.3 s, and (c) 1.0 s for 10 % Probability of Exceedance in 50 Years

4.4.6 Summary

The probabilistic seismic hazard assessment for Thaketa project site and its surrounding area. Accordingly the procedure of PSHA, the seismic sources are identified and the seismic source parameters of each seismic source are estimated by using the classical recurrence law of Gutenberg and Richter (1944) for the estimation of a- and b-values, recurrence interval of each magnitude earthquake, and the maximum earthquake potentials. The maximum likelihood method of Kijko (2004) is applied to estimate the maximum magnitude of earthquake potentials that can be expected from the areal seismic sources, the empirical relationships of fault (rupture) length and earthquake magnitude are used for the fault specific seismic sources. The seismic hazards are then determined by using EQRISK program and the seismic hazard maps of the Project area are developed for 2 % and 10 % probability of exceedance in 50 years, i.e. average 2475 years and 475 years recurrence interval. The seismic hazards results are depicted in TABLE 4-7 and 4-8.

Table 4.4-5 The Seismic Hazards Results for the Project Site

Recurrence interval in years	Ground Motion Parameters (peak ground acceleration; PGA and spectral acceleration; SA in g) at Project site			
	PGA (g)	SA (0.2 s)	SA (0.3 s)	SA (1.0 s)
2475 (2 % prob. of exceed. in 50 yrs	0.39 - 0.40	0.76 - 0.78	0.78 - 0.8	0.47 - 0.48
475 (10 % prob. of exceed. in 50 yrs	0.25 - 0.255	0.51 - 0.52	0.51 - 0.52	0.28 - 0.285

Table 4.4-6 The Seismic Hazards Results for the Project Area

Recurrence interval in years	Ground Motion Parameters (peak ground acceleration; PGA and spectral acceleration; SA in g) at Project site			
	PGA (g)	SA (0.2 s)	SA (0.3 s)	SA (1.0 s)
2475 (2 % prob. of exceed. in 50 yrs	< 0.38 - > 0.42	< 0.72 - > 0.82	< 0.76 - > 0.84	< 0.45 - > 0.50
475 (10 % prob. of exceed. in 50 yrs	< 0.245 - > 0.265	< 0.49 - > 0.54	< 0.49 - > 0.55	< 0.27 - > 0.30

4.5 Surface Water

The main surface waterway near the project site is Pazundaung (Ngamoeyeik) Creek. The surface water and groundwater sample locations are shown in FIGURE 4-17 and TABLE 4-9.

Construction activities and waste water discharged to water bodies may cause impact to water hydrology and quality. The study on existing surface water hydrology and quality were carried out to get the baseline data for impact evaluation. During water sampling from each location, 2 replicates of samples will be collected to store in transparent plastic bottle for chemical parameters and to keep in translucent bottle for biological characteristics. Type of storage and volume will be adjusted in accordance with the request of the laboratory.

Table 4.5-1 Water Sampling Locations at Thaketa (February, 2012)

Sample Code	Location	Coordinates
Surface water		
SW 1	Pazundaung Creek	96°13'02.2"E, 16°49'14.8"N
SW 2	Pazundaung Creek	96°13'14"E, 16°49'03.6"N
SW 3	Pazundaung Creek	96°13'06.3"E, 16°48'53.9"N
SW 4	Pazundaung Creek	96°12'58.9"E, 16°48'56"N
Ground water		
GW1	Existing plant site	96°13'24.3"E, 16°48'53.6"N
GW2	Existing plant site	96°13'25.3"E, 16°48'36.7"N
GW3	Existing plant site	96°13'37.5"E, 16°48'40.8"N
GW4	Existing plant site	96°13'38"E, 16°48'47.8"N

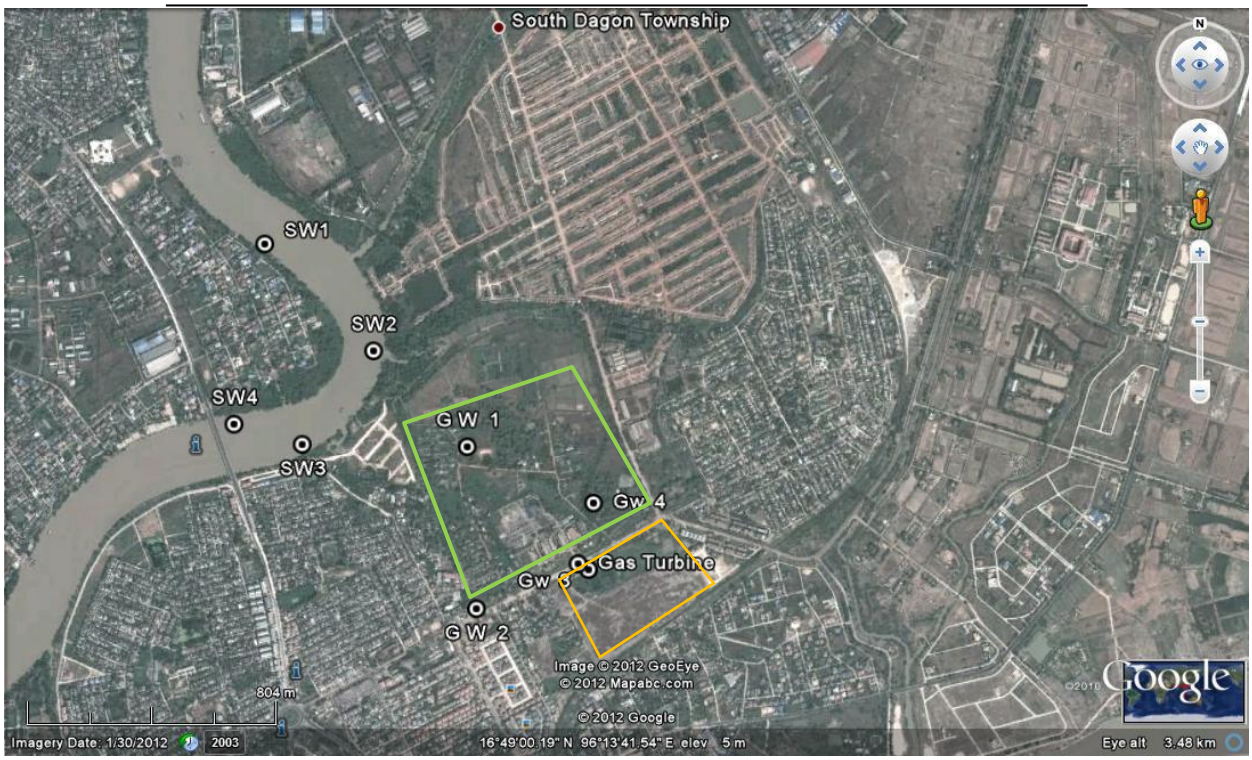


Figure 4.5-1 Surface Water and Ground Water Location Points at the Project Site

Existing Power Plant Proposed Power Plant

In situ parameters like temperature, pH, alkalinity/ acidity, conductivity, and dissolve oxygen DO will be measured directly by using ExStick EC500 pH/ Conductivity/ TDS/ Salinity/ Temperature Meter, and ExStick DO600 DO Meters and Senso Direct 150 Oxygen electrode and recorded.

To avoid the contamination, plastic or glass bottle will be applied preferably instead of using metal wares.

Sample preservation in the field is rather difficult as the permanent cold storage is not possible throughout. So the survey team are going to keep the sample bottles in temporary cold boxes, and then to send back to Office as fast as possible where the cold storage can be maintained until the laboratory analyses.

Surface water quality sampling was conducted during field survey at the designated sampling stations. Prior to conducting water sampling, physical characteristics of each sampling station were recorded. The in-situ measurements were described in the Table 4.5-2.

Table 4.5-2 *in-situ* Physical Parameter Measurement

Thaketa Gas Turbine (Surface Water & Ground Water Sampling)												
Name/Sr. No.	**SW 1(T)**	**SW 1(B)**	**SW 2(T)**	**SW 2(B)**	**SW 3(T)**	**SW 3(B)**	**SW4(T)**	**SW 4(B)**	**GW 1**	**GW 2**	**GW 3**	**GW 4**
Location	N - 16° 49' 14.8" E - 96° 13' 02.2" Elv - 4 m		N - 16° 49' 03.6" E - 96° 13' 14.0" Elv - 4 m		N - 16° 48' 53.9" E - 96° 13' 06.3" Elv - 7 m		N - 16° 48' 56.0" E - 96° 12' 58.9" Elv - 9 m		N 16° 48' 53.6" E 96° 13' 24.3" Elv - 16 m	N - 16° 48' 36.7" E - 96° 13' 25.3" Elv 11 m	N - 16° 48'40.8" E - 96° 13' 37.5" Elv - 9 m	N - 16° 48' 47.8" E 96° 13' 38.0" Elv 18 m
Time	0:45:00	11:05	11:25	11:30	11:40	11:55	12:10	12:30	2:50	3:20	3:50	4:40
Weather	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny
Turbidity	High	High	High	High	High	High	High	High				
Tem. (°C)	26.6	26.9	26.8	26.9	27	27.1	26.8	26.9	27.2	27.2	28.8	27.7
CD (µS)	3.15	3.18	3.09	3.15	3.4	3.51	3.91	3.99	1.534	1.221	1.105	0.609
pH	6.32	6.46	6.47	6.45	6.58	6.74	6.73	6.8	6.15	6.8	6.97	7.36
ORP (mv)	-3	-5	-5	-1	-5	-3	-3	-4	-49	-441	-233	35
Dissolved Oxygen (mg/l)	2.5	2.3	2.3	2.3	2.3	2.6	2.4	2.4				
Salinity (ppt)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Depth (m)	0.5 m	2.0 m	0.5 m	2.0 m	0.5 m	2.0 m	0.5 m	2.0 m	20.0 m	28.0 m	14.0 m	14.0 m
Type of Water	River	River	River	River	River	River	River	River	Tube Well	Tube Well	Tube Well	Tube Well
Remark	Tidal effect low						Tidal effect high					no fresh Water

Figure 4.5-2 Surface water sampling along the Pazundaung (Ngamoeyeik) Creek, Thaketa, February, 2012

Table 4.5-3 Results of Surface Water Quality in Pazundaung (Ngamoeyeik) Creek, Thaketa (2012)

	Parameters	Units	SW1	SW2	SW3	SW4
1.	BOD	(mg/l)	2.5	2.5	3.0	2.0
2.	COD	(mg/l)	1.47	3.68	16.19	5.52
3.	Turbidity	(FTU)	42.85	780	461	171
4.	Total Dissolved Solids	(mg/l)	1485	1378	1489	1700
5.	Cyanide	(mg/l)	ND	ND	ND	ND
6.	Nitrite Nitrogen	(mg/l)	0.025	0.006	0.007	0.008
7.	Nitrate Nitrogen	(mg/l)	0.098	0.096	0.012	0.010
8.	Iron as Fe	(mg/l)	0.442	0.445	0.429	0.528
9.	Arsenic as As	(ppm)	ND	ND	ND	ND
10.	Cadmium as Cd	(ppm)	0.005	0.007	0.007	0.008
11.	Copper as Cu	(ppm)	ND	ND	ND	ND
12.	Lead as Pb	(ppm)	ND	ND	ND	ND
13.	Mercury as Hg	(ppm)	ND	ND	ND	ND
14.	Calcium as Ca	(ppm)	8.14	8.29	14.15	14.04
15.	Zinc as Zn	(mg/l)	1.04	1.03	0.95	0.98

Source: Data collected on February 2012 (Resource & Environment Myanmar Ltd.)

Result of Study

Water quality station SW1 (96°13'02.2"E, 16°49'14.8"N)

The water quality station SW1 indicated that pH value was 6.39, dissolved oxygen was 2.5 mg/l, and temperature was about 26.6 °C at the depth of about 2 meter. Total dissolved solids are very high as 1485 mg/l. Turbidity was also high valued of 42.85 FTU. For chemical parameters BOD and COD were 2.5 mg/l and 1.47 mg/l respectively. Heavy metals were not detectable (As, Cu, Pb and Hg). Cyanide was also not detectable. Nitrite Nitrogen was 0.025 mg/l whereas Nitrate Nitrogen was 0.098 mg/l. Iron concentration was detected and value was 0.442 and Cadmium value was 0.005. Calcium values was 8.14 and base metal Zinc (Zn) was 1.04 respectively.

Water quality station SW2 (96°13'14"E, 16°49'03.6"N)

The water quality station SW2 indicated that pH value was 6.46, dissolved oxygen was 2.3 mg/l, and temperature was about 26.9 °C at the depth of about 2 meter. Total dissolved solids are very high as 1378 mg/l. Turbidity was also high valued of 780 FTU. For chemical parameters BOD and COD were 2.5 mg/l and 3.68 mg/l respectively. Heavy metals were not detectable (As, Cu, Pb and Hg). Cyanide was also not detectable. Nitrite Nitrogen was 0.006 mg/l whereas Nitrate Nitrogen was 0.096 mg/l. Iron concentration was detected and value was 0.445 and Cadmium value was 0.007. Calcium values was 8.29 and base metal Zinc (Zn) was 1.03 respectively.

Water quality station SW3 (96°13'06.3"E, 16°48'53.9"N)

The water quality station SW3 indicated that pH value was 6.66, dissolved oxygen was 2.3 mg/l, and temperature was about 27 °C at the depth of about 2 meter. Total dissolved solids are very high as 1489 mg/l. Turbidity was also high valued of 461 FTU. For chemical parameters BOD and COD were 3.0 mg/l and 16.19 mg/l respectively. Heavy metals were not detectable (As, Cu, Pb and Hg). Cyanide was also not detectable. Nitrite Nitrogen was 0.007 mg/l whereas Nitrate Nitrogen was 0.012 mg/l. Iron concentration was detected and value was 0.429 and Cadmium value was 0.007. Calcium values was 14.15 and base metal Zinc (Zn) was 0.95 respectively.

Water quality station SW4 (96°12'58.9"E, 16°48'56"N**)**

The water quality station SW3 indicated that pH value was 6.76, dissolved oxygen was 2.4 mg/l, and temperature was about 26.9 °C at the depth of about 2 meter. Total dissolved solids are very high as 1700 mg/l. Turbidity was also high valued of 171 FTU. For chemical parameters BOD and COD were 2.0 mg/l and 5.52 mg/l respectively. Heavy metals were not detectable (As, Cu, Pb and Hg). Cyanide was also not detectable. Nitrite Nitrogen was 0.008 mg/l whereas Nitrate Nitrogen was 0.010 mg/l. Iron concentration was detected and value was 0.528 and Cadmium value was 0.007. Calcium values was 14.04 and base metal Zinc (Zn) was 0.98 respectively.

Additional surface water and groundwater sample were collected in April 2013. The location of surface water and groundwater samples were shown in FIGURE 4-19.

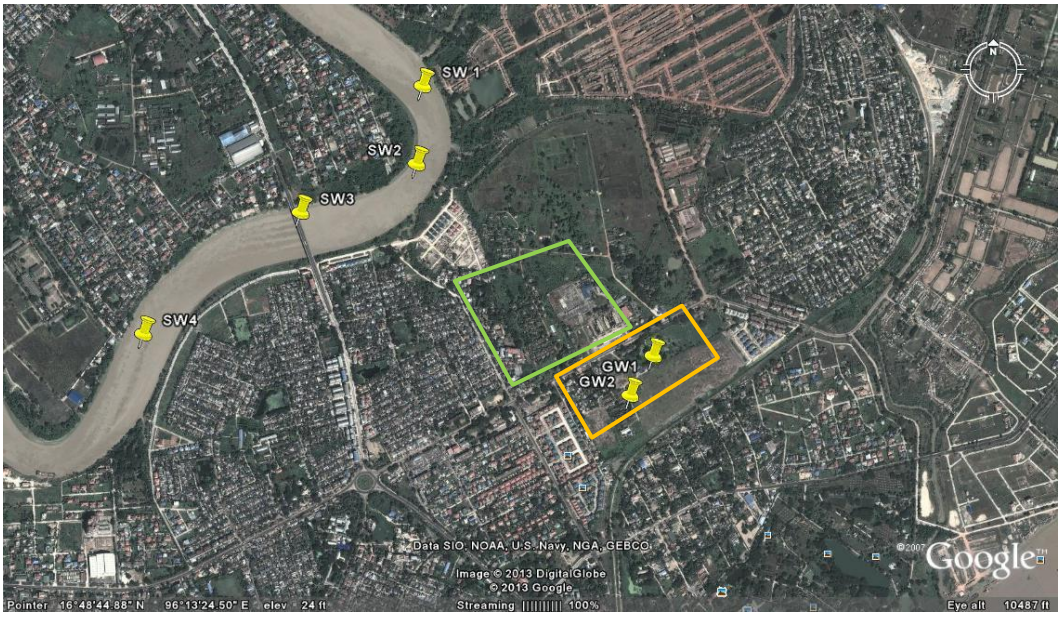


Figure 4.5-3 Location of Additional Surface Water and Groundwater Sampling Points for Proposed Project

Existing Power Plant

Proposed Power Plant

Figure 4..5-4 Surface Water, Plankton and Benthic Fauna Sampling along Pazundaung Creek (April, 2013)

Physical and chemical properties of surface water samples are shown in TABLE 4-12 and 4-13.

Table 4.5-4 Physical Properties of Surface Water Samples, Ngamoeyeik (Pazundaung) (April 2013)

Site ID	pH	EC (mS/cm)	TDS (ppm)	Temp (°C)	Turbidity (FNU)	DO (mg/l)	ORP
SW-1	7.17	12.3	6154	31.32	394	0.14	51.6
SW-2	7.26	11.75	5877	31.43	471	0.23	51

SW-3	7.14	11.99	5996	31.45	585	0.11	51.1
SW-4	7.21	13.76	6884	31.02	238	0.04	55

Table 4.5-5 Results of Surface Water Quality in Pazundaung Creek, Thaketa (April 2013)

Parameters		Units	SW1	SW3
1.	SS	(mg/L)	1051	1481
2.	BOD	(mg/L)	2.5	3.0
3.	COD	(mg/L)	0.736	0.368
4.	Turbidity	(FTU)	1536	954
5.	Nitrate Nitrogen NO_3-N	(mg/L)	0.08	0.01
6.	Total Nitrogen	(mg/ml)	7.7	6.4
7.	Arsenic as As	(ppm)	ND	0.0444
8.	Cadmium as Cd	(ppm)	0.0004	0.001
9.	Copper as Cu	(ppm)	0.04	0.17
10.	Lead as Pb	(ppm)	0.0079	0.0006
11.	Mercury as Hg	(ppm)	0.0003	0.0002
12.	Zinc as Zn	(mg/L)	1.02	1.25
13.	Ammonium Nitrogen as NH_4-N	(mg/L)	nil	nil
14.	Phosphorus as P	(mg/L)	0.01716	0.33
15.	Phosphate as PO_4	(mg/L)	0.052	1.0
16.	Oil and Grease	(mg/L)	1	<1
17.	Total Coliforms	(cfu/100ml)	0	0
18.	Fecal Coliforms	(cfu/100ml)	0	0
19.	E.coli	(cfu/100ml)	0	0

Source: Data collected on April 2013 (Resource & Environment Myanmar Ltd)

Result of Study

Water quality station SW1 (96°13'11.2"E, 16°49'8.4"N)

The water quality station SW1 indicated that pH value was 7.17, dissolved oxygen was 0.14 mg/l, and temperature was about 31.32 °C at the depth of about 2 meter. Total dissolved solids are very high as 6154 mg/l. Turbidity was also high valued of 394 FTU. For chemical parameters BOD and COD were 2.5 mg/l and 0.736 mg/l respectively. Heavy metals were detectable exception of Arsenic. Cu value was 0.04, Pb value was 0.0079 and Hg value was 0.0003. Cyanide was also not detectable. Total Nitrogen was 7.7 mg/l whereas Nitrate Nitrogen was 0.08 mg/l. Cadmium value was 0.0004. Total coliforms was not observed.

Water quality station SW3 (96°12'56.8"E, 16°48'54.1"N)

The water quality station SW3 indicated that pH value was 7.14, dissolved oxygen was 0.11 mg/l, and temperature was about 31.45 °C at the depth of about 2 meter. Total dissolved solids are very high as 5996 mg/l. Turbidity was also high valued of 585 FTU. For chemical parameters BOD and COD were 3 mg/l and 0.368 mg/l respectively. Heavy metals were observed and the values were noted as As – 0.444 mg/l, Cu-0.17 mg/l, Pb-0.0006 mg/l and Hg-0.0002 mg/l. Total Nitrogen was 6.4 mg/l whereas Nitrate Nitrogen was 0.01 mg/l. Cadmium value was 0.001. Total coliforms was not observed.

4.6 Groundwater

4.6.1 Introduction

This section describes the groundwater and hydrogeology for the proposed project. In preparation for this section, a desk study of available reports, data and maps describing the groundwater and hydrogeologic characteristics of the project area was conducted. In addition, a field study was performed to evaluate the potential impacts to the groundwater in the vicinity of the site. The objective of the data review and subsequent field studies were to obtain sufficient information to identify the potential impacts to groundwater resources that might result from the construction and operation of the proposed project.

The information on existing conditions of groundwater leads to evaluation of the impact from the project to groundwater as well as to find out measures to mitigate those impacts. The Irrawaddy Formation (Pliocene) and Gravel Beds of Quaternary are the main aquifer of the proposed project area.

Results of the Field Survey

Groundwater resources were identified within the Project Site using existing geological map and topographic map before field study. A total of 4 locations of groundwater at the existing wells were selected to collect sample for water quality. *In situ* parameters like temperature, pH, alkalinity / acidity, conductivity, and dissolve oxygen DO will be measured directly by using ExStick EC500 pH/ Conductivity/ TDS/ Temperature Meter, and ExStick DO600 DO Meters, and SensoDirect 150 Oxygen electrode. The result of ground water quality analysis was compared with WHO drinking water standard to indicate the ground water suitability for consumption. Examination from tube wells from the project site the source of groundwater is alluvial aquifer and Irrawaddy Formation. The average groundwater level within the sampling site is 14 to 20 meter.

Results

The baseline groundwater quality status in the region is established by analyzing 3 samples in February 2012. The water samples were analyzed at the fresh water aquaculture research water and soil examination laboratory, department of Fisheries aquaculture division, Ministry of Livestock and Fisheries and department of Applied Geology, Yangon University. Results of the ground water were presented in TABLE 4-15.

Table 4.6-1 Results of Groundwater Quality (February 2012)

S.N	Parameters	Units	GW1	GW2	GW3	WHO
1.	COD	(mg/l)	7.36	0.74	4.42	no guideline
2.	BOD	(mg/l)	1.5	1.5	1.5	-
3.	Turbidity	(FTU)	358	48.49	3.67	no guideline
4.	Total Dissolved Solids	(mg/l)	690	543	496	no guideline
5.	Nitrite Nitrogen	(mg/l)	0.015	0.008	0.015	50 Total Nitrogen
6.	Nitrate Nitrogen	(mg/l)	0.09	0.01	0.08	-

7.	Iron as Fe	(mg/l)	0.014	0.019	0.018	-
8.	Cadmium as Cd	(ppm)	0.003	0.004	0.004	0.003
9.	Copper as Cu	(ppm)	ND	ND	ND	2
10.	Lead as Pb	(ppm)	ND	ND	ND	0.01
11.	Mercury as Hg	(ppm)	ND	ND	ND	0.001
12.	Calcium as Ca	(ppm)	4.18	4.29	4.16	-
13.	Cyanide	(mg/l)	Nil	Nil	Nil	0.07
14.	Arsenic as As	(ppm)	ND	ND	ND	0.01
15.	Zinc as Zn	(mg/l)	1.02	0.99	0.89	3

FIGURE 4.6-1 Ground water sampling in the project area.

Discussion of Results

*GW1 (*96°13'24.3"E, 16°48'53.6"N)

The measurement of ground water quality at this station found that pH was 6.2, temperature value of 27.2 degree Celsius (°C), conductivity value of 1.53 micro second per cm (µS/cm). Total dissolved solids were 1025 mg/liter. However there was no guideline indicated quality of the water on high total dissolved solids, which may cause water taste to be salty. Heavy metal namely Arsenic, Copper, Lead and Mercury were not detected. In addition, cyanide was indicated as nil. However, Iron, Cadmium, Calcium and Zinc was 0.01, 0.003, 4.18 and 1.02 mg/l respectively.

Nitrite Nitrogen was 0.015 mg/l whereas Nitrate Nitrogen was 0.09 mg/l. When compared all parameter determination with WHO standard, values of the parameters indicated that they were well within the standard.

GW2 (96°13'25.3"E, 16°48'36.7"N)

The measurement of ground water quality at this station found that pH was 6.8, temperature value of 27.2 degree Celsius (°C), conductivity value of 1.22 micro second per cm (µS/cm). Total dissolved solids were 809 mg/liter. However there was no guideline indicated quality of the water on high total dissolved solids, which may cause water taste to be salty. Heavy metal namely Arsenic, Copper, Lead and Mercury were not detected. In addition, cyanide was indicated as nil. However, Iron, Cadmium, Calcium and Zinc was 0.019, 0.004, 4.29 and 0.99 mg/l respectively. Nitrite Nitrogen was 0.008 mg/l whereas Nitrate Nitrogen was 0.01 mg/l. When compared all parameter determination with WHO standard, values of the parameters indicated that they were well within the standard.

GW3 (96°13'37.5"E, 16°48'40.8"N)

The measurement of ground water quality at this station found that pH was 6.97, temperature value of 28.8 degree Celsius (°C), conductivity value of 1.105 micro second per cm (µS/cm). Total dissolved solids were 743 mg/liter. However there was no guideline indicated quality of the water on high total dissolved solids, which may cause water taste to be salty. Heavy metal namely Arsenic, Copper, Lead and Mercury were not detected. In addition, cyanide was indicated as nil. However, Iron, Cadmium, Calcium and Zinc was 0.018, 0.004, 4.16 and 0.89 mg/l respectively. Nitrite Nitrogen was 0.015 mg/l whereas Nitrate Nitrogen was 0.08 mg/l. When compared all parameter determination with WHO standard, values of the parameters indicated that they were well within the standard.

Two additional groundwater samples were collected in April 2013. The physical and chemical results were shown in TABLE 4-16.

Table 4.6-2 Physical Properties of Groundwater Sample, April 2013

Site ID	pH	EC (mS/cm)	TDS (ppm)	Temp (°C)	Turbidity (FNU)	DO (mg/l)	ORP
GW-1	10.7	1.971	983	30.22	7.1	1.47	44.4
GW-2	9.87	1.409	704	31.34	23.1	2.86	33.2


Figure 4-22 Ground water sampling and measuring in situ physical parameter

Table 4.6-3 Results of Groundwater Quality (April, 2013)

S.N	Parameters	Units	GW1	GW2	WHO
1.	COD	(mg/L)	0.736	3.68	no guideline
2.	BOD	(mg/L)	1.5	2	-
3.	Total Nitrogen	(mg/L)	10.3	11.1	50 Total Nitrogen
4.	Nitrate Nitrogen as NH_4N	(mg/L)	0.019	1.10	no guideline
5.	Cadmium as Cd	(ppm)	0.0001	0.0002	0.003
6.	Copper as Cu	(ppm)	0.06	0.09	2
7.	Lead as Pb	(ppm)	0.0130	0.0083	0.01
8.	Mercury as Hg	(ppm)	0.0063	0.0038	0.001
9.	Arsenic as As	(ppm)	0.0173	0.0090	0.01
10.	Zinc as Zn	(mg/L)	0.94	1.20	3
11.	Salinity	(ppt)	nil	nil	-
12.	Phosphate as PO_4	(mg/L)	nil	0.58	-
13.	Phosphorus as P	(mg/L)	nil	0.1914	-
14.	Total Coliforms	(cfu/100ml)	0	0	-
15.	Fecal Coilforms	(cfu/100ml)	0	0	-
16.	E.coli	(cfu/100ml)	0	0	-

- Yellow shaded are higher than standard

Discussion of Results

*GW1 (*96°13'38.40"E, 16°48'37.90"N)

The measurement of ground water quality at this station found that pH was 10.7, temperature value of 30.22 degree Celsius (°C), conductivity value of 1.97 micro second per cm (µS/cm). Total dissolved solids were 983 mg/liter. However there was no guideline indicated quality of the water on high total dissolved solids, which may cause water taste to be salty. Heavy metal namely Arsenic, Lead and Mercury were detected and higher than the WHO guideline. However, Cadmium, and Zinc was 0.0001, and 0.94 mg/l respectively. Nitrate Nitrogen was 0.019 mg/l.

GW2 (96°13'35.70"E, 16°48'33.45"N)

The measurement of ground water quality at this station found that pH was 9.87, temperature value of 31.34 degree Celsius (°C), conductivity value of 1.41 micro second per cm (µS/cm). Total dissolved solids were 704 mg/liter. However there was no guideline indicated quality of the water on high total dissolved solids, which may cause water taste to be salty. Heavy metal namely Arsenic, Copper, Lead and Mercury were detected and Mercury was higher than WHO guideline. However, Cadmium, and Zinc was 0.0002, and 1.2 mg/l respectively. Nitrate Nitrogen was 1.10 mg/l.

Original laboratory results of soil , groundwater and surface water are presented in appendix-5.

4.7 Ambient Air Quality

The proposed project represents mostly sub-urban/residential set up. The likely changes in the ambient air quality are limited to construction phase due to proposed project activities as described in Chapter 3. The sources of air pollution include existing power plant, vehicular traffic, dust arising from unpaved roads and domestic fuel burning.

As of a tropical monsoon country locating northeast of the Bay of Bengal, the country has regular SW monsoon wind in the rainy season and NE monsoon wind in the winter or cold dry season.

Because of the existing and forthcoming development of Gas Turbine, there would be threat to lower the air quality.

Based on the prevailing wind directions of the proposed project site, the ambient air samples were collected from two locations. Each location which was located at each direction (south and north) of the project site respectively were selected in order to obtain not only the existing baseline status and also for the impact assessment on the probability of movement of pollutants to nearby surroundings.

TABLE 4-18 presents baseline air quality monitoring stations. The location of air quality monitoring stations is shown in FIGURE 4-23.

Table 4.7-1 Baseline Air Quality Monitoring Stations

Monitoring Location	Date	Description 1 km of the project site	Level above the ground
AQM-1	29.4.2013	**West of the project site** (16° 48' 39.5'' N, 96°13' 37.6'' E)	1.5 meters
AQM-2	2.5.2013	**Within the proposed project site** (16° 48' 42.8'' N, 96° 13' 45.7'' E)	1.5 meters

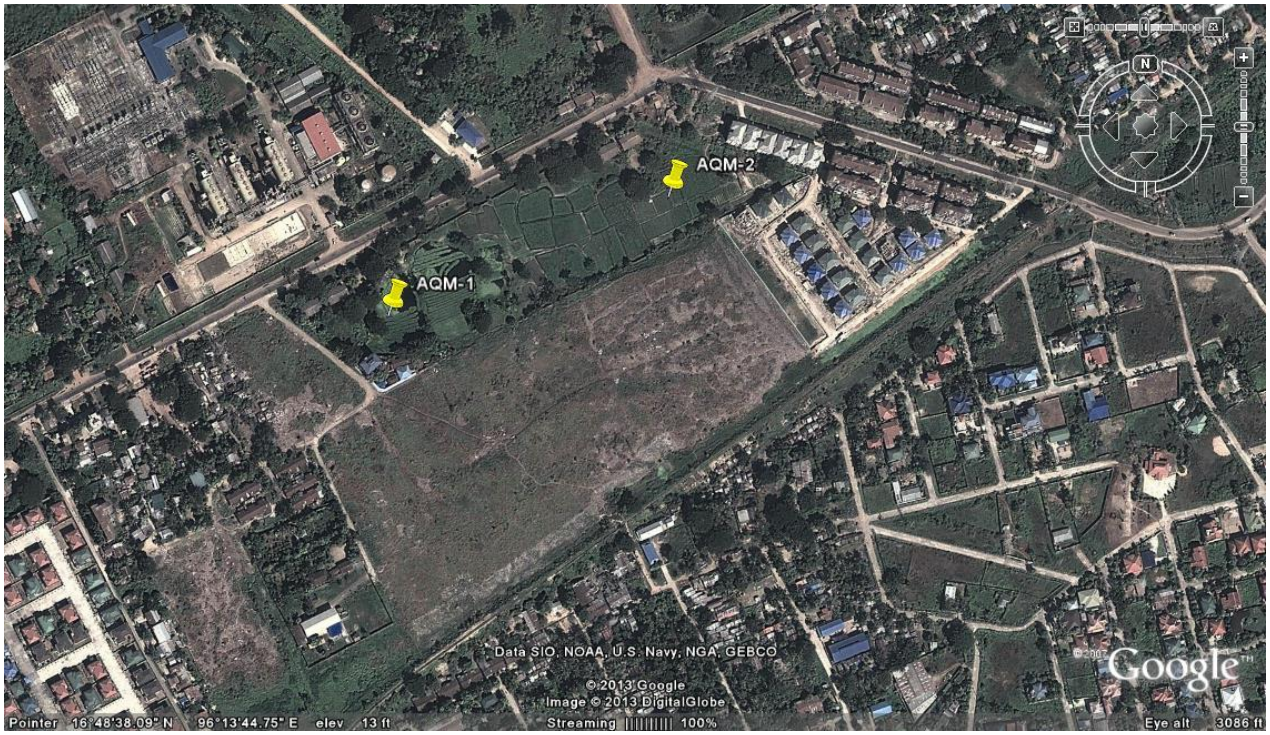


Figure 4.7-1 Air Quality Monitoring Stations at Proposed 106 MW CCPP at Thaketa

4.7.1 Air Quality Monitoring Instrument

The Hazscanner ™ EPAS wireless environmental perimeter air station was deployed to measure the selected air parameters. The instrument is factory calibrated with calibration Span check.

Calibration: Gravimetric reference NIST traceable- SAE fine dust –ISO12103-1.

Accuracy : ± 10% to filter gravimetric SAE fine test dust.

4.7.2 Data Reliability and Validity

This survey developed the quality assurance plan then followed by data analysis and data interpretation.

4.7.3 Application of the International Standards and Guidelines

To reveal the existing status of baseline air quality, it took the form of comparisons of the average ambient air quality measured with the international air quality standards. All this leads to mitigate the potential impact on the environment including general population along with implementation of the suitable control measures.

(a) Ambient air quality standards

There are no own air quality standards in Myanmar yet. The survey should adopt the relevant international air quality guidelines and standards.

World Health Organization (WHO)

The WHO Air quality guidelines (AQG) are updated in order to assure their global applicability based on low-and middle-income countries where air pollution levels are the highest.

USEPA (NAAQS)

This study selects both primary and secondary standards set which limits to protect public health including the health of sensitive subtypes of general population such as the asthmatics, children and the elderly and ecology.

4.7.4 Air Monitoring Results

4.7.4.1 Air Quality and Local Meteorology

The climate and air quality data include primary data collection from ambient air monitoring along with the collection of Temperature, Relative Humidity, Wind speed and Wind direction simultaneously at the two selected points.

4.7.4.2 Point AQM-1– West of the Proposed Project Site

Figure 4.7-2 Air Monitoring Station at Point (1) AQM-1

(a) Ambient Dust Levels

TABLE 4-19 presents the results of dust (particulate matters) concentrations continuously monitored per minute over an average 24-hr period at point 1 (AQM-1).

Table 4.7-2 Baseline PM10 and PM2.5 Concentrations at Point (1) (24-hr Average)

Location	PM10 (µg/m^3)	PM2.5 (µg/m^3)
Point 1		
Day & Night (average)	**63.56**	**4.02**
WHO guideline	50[1]	100[1]
NAAQS (USEPA)	150[1]	NA
Thailand	120	330
IFC	50	25
NEQG	50	25

(1) 24hr average

Bold indicates higher than WHO air quality guidelines

NA – not available

The results from the baseline survey at point (1) indicate that the 24-hour average levels of PM10 and PM2.5 did not meet the WHO guideline and IFC PM10 standard. This may have been caused due to traffic on the road shaft during road construction near the plant site at the time of collecting baseline data.

(b) Ambient Gaseous Levels

TABLE 4-20 presents the results of the ambient gases levels continuously monitored per minute over an average 24-hr period at point 1.

Table 4.7-3 Baseline Ambient Gases Levels at point (1) (24-hr Average)

Location	CO ppm	VOC ppm	SO_2 ppb	NO_2 ppb
Point 1				
Day & Night (average)	0.37	0	14.42	27.24
WHO guideline	NA	NA	20[1]	40 (annual)
NAAQS (USEPA)	9 (8hr)	NA	0.5 (3hr)	53 (annual)
IFC	-	-	20 (24 hr)	200 (1hr)

(1) 24hr average

Bold indicates higher than WHO air quality guidelines

NA – not available

The survey results at the point 1 (AQM-1) indicate that baseline CO, VOC, SO_2 and NO_2 levels meet both the WHO guideline, IFC and NAAQS (USEPA) standard.

(c) Local Climate

TABLE 4.7-4 presents 24hr average condition of local climate during the sampling period

Table 4.7-4 The Local meteorology at point 1 (24-hr Average)

Sr	Temperature Deg (C)	Relative Humidity (RH) %	Wind Speed (kph)	Wind Direction (Deg)
1	30.06	65.12	3.71	98.37

4.7.4.3 Point 2 (AQM-2) – Within the Proposed Project Site

Figure 4.7-3 Air Monitoring Station at Point 2 (AQM-2)

(a) Ambient Dust Levels

TABLE 4-22 presents the results of dust (particulate matters) concentrations continuously monitored per minute over an average 24-hr period at point 2.

Table 4.7-5 Baseline PM10 and PM2.5 Concentrations at Point (2) (24-hr Average)

Location	PM10 in µg/m^3	PM2.5 24-hr in µg/m^3
Point 2		
Day & Night (average)	**56.96**	**4.26**
WHO guideline	50[1]	100[1]
NAAQS (USEPA)	150[1]	NA
Thailand	110	330
NEQG	50	25

(1) 24hr average

Bold indicates higher than WHO air quality guidelines

NA – not available

The results from the baseline survey at point 2 (AQM-2) indicate that the 24-hour average levels of both PM10 and PM2.5 did not meet the WHO guideline and the NAAQS (USEPA) standard. This may have been caused due to traffic on the road shaft during road construction near the plant site at the time of collecting baseline data.

(b) Ambient Gaseous Levels

TABLE 4.7-6 presents the results of the ambient gases levels continuously monitored per minute over an average 24-hr period at point 2.

Table 4.7-6 Baseline Ambient Gases Levels at Point (2) (24-hr Average)

Location	CO ppm	VOC ppm	SO_2 ppb	NO_2 ppb
Point 2				
Day & Night (average)	0.41	0	10.94	**24.04**
WHO guideline	NA	NA	20[1]	40 (annual)
NAAQS (USEPA)	9(8hr)	NA	0.5(3hr)	53(annual)

(1) 24hr average

Bold indicates higher than WHO air quality guidelines

NA – not available

The survey results at the point 2 (AQM-2) indicate that baseline CO, VOC, SO_2 and NO_2 levels meet the WHO guideline and NAAQS (USEPA) standard.

(c) Local Climate

TABLE 4.7-7 presents 24hr average condition of local climate during the sampling period

Table 4.7-7 The Local meteorology at point 2 (24-hr Average)

Sr	Temperature Deg (C)	Relative Humidity (RH) %	Wind Speed (kph)	Wind Direction (Deg)
1	29.57	66.12	6.37	184.24

4.8 Ambient Noise Quality

The background ambient noise levels in the area were measured once for 24hours at three locations within the project site. Noise levels were recorded with the help of a digital noise level meter. Noise level were recorded for 24 hours and the noise quality is reported as L(min), L(max) ,Leq24 hr and Leq1hr for each of the three locations.

4.8.1 Methodology

Noise measurements were undertaken at three locations including the project site for 24hr duration. The day noise level has been monitored during 7 AM to 10 PM and night levels during 10 PM to 7 AM. The existing pre-project noise level was measured during 29 April to 2 May, 2013 at the area around the power plant site and the nearby the project site. In this project, the sound level meter model SL-4023SD was used. The location of the noise monitoring station is shown in FIGURE 4-20.

Figure 4.8-1 Location of Noise Monitoring Stations in The Project Area

Attribute	Parameter	Frequency of Monitoring & methodology
Noise	Noise levels in dB (A) at 3 locations	Day and night noise levels were recorded continuously at each location. The data has been computed for Lday , Lnight, Lmin & Lmax

For noise levels measured over a given period of time interval, it is possible to describe important features of noise using statistical quantities. This is calculated using the percent of the time certain noise levels are exceeded during the time interval. The notation for the statistical quantities of the noise levels are described below:

- L10 is noise level exceeded 10% of the time;
- L50 is noise level exceeded 50% of the time; and
- L90 is noise level exceeded 90% of the time.

4.8.2 Equivalent Sound Pressure Level (L eq)

The Leq is the equivalent continuous sound level, which is equivalent to the same sound energy as the actual fluctuating sound measured in the same period. This is necessary because sound from noise source often fluctuates widely during a given period of time.

This is calculated from the following equation:

Leq(hrly) = L50+((L10 - L90)2 / 60)

Lday : Is defined as the equivalent noise level measured over a period of time during day (7 AM to 10 PM)

Lnight : Is defined as the equivalent noise level measured over a period of time during night (10PM to 7 AM).

Ambient Noise Level of the project site is presented in TABLE 4-25.

Table 4.7-8 Ambient Noise Level Monitoring Results

Code	Location	Latitude	Longitude	Leq Day dB(A) 7:00 – 22:00	Leq Night dB (A) 22:00 – 7:00	Distance from the Existing Project site (kms)
N1	West of proposed plant site	16°48'39.52"N	96°13'37.60"E	55	57	140 m away from existing gas turbine
N2	South of proposed plant site	16°48'31.40"N	96°13'36.84"E	48	47	375 m away from existing gas turbine
N3	East of Proposed Plant Site	16°48'41.79"N	96°13'52.02"E	59	45	535 m away from existing gas turbine
	Industrial Limits*			70	70	NEQEG guideline is same as World Bank guideline.
	Residential Limits*			55	45	

- Standard – WBG EHS General Guidelines. (-Industrial day time, Industrial night time, Residential day time, Residential night time)

The noise monitoring stations are located beside the car road and 100m to 500m away from the existing gas-fired power plant. The baseline noise levels are typical of sub-urban/rural settings with high noise levels at N3 in day time and all noise points in nighttime. The Project is located in a sub-urban/rural area and the project site is also situated in front of the existing power plant, nearby the industrial zone and other housing project. The dominant source of noise was from human and activities, including vehicle traffic from motorway and existing power plant in the nearby area. Therefore, the baseline noise level does not meet the residential limits of NEQEG and it can meet only industrial limits.

CHAPTER V

EXISTING ENVIRONMENT: ECOLOGY

5.1 Introduction

As part of the Environmental Impact Assessment (EIA) of the proposed Combined Cycle Power Plant project, an environmental baseline study was carried out in areas surrounding the project site. As noted earlier, the specific objectives of the baseline study were to gather information on the existing physical, biological, and socio-economic environment of the areas in and around the project site; to gather and assess peoples' perception on different aspects of the proposed project. This Chapter describes the existing biological environment of areas in and around the project site based on the baseline survey carried out as a part of the present study. The baseline ecological survey primarily focused on identifying floral and faunal diversity and distribution within and surrounding the project site.

Possible impacts of the project activities have been evaluated against these baseline environmental conditions.

5.2 Approach and Methodology

An ecological survey was carried out as a part of the EIA in order to assess the floral and faunal diversity in areas surrounding the proposed project site. The main purposes of the ecological survey were (i) to enlist the plant and wildlife species with their national and international status, (ii) to enlist keystone, rare and threatened flora and fauna, (iii) to investigate the distribution and abundance of flora and fauna including fish species, and (iv) to make an assessment of the impacts for the proposed project activities on the ecological environment. Floral and faunal diversity fluctuate seasonally due to environmental reasons. Seasonal survey (spanning over a year) could provide detailed information on ecological diversity for the study area. However, in the present study, a rapid survey was conducted in February 2012 and April 2013 during daytime. The Ecologists of the EIA team visited areas surrounding the project site (approximately 5 km surrounding the project site for habitat map preparation) to collect firsthand information on floral and faunal diversity. Literature review and informal interviews with local people were also conducted as a part of the study. Herpeto-faunal and mammalian survey was done through visual search and also through discussion with local people. Floral survey was conducted through visual and rapid field surveys.

Survey Area

Detailed field survey areas are:

1) the existing power plant area

2) the proposed new power plant area

2) water intake and discharged area in Ngamoeyeik creek

The coordinate location of biodiversity survey areas were listed below with table and figure of biodiversity survey area was described in figure 5.2-1.

Name	Longitude	Latitude
Biodiversity 1	96°13'36.11"E	16°48'39.49"N
Biodiversity 2	96°13'38.59"E	16°48'38.58"N
Biodiversity 3	96°13'43.53"E	16°48'43.28"N
Biodiversity 4	96°13'39.66"E	16°48'35.23"N
Biodiversity 5	96°13'46.67"E	16°48'38.73"N

Biodiversity 6	96°13'28.75"E	16°48'39.56"N
Biodiversity 7	96°13'32.57"E	16°48'47.58"N
Biodiversity 8	96°13'25.92"E	16°48'45.13"N
Biodiversity 9	96°13'27.03"E	16°48'50.68"N
Biodiversity 10	96°12'59.60"E	16°48'50.50"N
Biodiversity 11	96°13'8.99"E	16°48'54.04"N
Biodiversity 12	96°13'13.68"E	16°48'58.97"N

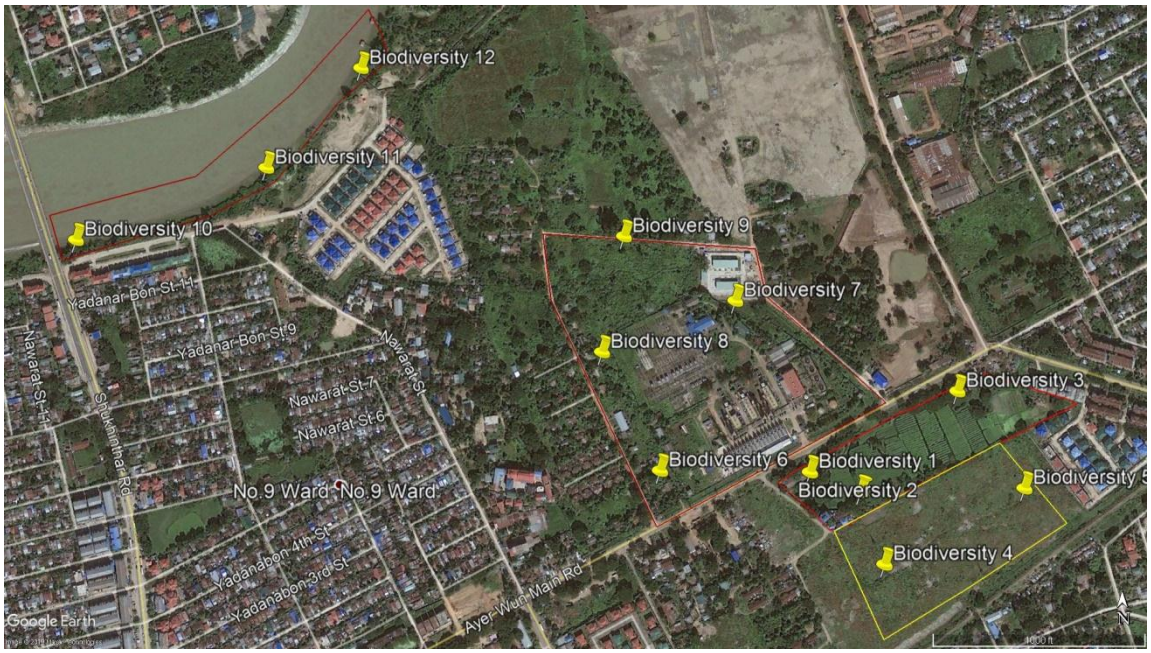


Figure 5.2-1 Location of Biodiversity Survey Area

5.2.1 Terrestrial Flora

The study area supports various terrestrial floras, some of which of these grow naturally, while most have been planted. Common terrestrial flora in the study area includes Kokko tree - *Mimosaceae*, Mango tree - *Anacardiaceae*, and *Moraceae* - Pein –hne etc. Three types of terrestrial floral habit - tree, shrub and herb exists in the project areas. Most floral species particularly the trees and shrubs are cultivated and planted. Common and observed list of flora are listed in APPENDIX-4.

Total of 14 mangrove species were observed in Ngamoeyeik (Pazundaung) Creek (outside of the project). Ranking of ecological significance by IVI of mangrove species in the study area, i.e. about 1 km from the project boundary, were given in TABLE 5.2-1.

Table 5.2-1 Ranking of Important Value Index (IVI) in the Mangrove Area, One Kilometer from The Project Boundary

No.	Scientific Name	Relative Density (%)	Relative Frequency (%)	Relative Dominance (%)	Important Value Index (%)
1	*Avicennia officinalis* L.	65.35	33.33	78.60	177.28
2	*Hibiscus tiliaceus* L.	11.88	10.00	1.63	23.51
3	*Dolichandrone spathacea* Schum	3.96	10.00	4.18	18.14
4	*Sonneratia caseolaris* (L.) Engl.	2.97	6.67	6.49	16.13
5	*Clerodendrum inerme* Gaertn.	5.94	6.67	0.37	12.97
6	*Flueggea leucopyrus* Willd.	1.98	6.67	0.15	8.80
7	*Samanea saman* (Jacq.) Merr.	0.99	3.33	2.96	7.28
8	*Pithecellobium dulce* (Roxb) Benth.	0.99	3.33	2.43	6.75
9	*Excoecaria agallocha* L.	0.99	3.33	1.04	5.36
10	*Erythrina stricta* Roxb.	0.99	3.33	0.98	5.31
11	*Acacia auriculiformis* A. Cunn.	0.99	3.33	0.78	5.10
12	*Dalbergia spinosa* Roxb.	0.99	3.33	0.21	4.54
13	*Capparis tenera* Dalzell	0.99	3.33	0.12	4.45
14	*Acanthus ilicifolius* L.	0.99	3.33	0.06	4.38
Total		100.00	100.00	100.00	300.00

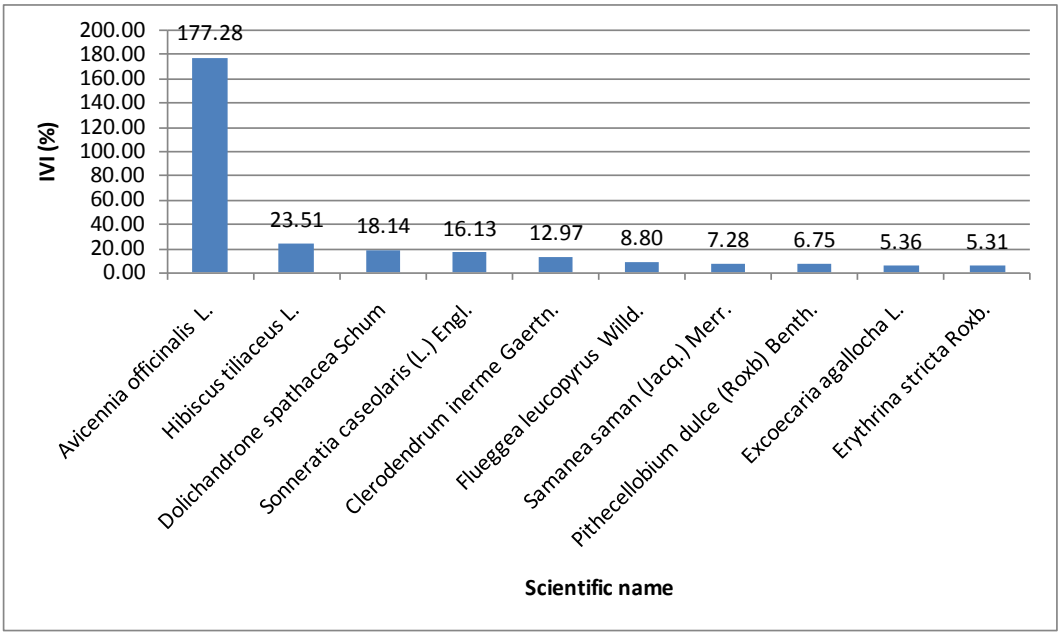


Figure 5.2-2 Important Value Index of Top Ten Species in The Mangrove Forest

5.2.2 Faunal Diversity

Animal and fish which grow in the wild are known as fauna. The study areas have various assemblages of animal communities; some species use the areas as permanent habitat, while others as temporary habitat. Based on habitat, faunal species are divided into two major categories viz. (a) aquatic fauna, and (b) terrestrial fauna.

5.2.2.1 Terrestrial Fauna

A total of 17 butterfly species were recorded in the proposed project area during the survey period (TABLE 5.2-2). All the recorded butterfly species were common species (FIGURE 5.2-3). Estimated butterfly density of the proposed project area is low and the distribution of the butterflies is random. Shannon-Wiener species diversity index value (H') is 3.54 (3.294-3.756) and Evenness (E') value is 0.607, which indicates the relatively even distribution of the butterfly species in the proposed project area (TABLE 5.2-4). Thirteen equally common species were estimated in the project area.

Table 5.2-2 Recorded Butterfly Species of The Proposed Project Area

No	Family	Genus	Common name	Remark
1	Danaidae	*Euploea core godartii*	Crow	Common
2	Danaidae	*Danaus chrysippus*	Plain Tiger	Very Common
3	Danaidae	*Danaus genutia*	Common Tiger or Striped Tiger	Very Common
4	Peridae	*Catopsilia pomona*	Emigrant	Very Common
5	Peridae	*Appias lyncida vasava*	Chocolates Albatross	Common
6	Pieridae	*Ixias pyrene verna*	Whight Orange Tip	Common
7	Pieridae	*Catopsilia pyranthe pyranthe*	Mottled Emigrant	Common
8	Pieridae	*Catopsilia scylla comelius*	Orange Emigrant	Common
9	Peridae	*Appias lyncida vasava*	Chocolates Albatross	Common
10	Pieridae	*Hebomoia glaucippe*	Great Orange Tip	Common
11	Pieridae	*Eurema hecabe*	Common Grass Yellow	Very Common
12	Peridae	*Leptosia nina nina*	Psyche	Common
13	Nyamphalidae	*Cathosia cyane euanthes*	Leopard Lacewing	Common
14	Nyamphalidae	*Cathosia penthesilea methypsea*	Orange Lacewing	Common
15	Nyamphalidae	*Hypolimnas misippus*	Danaid Eggfly	Common
16	Nyamphalidae	*Argyronome laodice*	Pallas's Fritillary	Uncommon
17	Lycaenidae	*Jamides cunilda nisanca*	Jamides	Common

Table 5.2-3 Species Diversity of Butterflies in The Proposed Project Area

Index/Item	Proposed project site
Shannon-Wiener Diversity H' (range)	3.54 (3.294-3.756)
Evenness E'	0.607

Number of equally common species	13
No. of species	17

Figure 5.2-3 *Catopsilia pomona*

Birds

Birds are included in the wildlife animals with considerable number of the species listed under the categories of threatened and near threatened species. Some natural habitats of the birds including wetlands and forests were destructed or degraded. Lowland and highland forests inhabited by various bird species were cleared with different purposes such as timber extraction, cultivation, human settlement and development projects etc. Hunting is still a major threat to wildlife even in national parks and wildlife sanctuaries, as local people living around protected area margins are poor and supplemented their income by collecting and selling various forest products collected within.

A total of 14 bird species, which belong to 13 families, were recorded at the proposed project area (TABLE 5.2-4). The bird Barn Swallow *Hirundo rustica*, Red-whiskered Bulbul *Pycnonotus cafer* (FIGURE 5.2-4) and Eurasian Tree Sparrow *Passer montanus* were dominant species in the proposed project area. Population density was estimated to be low. Shannon-Wiener species diversity (H') index value was 2.753 (2.608-2.895), and Evenness (E') value was 0.378, which indicated the uneven distribution of the birds in the proposed project area. Seven equally common bird species were also recorded (TABLE 5.2-5).

During the study periods some bird species were seen in all kinds of habitat showing their capability of wide distribution. Such commonly distributed species comprise insect eaters, some omnivores that have alternative food choice on insects, flowers, seeds and fruits. The common species of the study area include *Pycnonotus species* and *Passer* species. In the present study, the kingfishers and little egret *Egretta garzetta*, prefer the edge of the water bodies as they need to search the food in aquatic area.

Some bird species are adapted to different habitats and they can be found in shrubland, human habitation area and rice field; e.g. black drongo *Dicrurus macrocercus*, and red-vented bulbul *Pycnonotus cafer*. Some bird species recorded in the present study were normally common in the human habitation area and cultivated land; e.g. house sparrow *Passer domesticus*, Baya weaver *Ploceus philippinus*, and common myna *Acridotheres tristis*.

Table 5.2-4 Bird Species Recorded during the Study Period in the Proposed Project Area

Sr. No.	Order/Family	Common name	Species	Frequency	IUCN status	Habit	Habitat
	CICONIIFORMES						
1	Ardeidae	Little egret	*Egretta garzetta*	1	-		Water channel
	FALCONIFORMES						
2	Accipitridae	Shikra	*Accipiter badius*	1	-		Shrubland
	COLUMBIFORMES						
3	Columbidae	Rock Pigeon	*Columba livia*	14	-		human habitation
4	Columbidae	Spotted Dove	*Streptopelia chinensis*	4	-		scattered trees
	STRIGIFORMES						
5	Strigidae	Spotted Owlet	*Athene brama*	2	-		human habitation
	CORACIIFORMES						
6	Alcedinidae	White-throated Kingfisher	*Halcyon smyrnensis*	1	-		stream
	PASSERIFORMES						
7	Hirundinidae	Barn Swallow	*Hirundo rustica*	65	-	migratory	cropland,stream
8	Pycnonotidae	Red-vented Bulbul	*Pycnonotus cafer*	56	-		Human habitation,shrub
9	Muscicapidae	Pied Bushchat	*Saxicola caprata*	3	-		shrub land ,cropland
10	Dicruridae	Black Drongo	*Dicrurus macrocercus*	8	-		Shrubland
11	Sturnidae	Common Myna	*Acridotheres tristis*	25	-		human habitation, Shrubland
12	Ploceidae	Baya Weaver	*Ploceus philippinus*	8	-		coconut plam
13	Passeridae	Eurasian Tree Sparrow	*Passer montanus*	45	-		human habtitation, cropland
14	Passeridae	House sparrow	*Passer domesticus*	4	-		human habtitation

Figure 5.2-4 *Pycnonotus cafer*

Table 5.2-5 Species Diversity of Birds in The Proposed Project Area

Index/Item	Proposed project site
Shannon-Wiener Diversity H' (range)	2.753 (2.608-2.895)
Evenness E'	0.378
Number of equally common species	7
No. of species	14

Mammals

A total of four small mammal species were recorded during the survey periods (TABLE 5.2-6). Some species like Common Palm civet *Paradoxurus hermaphroditus*, White belleyed rat *Niviventer fulvscens*, and Small AsianMongoose *Herpestes javanicus* (FIGURE 5-4) were found mainly in the shrubland and rice field edge whereas Large Indian Civet *Viverra zibetha* was found in mangrove forest and scattered trees.

Figure 5.2-5 Small Asian Mongoose *Herpestes javanicus*

Table 5.2-6 Recorded Mammal Species of the Proposed Project Area

No	Scientific name	Common name	Family	Remark	IUCN status
1	*Viverra zibetha*	Large Indian Civet	Viverridae	Interview	Lc
2	*Paradoxurus hermaphroditus*	Common Palm Civet	Viverridae	Interview	NT
3	*Herpestes javanicus*	Small AsianMongoose	Herpestidae	Observed	Lc
4	*Niviventer fulvscens*	White belleyed rat	Muridae	Observed	Lc

Reptilian and Amphibian species

Twelve reptilian species (TABLE 5.2-7) and six amphibian species (TABLE 5.2-8) were recorded at the proposed project site during the survey period. Among the recorded reptilian species, Indian flap shell turtle *Lissemys punctata* (FIGURE 5.2-6) was listed as least concern species and other four reptilian species, *Naja kaouthia*, *Bungarus fasciatus*, *Daboia russellii*, *Ptyas korros* and *Ptyas mucosa*, are listed under Appendix II of CITES indicating as protected species in wildlife trade but they are also least concern in IUCN. Among the recorded frog species, *Rana* species are common in the area distributing in many parts of the area in wet season.

Figure 5.2-6 Indian flap shell turtle *Lissemys punctate*

The Indian flap shell turtle (Lissemys punctata) is a freshwater species of turtle found in South Asia. The “flap-shelled” name stems from the presence of femoral flaps located on the plastron. These flaps of skin cover the limbs when they retract into the shell. It is unclear what protection the flaps offer against predators. Indian flap shell turtles are widespread and common in the South Asian provinces. Indian flap shell turtle was Least Concern of IUCN red list species. These species are found very common in rivers and agriculture land. According to the interview result, this Indian flap shell turtle was found near the Ngamoeyeik Creek.

Figure 5.2-7 *Naja kaouthia*

Table 5.2-7 Recorded Reptile Species of The Proposed Project Area

Sr. No.	Scientific name	Common name	Family	Habitat	IUCN, 2009 CITES, 2009	Source
1	*Naja kaouthia*	Monocellate cobra	Elapidae	Shrub land	Lc	Interview
2	*Bungarus fasciatus*	Banded krait	Elapidae	Shrub land	Lc	Interview
3	*Daboia russellii*	Russell's Viper	Viperidae	Rice field	Lc	Interview
4	*Ptyas korros*	Indo-chinese rat snake	Colubridae	Shrub land, Grass	Lc	Interview
5	*Ptyas mucosa*	Indian rat snake	Colubridae	Channel	Lc	Interview
6	*Xenochrophis piscator*	Checkered keelback	Colubridae	Pond	Lc	Interview
7	*Xenochrophis spp.*	keelback	Colubridae	Pond	Lc	Interview
8	*Amphiesma stolata*	Striped keelback	Colubridae	Grassland	Lc	Interview
9	*Lissemys punctata*	Indian flap shell turtle	Trionychidae	Pond	Lc	Interview
10	*Eutropis carinatus*	Common skink	Scincidae	Grass/ Shrubland	Lc	Interview
11	*Calotes versicolor*	Garden fence lizard	Agamidae	Human habitation	Lc	Interview
12	*Calotes emma*	Tree dwelling lizard	Agamidae	Tree, Human habitation	Lc	Interview

Figure 5.2-8 *Rana tigrina*

Table 5.2-8 Recorded Amphibian Species of the Proposed Project Area

Sr. No.	Scientific name	Common name	Family	Habitat	IUCN, 2009 CITES, 2009	Source
1	*Rana tigrina*	Common bull frog	Ranidae	Rice field	Lc	Interview
2	*Rana limnocharis*	Paddy frog	Ranidae	Rice field	Lc	Interview
3	*Rana limnocharis greenii*	Paddy frog	Ranidae	Rice field	Lc	Interview
4	*Polypedates leucomystax*	Common Tree frog	Rhacophoridae	Rice field	Lc	Interview
5	*Bufo melanosticttus*	Common toad	Bufonidae	Shrubland, Human habitation	Lc	Interview
6	*Kaloula pulchra*	Painted bull frog	Microhylidae	Rice Field	Lc	Interview

5.2.2.2 Aquatic Ecology

Fish

A total of 30 fish species at upstream and 33 species at downstream were recorded during the survey period, although there was variation in individual catch rates (TABLE 5.2-9 and 5.2-10). The fishes are important food source of the local people. The fish species *Mystus cavasius* and *Glossogobius giuris* were found as very common species in the studied river. The fish species *Puntius chola* (FIGURE 5.2-9) and *Labeo calbasu* (FIGURE 5.2-10) were observed as common species. The species *Puntius chola* was found as dominant species in both upstream and downstream areas. The species *Mystus cavasius* was also relatively common in downstream area.

Table 5.2-9 Fish Species Recorded in Upstream Area of Rivers 1 Km From Project Boundary during the Survey Period

Sr. No.	Scientific Name	Common Name	Family	Remark
1	*Notopterus notopterus*	Grey featherback	Notopteridae	Observed
2	*Puntius chola*	Barb	Cyprinidae	Observed
3	*Amblypharyngodon mola*	Mola carplet	Cyprinidae	Observed
4	*Labeo calbasu*	Carp	Cyprinidae	Observed
5	*Cirrhinus mrigala*	Carp	Cyprinidae	Observed
6	*Clarias batrachus*	Walking catfish	Claridae	Observed
7	*Heteropneustes fossilis*	Stinging catfish	Heteropneustidae	Observed
8	*Anabas testudineus*	Climbing perch	Anabantidae	Observed
9	*Late calcarifer*	Giant sea perch	Centropomidae	Observed
10	*Mystus montanus*	Striped dwarf catfish	Bagridae	Observed
11	*Mystus vittatus*	Catfish	Bagridae	Observed
12	*Mystus bleekeri*	Catfish	Bagridae	Observed
13	*Mystus leucophasis*	Catfish	Bagridae	Observed
14	*Neotropius acutriostris*	Dwarf cat-fish	Schilbeidae	Observed
15	*Channa striatus*	Striped snake head	Channidae	Observed
16	*Channa orientalis*	Brown snakehead	Channidae	Observed
17	*Channa panaw*	Green snakehead	Channidae	Observed
18	*Macrognathus aral*	Lesser spiny eel	Mastacembelidae	Observed
19	*Macrognathus zebrinus*	Burmese spiny eel	Mastacembelidae	Observed
20	*Monopterus albus*	Asian swamp eel	Synbranchidae	Observed
21	*Monopterus cuchia*	Cuchia	Synbranchidae	Observed
22	*Oreochromic spp*	Mozambic cichlid	Cichlidae	Observed
23	*Boleophthalmus boddarti*	Boddart's goddle eye goby	Gobiidae	Observed
24	*Tenualosa ilisha*	River shad	Clupeidae	Observed
25	*Glossogobius giuris*	Gobifish	Gobiidae	Observed
26	*Polynemus paradiseus*	Mangoes fish	Polynemidae	Observed
27	*Sillago sihama*	Silver whiting	Sillaginidae	Observed
28	*Cynoglossus lingua*	Long tonguesole	Cynoglossidae	Observed
29	*Trichiurus lepturus*	Enlargehead hairtail	Trichiuidae	Observed
30	*Arothron stellatus*	Starry puffer fish	Tetraodontidae	Observed

Table 5.2-10 Fish Species Recorded in Downstream Area during the Survey Period

Sr. No.	Scientific Name	Common Name	Family	Remark
1	*Notopterus notopterus*	Grey featherback	Notopteridae	Observed
2	*Puntius chola*	Barb	Cyprinidae	Observed
3	*Amblypharyngodon mola*	Mola carplet	Cyprinidae	Observed
4	*Labeo calbasu*	Carp	Cyprinidae	Observed
5	*Cirrhinus mrigala*	Carp	Cyprinidae	Observed
6	*Catla catla*	Carp	Cyprinidae	Observed
7	*Clarias batrachus*	Walking catfish	Claridae	Observed
8	*Heteropneustes fossilis*	Stinging catfish	Heteropneustidae	Observed
9	*Anabas testudineus*	Climbing perch	Anabantidae	Observed
10	*Late calcarifer*	Giant sea perch	Centropomidae	Observed
11	*Mystus montanus*	Striped dwarf catfish	Bagridae	Observed
12	*Mystus vittatus*	Catfish	Bagridae	Observed
13	*Mystus bleekeri*	Catfish	Bagridae	Observed
14	*Mystus leucophasis*	Catfish	Bagridae	Observed
15	*Wallago attu*	Freshwater catfish	Siluridae	Observed
16	*Neotropius acutriostris*	Dwarf cat-fish	Schilbeidae	Observed
17	*Channa striatus*	Striped snake head	Channidae	Observed
18	*Channa orientalis*	Brown snakehead	Channidae	Observed
19	*Channa panaw*	Green snakehead	Channidae	Observed
20	*Macrognathus aral*	Lesser spiny eel	Mastacembelidae	Observed
21	*Macrognathus zebrinus*	Burmese spiny eel	Mastacembelidae	Observed
22	*Monopterus albus*	Asian swamp eel	Synbranchidae	Observed
23	*Monopterus cuchia*	Cuchia	Synbranchidae	Observed
24	*Oreochromic spp*	Mozambic cichlid	Cichlidae	Observed
25	*Boleophthalmus boddarti*	Boddart's goddle eye goby	Gobiidae	Observed
26	*Tenualosa ilisha*	River shad	Clupeidae	Observed
27	*Coilia dussumieri*	Goldspotted grenadier anchovy	Platacidae	Observed
28	*Glossogobius giuris*	Gobifish	Gobiidae	Observed
29	*Polynemus paradiseus*	Mangoes fish	Polynemidae	Observed

30	*Sillago sihama*	Silver whiting	Sillaginidae	Observed
31	*Cynoglossus lingua*	Long tonguesole	Cynoglossidae	Observed
32	*Trichiurus lepturus*	Enlargehead hairtail	Trichiuidae	Observed
33	*Arothron stellatus*	Starry puffer fish	Tetraodontidae	Observed

Figure 5.2-9 *Puntius chola*

Figure 5.2-10 *Labeo calbasu*

Benthos Species

Two benthic species were recorded in both upstream and downstream areas in the rivers 1 km far from project boundary (TABLE 5.2-11**)**. In upstream site, the species *Scarteloas tenius* was found to be common, and in downstream site *Leptocarpus fluminicola* was common.

Table 5.2-11 Recorded benthic species of Ngamoeyeik Creek

No	Family	Species	Common name	Status
1	Gobiidae	*Scarteloas tenius*	Slender mudskipper	Common
2	Palaemonidae	*Leptocarpus fluminicola*	Ganges delta prawn	Common

Plankton

A total of 13 plankton species were recorded, where 7 species were observed as zooplankton species and 5 species as phytoplankton species (TABLE 5.2-12). Among the recorded species, 2 zooplankton species, *Calanus finmarchicus* and *Cyclops vicinus*, were found as common species. One phytoplankton species, *Tetraedron regulare*, was also observed as common species in the studied river segment. The Shannon_Wiener diversity Index value (H') was highest in station IV (3.199) and lowest in station II (3.028). Species diversity value of planktons in the studied segment was moderate.

Table 5.2-12 Plankton Species Recorded in the Ngamoeyeik Creek

Sr. No.	Family	Group	Species	No./litter			
				Station I	Station II	Station III	Station IV
1	Calanidae	Zooplankton	*Calanus finmarchicus*	2	2	12	2
2	Paracalanidae	Zooplankton	*Paracalanus parvus*	3	3	3	5
3	Oithonidae	Zooplankton	*Oithona rigida*	4	0	3	8
4	Cyclopidae	Zooplankton	*Cyclops vicinus*	10	12	0	2
5	Bosminidae	Zooplankton	*Bosmina longirostris*	0	10	11	5
6	Oocystaceae	Phytoplankton	*Tetraedron regulare*	18	11	5	6
7	Fragilariaceae	Phytoplankton	*Synedra ulna*	4	3	7	0
8	Fragilariaceae	Phytoplankton	*Synedra gallionii*	2	2	9	4
9	Naviculaceae	Phytoplankton	*Nitzschia lanceolata*	3	0	4	0
10	Stephanodiscaceae	Phytoplankton	*Cyclotella striata*	5	7	5	6
11	Oedogoniaceae	Phytoplankton	*Oedogonium inconspicuum*	6	3	0	7
12	Desmidiaceae	Phytoplankton	*Pleurotaenium indicum*	7	2	4	3
13	Chlorococcaceae	Phytoplankton	*Chlorococcum humicola*	6	8	3	5
Total Number				70	63	66	53
Total species				12	11	11	11

Sr. No	Family	Group	Species	No./litter			
Diversity Index (H')				3.145	3.028	3.137	3.199

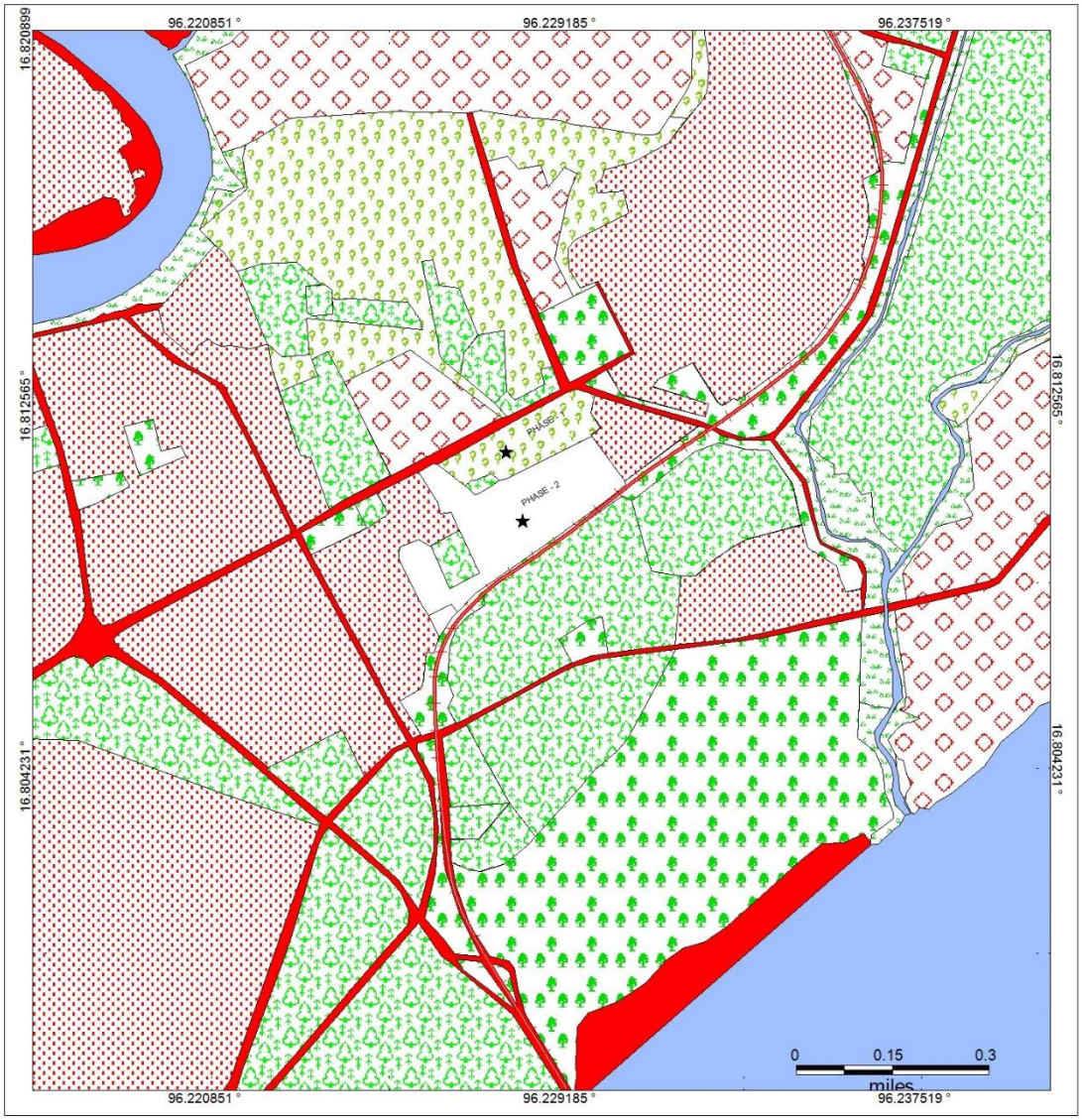
Note- Plankton sampling stations are same as surface water sampling stations in 2012.

5.2.2.3 Distribution of Ecological Habitats in the Project Area and Environ

In the area around 1.2 kilometer of the project location, there observed nine types of major habitats and some of which are combination of different habits. They are:

1. Agricultural, Farmland, Orchard (fruit trees) with minor inhabitants
2. Garbage area
3. Human habitation area, minor trees and plants, high population
4. Industrial area, developed with human activities
5. Sparse human habitation with some orchard trees, some religious areas
6. Park area, barren land, small water bodies and grass land
7. Mangrove area, swampy land along the tidal stream; highly sensitive ecological spot
8. Shrubland and grassland, mostly along the railways and car roads
9. Water bodies, ponds, Pazundaung (Ngamoyeik) creek and Bago River

The map of Distribution of Ecological Habitats in the project area and environ is shown in FIGURE 5.2-11.



Text	Count	Sum(Area_Sq_m
Agricultural Land	5	493,666
Garbage Area	1	104,035
Human Habitation, highly populated area	11	1,958,435
Industrial development area	6	748,786
Orchard and Religious areas	12	359,885
Orchard with some human habitation	12	1,108,467
Park and Public areas	11	827,033
Mangrove Forest	3	143,715
roads	1	234,276
Shrub and Grassland	8	189,772
River and surface water areas	4	790,195
*****	0	0

Figure 5.2-11 Distribution of Ecological Habitats in the Project Area and Environ

CHAPTER VI

EXISTING ENVIRONMENT: SOCIO-ECONOMIC

6.1 Introduction

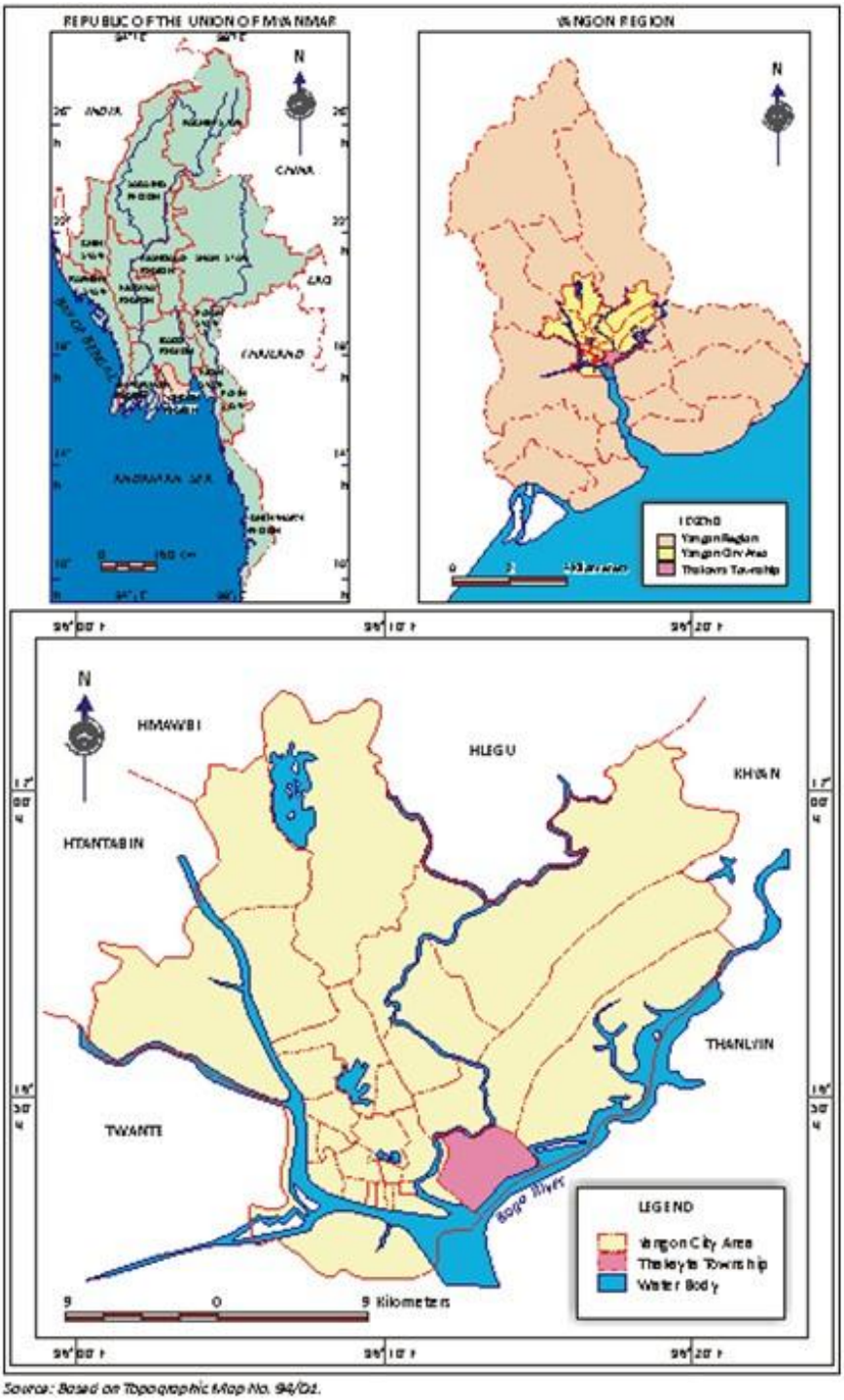
The proposed project area is located in Thaketa Township. Thaketa Township itself lies between North Latitudes 16º 48' 35.4" and East longitudes 96º 13' 43.63". Thaketa Township is located on the small peninsula between Yangon River, and Bago River. It is located on the flat plain consisted of alluvial soils with the height of 4.8 meter above sea level.

It is located about 8 km to the northeast of the downtown of Yangon City and occupies the area between Pazundaung Creek and Bago River. Geographically, it is bounded by Thingangyun Township in the north, Dagon Myothit (South) and Dagon Myothit (Seikkan) townships in the northeast, the Bago River in the east, the confluence of the Yangon and Bago Rivers in the south, Dagon Township in the southwest, and Pazundaung Creek in the northwest.

Thaketa Township comprises 19 wards in which project area is located in No. 10 Ward (north). The project area has a fairly compact shape surrounded by dump site and residential areas. Therefore, it is important to assess the impact of power plant to this surrounding residential area.

6.2 Demography of Thaketa Township

In order to relocate the squatter and to have the shape of Yangon City more compact, the New Rangoon City Extension Project was launched and implemented in 1958. In the beginning (1958), Thaketa Township had 15,720 households with a total population of 55,050 persons. The township was more accessible after the construction of Thuwunna Bridge (1981) which a crossed over the Ngamoeyeik Creek. The population of the township increased to 193,190 in 1983. In 1999, the township's population was 199,567 and it increased to 213,238 in 2003. The moving out of the poorer families to other townships resulted in the reduction of population with 198,020 in 2004 and 209,378 in 2006. However, the population increased again in 2007 because new house owners moved in, but at a slower rate. The population density of Thaketa Township increased from 30,754 persons per square mile in 1958 to 46,407 persons per square mile 1963. Because of the extension of township area, the density decreased to 29,236 persons per square mile. It gradually increased to 38,715 persons in 1983 and 39,993 persons in 1999 and 42,130 persons in 2007.



Source: Based on Topographic Map No. 94/D2.

Figure 6.2-1 Location of Thaketa Township, Yangon Region

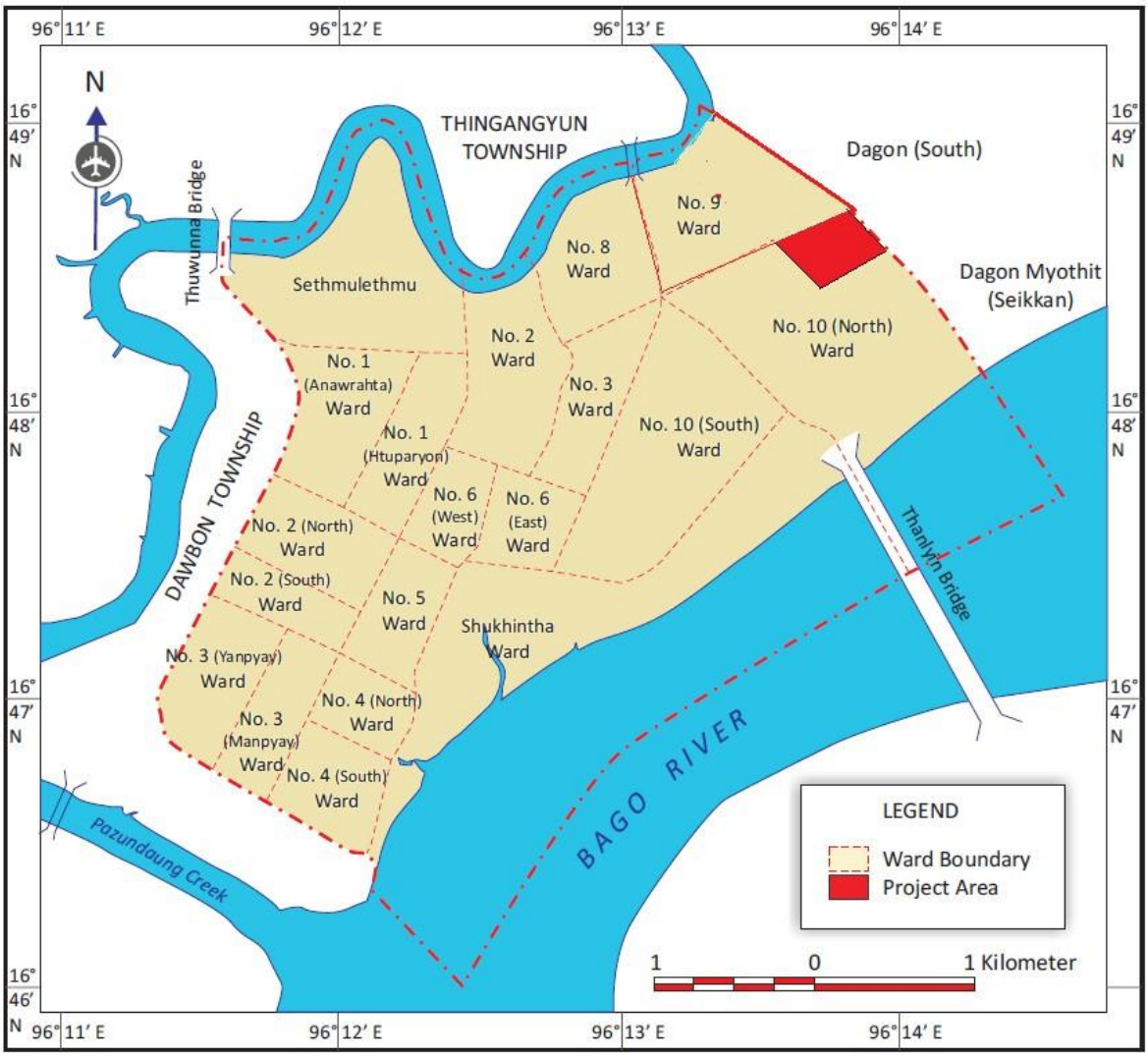


Figure 6.2-2 Location of Project Area

According to the data available for 2007, the density was highest in Ward No. (2-North) with 84,269 persons, largely on account of its location close to the core area of the town. With 82,433 persons per square mile. No. (9) Ward ranked second in population density. It is located close to the main roads linking with Kamarkyi Bridge of Thuwunna and that leading to Dagon Myothit (South) Township. Although population density of No.9 ward is high, there are very few residential units in the surrounding area of the project site located in the eastern part of No.9 ward. The project area is surrounded by creek, vacant lands, agricultural lands and dump site. In 2012, there are 29,483 houses with 43,076 households and total population of 204,036 persons in Thaketa Township. The highest population (17,157persons) was found in 1/Atnawmar Ward and the lowest population (3,647 persons) was observed in Satmulatmu Ward in 2012. In No. 10 (North) where the project site is located has 1,210 houses with 1,432 households and the total population of 9,248 persons in 2012. Among this total population, 4,824 persons are males and 4,424 persons are females. (TABLE 6-1and FIGURE 6-3 and 6.4).

Table 6-1: Total Population of Thaketa Township (2012).

Sr.	Wards	Houses	Households	Total		
				Male	Female	Total
1	Satmulatmu	401	607	1993	1654	3647
2	1/ Atnawmar	2183	3278	8149	9008	17157
3	1/ Htuparyon	1748	2727	5571	6232	11803
4	2/ (South)	1108	1731	4116	4554	8670
5	2/ (North)	1700	2528	6049	6748	12797
6	3/ Yanpyay	2038	3072	7133	7858	14991
7	3/ Manpyay	1596	2398	5211	5824	11035
8	4/ (South)	1174	1837	3683	4065	7748
9	4/ (North)	912	1453	3109	3417	6526
10	5/ Ward	991	1478	3075	3323	6398
11	6/ (East)	1243	1755	3902	4061	7963
12	6/ (West)	1445	2034	4682	4855	9537
13	7/ (East)	1663	2827	6050	5167	11217
14	7/ (West)	585	1250	2399	2619	5018
15	8/ Ward	1923	2722	5917	6348	12265
16	9/ Ward	1465	2036	4163	4410	8573
17	10/ (South)	4325	6748	16002	16945	32947
18	10/ (North)	1432	1210	4824	4424	9248
19	Shukinthar	1551	1385	3204	3292	6496
Total		29483	43076	99232	104804	204,036

Source: General Administrative Department, Thaketa Township

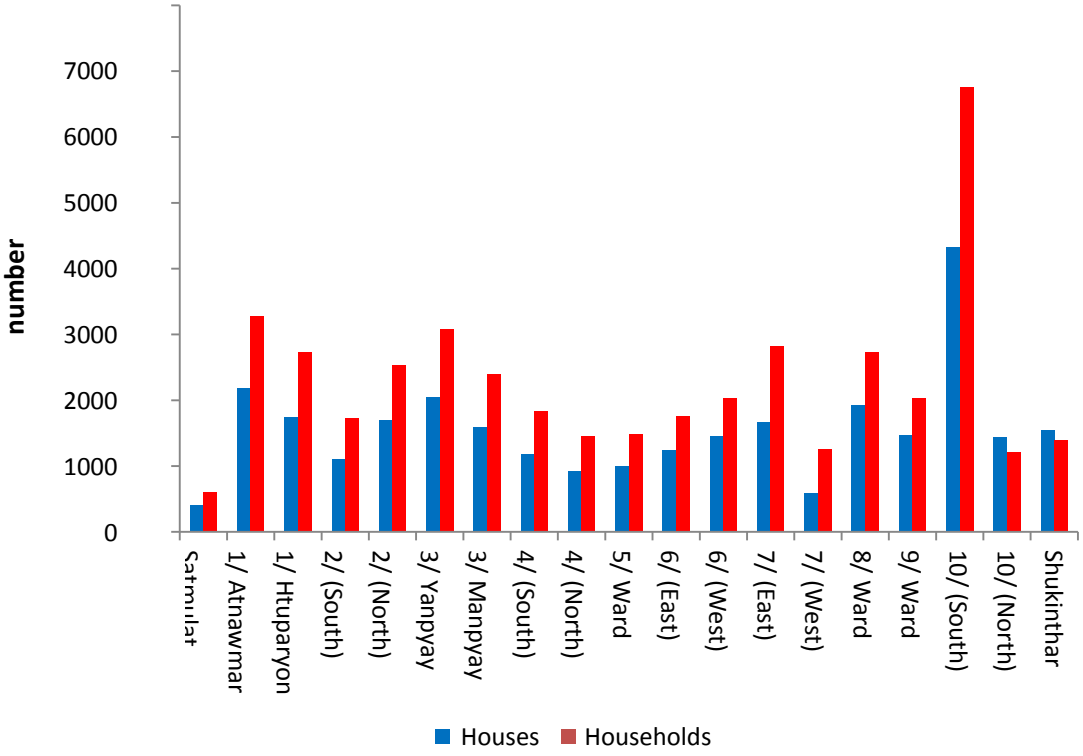


Figure 6.2-3 Houses and Households in Thaketa Township

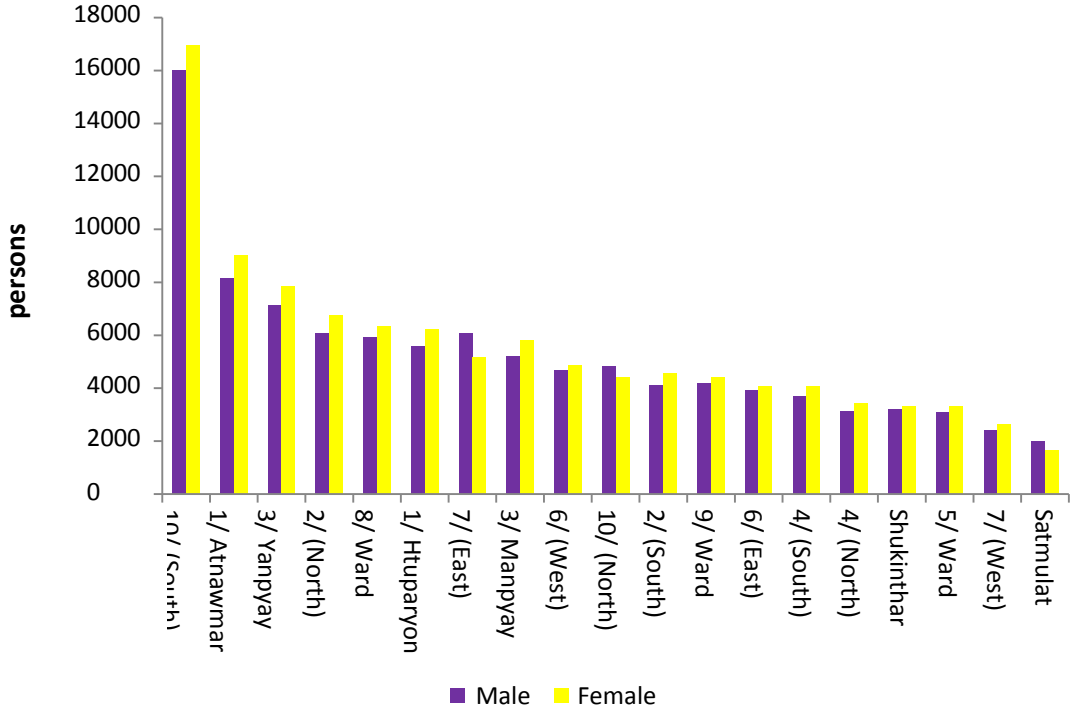


Figure 6.2-4 Total Population of Thaketa Township (2012)

6.3 Electricity Power Supply and Water Supply of Thaketa Township

Electricity for Thaketa Township is supplied from the Thaketa Gas Turbine which is located in Ward No.10 (North). Thaketa Gas Turbine is also supplying electricity to Thanlyin, Kyauktan, Dagon (South), Dagon (North), Thingangyun, Dawbon, Tamwe, Mingalartaungnyunt and Pazundaung townships. In Thaketa Township, the total 29,483 houses or 89 percent receive the electricity supplied by the state-owned sources and the remaining households depend on small engines, batteries or other private sources.

In Thaketa Township, there are 7,360 houses (27 percent) that can access to piped water, 2,304 houses (8 percent) that supplied by tube-wells and 17,035 houses (62 percent) that depend on water purchased from private tube- well owners and tank water. Water shortage is more common in Ward No. 10 (South), Ward No.9 and Ward No. 6(West), in which over 90 percent of the households have to buy water for their domestic consumption. Generally, sources of water for drinking and other use of residents are pipe water and tube well in this township.

6.4 Transportation of Thaketa Township

Thaketa Township is accessible by both roads and waterways. Although the train that leaves Ywathagyi Station runs through No.10 (North) Ward to Khayan-Thonegwa, only a few people use this mode for travelling. The most widely used mode of transportation is public bus lines.

The quality of roads is classed into three levels in which paved roads as level 1 (high level), gravel roads as level 2 (medium level), and the earth roads as level 3 (low level). Level 2 roads are more common in Ward No.10 (South) with 57 percent, Sethmuletmu Ward with 33 percent and Ward No.9 with 20 percent. The roads condition is poorest in Ward No.9 where level 3 roads is accounted for 60 percent.

Although much of the roads have been upgraded to some extent, in recent years, some main roads are still narrow in width and unfavorable for city buses. For daily commuting or other trips to downtown area and other parts of Yangon City, the majority of the inhabitants depend on public transport and buses. Most of the government employees, company employees, students, retail sellers, casual workers and daily wage-earners usually use the

public buses. During the past decade, the township was served by bus lines and several special transport vehicles arranged by the departments concerned. At present, there are ten public buses and one special bus line in Thaketa Township. Public transportation modes in this township include both road and railways transportation.

6.5 Socioeconomic Profile of Respondents in the Project Area

Yangon is an Economic Centre, an Industrial Centre and a transportation hub in the Republic of the Union of Myanmar. Currently, the Industrial Parks near Yangon are developing with power supply and demand are also continuously growing. The gap between power supply and demand can be filled through the construction of power plant near Yangon. The project which has already being located in No.10 (North) Ward of Thaketa Township. The exact location of the project site is at North Latitude 16º 48' 41" and East longitude 96º 13' 36".

In order to generate electric power to add Myanmar's National Grid, the project has planned in an approximately 0.12 squares km (29.65 acres) area in Thaketa Township. The proposed generator and associated facilities covers some shrub land and disposal site.

6.5.1 Methodology

Semi-structured interviews and questionnaire distribution were done in Ward No.9 and Ward No.10 (North) in Thaketa Township. There were 100 respondents in the survey, and the survey focused on potential impacts of the project to surrounding residential areas.

Survey Area

Socio-economic survey were done through questionnaire survey in Ward No.9 and Ward No.10 (North) in Thaketa Township during field survey period between 9th April and 29th April 2013 (see in

Figure 6.5-1).

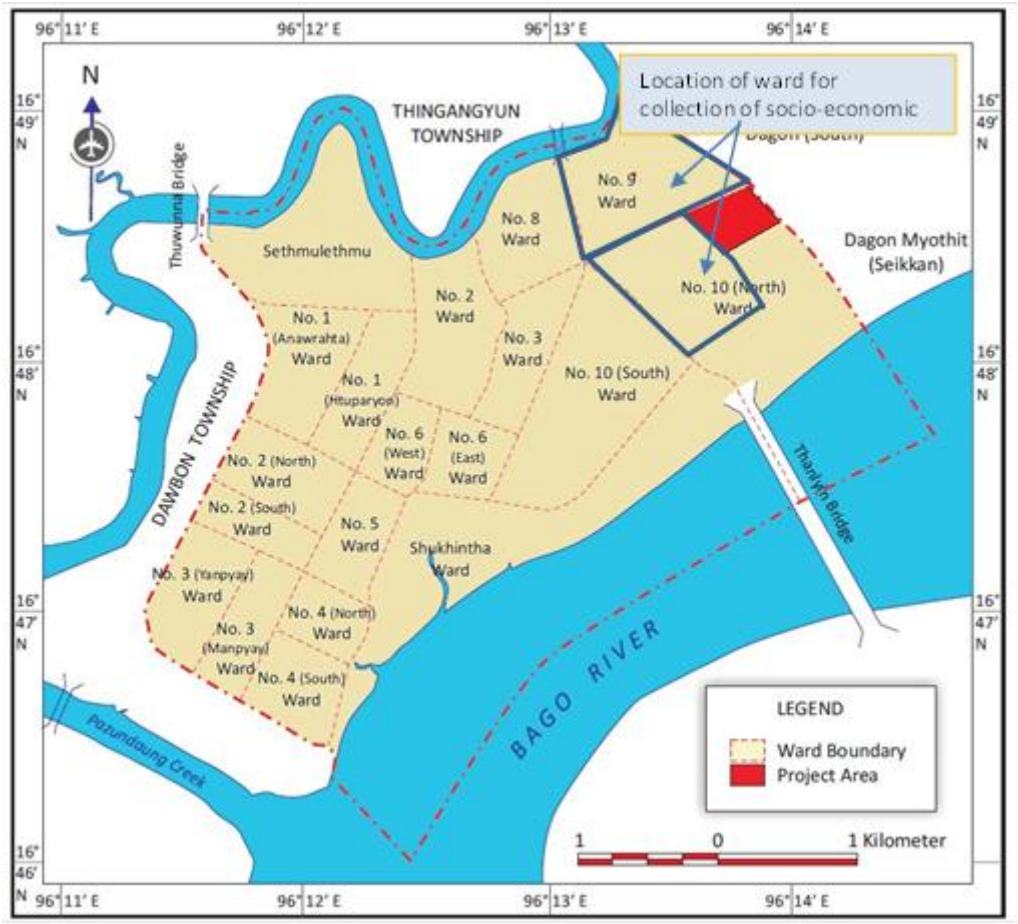


Figure 6.5-1 Location of wards for collection of socio-economic data

6.5.2 Demography

There are 8,976 persons in No.9 Ward and 9,064 persons in No.10 (North) Ward. Among them, 100 respondents are selected as sample population for the study. (TABLE 6-2 and FIGURE 6-5).

Table 6.5-1 Total Population of Sample Wards

No.	Ward	House	Household	Total		
				Male	Female	Total
1	No. 9 Ward	1,465	2,050	4,633	4,343	8,976
2	No.10(North)Ward	1,432	1,861	4,707	4,357	9,064

Source: Field Survey, REM Co.

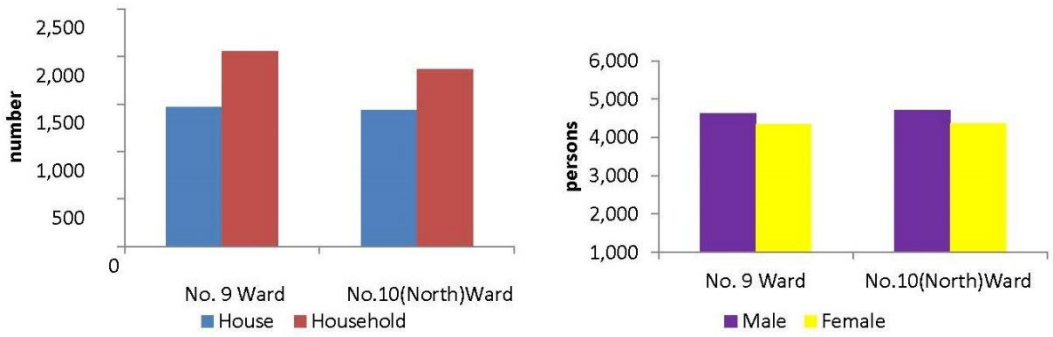


Figure 6.5-2 Houses, Household and Population of Sample Wards

6.5.3 General Profile of Respondents

6.5.3.1 Gender and Age Group

Among the 100 respondents, 42 persons are males and 58 persons are females. About 50 percent of the respondents fell in the age group between 20 years and 50 years in No.9 Ward and 66 percent of the respondents are between 20 years and 50 years in No. 10(North) Ward. Remaining 50 percent and 34 percent represented the age group above 50 years in the two wards. Most of the family size, 60 percent and 41 percent of the respondents, have family members between 4 to 6 persons in both No.9 Ward and No.10 (North) Ward. (FIGURE 6-6)

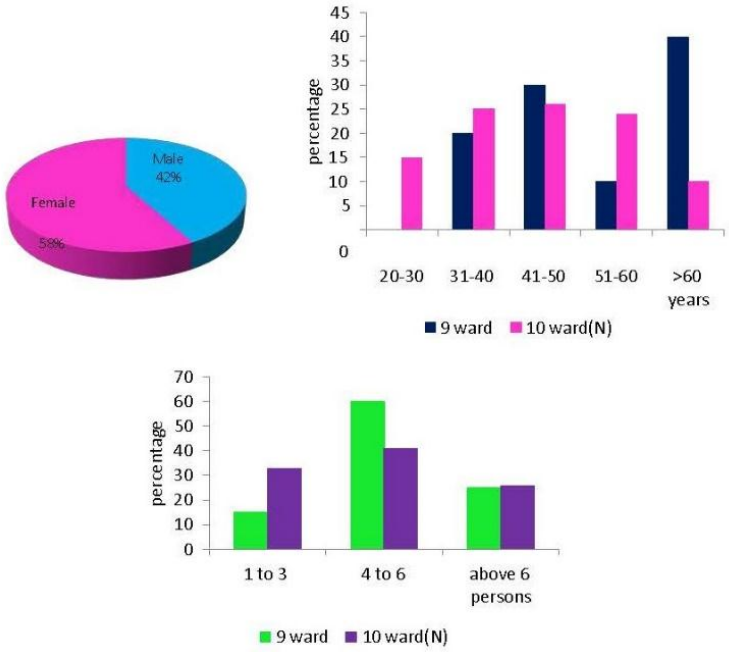


Figure 6.5-3 Gender, Age Groups and Family Size Of Respondents

6.5.3.2 Education Level

Number of respondents in illiterate and primary school level of education was more in No. 10 (North) Ward than that of No.9 Ward. In contrast, number of respondents with middle and high school levels of education was more in No.9 Ward than that of No. 10 (North) Ward. The higher the education level, the more knowledge on environment

received by respondents. It pointed out that more respondents from Ward No.9 aware of environmental impact of the project than that of No.10 (North) Ward. There are no respondents in illiterate and monastic level of education in No.9 Ward. (FIGURE 6-7).

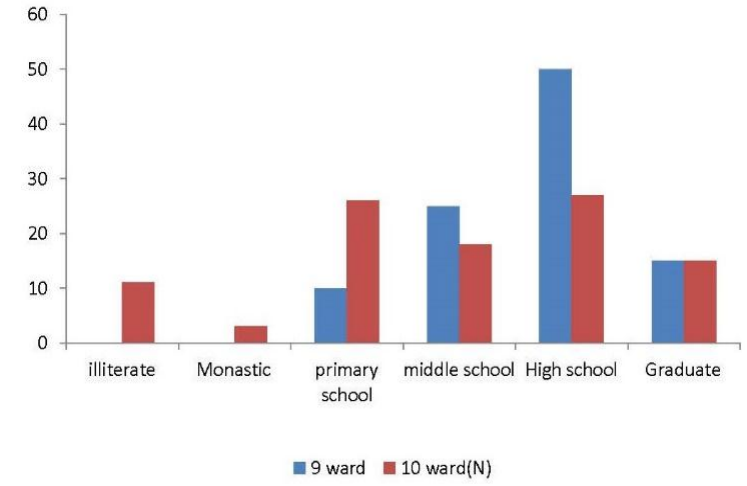


Figure 6.5-4 Education of Respondents (%)

6.5.3.3 Income Level

In the survey wards, monthly income level of respondents can be classified into 3 classes such as less than 50,000 kyats, 50,000 to 100,000 kyats and 100,000 to 200,000 kyats. In No.10 (North) Ward, 71 percent of the respondents fell in 100,000 to 200,000 kyats group. Only a few percent of respondents received monthly income below 50,000 kyats per month in No. 10 (North) Ward. Higher percentage in high income groups showed that higher ability of respondents from Ward No.10 (North) to regular their intimate environment than that of respondents from Ward No.9. Generally, higher income groups can spend more money to regulate their environment and they have less impacts of the project. Less income group, generally, suffers directly from the impacts of the projects. (FIGURE 6-8).

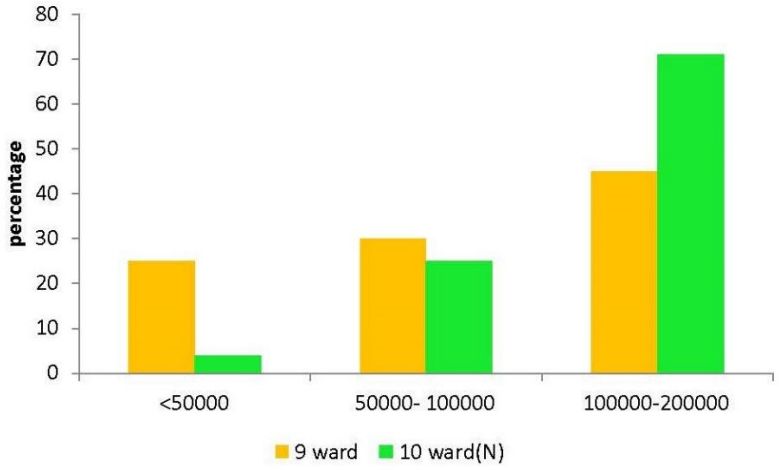


Figure 6.5-5 Monthly Income of Respondents

6.5.4 Housing Conditions and Assets

Household property of respondents such as houses and household items in the survey is very simple. Four types of houses are found in the project area. These are

1. Brick building house,
2. Apartment,
3. Wooden houses, and
4. Huts.

Percentages on wooden houses in No.9 Ward are higher than that of WardNo.10 (North). There are no apartments and only a few huts in Ward No.9 compared to Ward No.10 (North). Respondents from Ward No.10 have all types of houses. Generally, huts and wooden houses are more vulnerable for some environmental impacts such as fire hazards, flood and air pollution. (FIGURE 6-9).

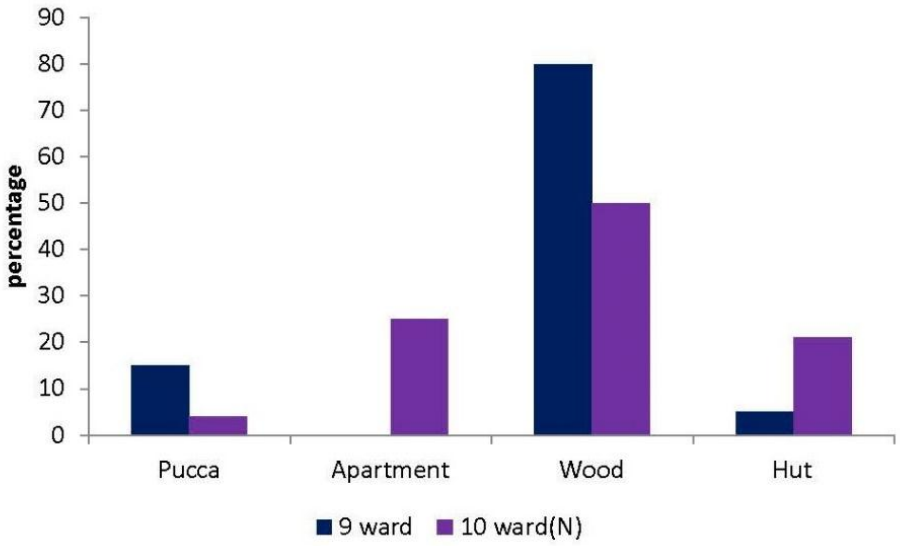


Figure 6.5-6 House type of Respondents

Survey results showed that most of the respondents owned household items such as kitchen, toilet, bath rooms, TV sets, furniture and electric goods. However, about 51 percent of respondents from No.10 (North) Ward did not possess electric goods and about 35 percent of respondents did not own TV sets. The more they possess electric goods, the higher their demand on electricity. It will lead to a positive image on the power plant project although they are not sure to receive electric power from the project. (TABLE 6-3).

Table 6.5-2 Household Items owned by Respondents (%)

Items	No. 9 Ward		No.10(North) Ward	
	possess	Not possess	possess	Not possess
Kitchen	100	0	81	19
Toilet	100	0	88	12
Bath room	10	90	31	69
TV Sets	90	10	65	35
Furniture	100	0	100	0
Electric Goods	80	20	49	51

Source: Field Survey, REM Co.

6.5.5 Places used for Socioeconomic Purposes

For religious purposes, about 90 per cent of respondents from project area used nearby monasteries and remaining percentages of respondents go to Shwedagon Pagoda and downtown area for religious affairs. Children from respondents' families attended classes at nearby schools.

There would be less potential impact of the project to these social movements because no relocation programme for residential areas under the project is required. The respondents could maintain their regular routines for social movement.

For commercial purpose, 100 per cent of respondents in No.9 Ward and 82 percent of respondents in No.10 (North) Ward go to the No. 10 market of Thaketa Township. According to the survey there would also be less potential impact of the Project on commercial purpose of residents lived in the project area.

6.5.6 Public Health and Health Status

To collect the baseline information on health condition of the people in and around the project site, present survey was conducted by questionnaire on 100 representative households. Health condition is determined on the basis of population, level of education, livelihood and income, water and sanitation systems, health knowledge and its application, health facility and utilization, usage of alcohol, tobacco and medical history etc.

Majority of people in the area around the project site are government staffs in No.9 Ward and dependents in No.10 (North) Ward. Daily income in the range of Kyats 2001 to 4000. Income is a control of health because poor people cannot take proper investigation or treatment if they suffer from diseases. According to the chart, there are many families (37%) with above 6000 kyats of daily income. Remaining 63 percent represented for the income groups lower than 6,000 kyats per day. This amount of income is to share among food, clothing, power supply, social, travels and medical expenses. If the disease the respondents suffer is dangerous, it is a burden for them. Therefore, they worried about the health impacts of the projects on their existing neighbourhood. (FIGURE 6-10)

Level of education of the residents is an important factor for the community health. If they have low education, they cannot know how to get healthy. In this community, 23% represented primary education level but 15% are graduates. Some (31%) is in higher education level. So, from the educational point of view, people in the potentially affected area have sufficient education for health awareness and family health management. (FIGURE 6-11)

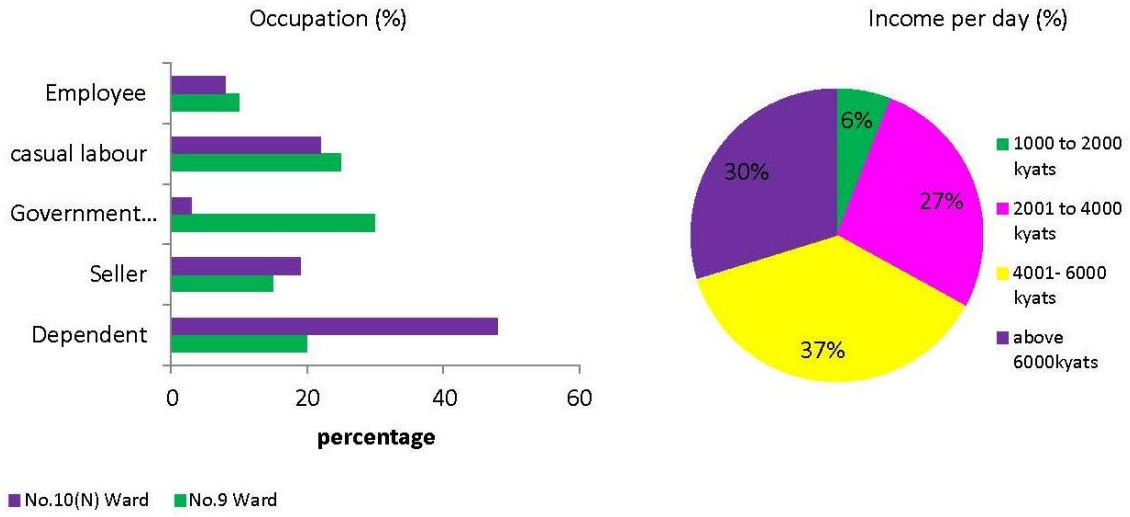


Figure 6.5-7 Type of Occupation and Income of the Potentially Impacted People

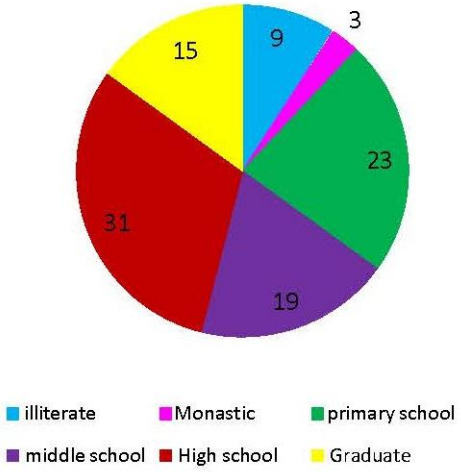


Figure 6.5-8 Level of Education in the Study Area

Present survey approves that at least 10 percent of the people drink alcohol regularly, 73 percent take tobacco and 15 percent eat betal. Usage of alcohol can cause hypertension and reduce control of high blood pressure, so susceptible to get stroke. In this area, many people have the symptom of hypertension. Usage of tobacco smoking causes coronary artery disease, hypertension, stroke, CA lips, tongue, oesophagus, stomach, bladdre, etc. In this area, the most common disease other than common cold is hypertension which is most probably due to smoking tobacco and drinking alcohol.

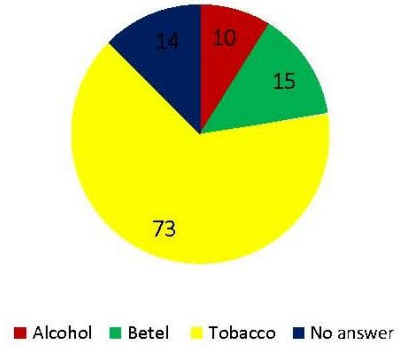


Figure 6.5-9 Usage of Alcohol, Betel and Tobacco (%)

There are 7 types of diseases and health problems in the project area. Among them, common cold, hypertension, Nerves pain, and gastritis are more frequently observed among respondents. Hyper tension and Common cold are mainly found among the respondents in the survey area. For medical treatment, respondents usually go to GP clinic and public pharmacy stores. About 90 percent from No.9 Ward and 59 percent from No.10 (North) Ward go to GP clinic for medical treatments. Other medical treatments include going to hospital and taking traditional herbal medicines (FIGURE 6-13). According to the opinion of the respondents, the noise problem and foul smell from the plant are main reasons to impact to the health conditions of respondents.

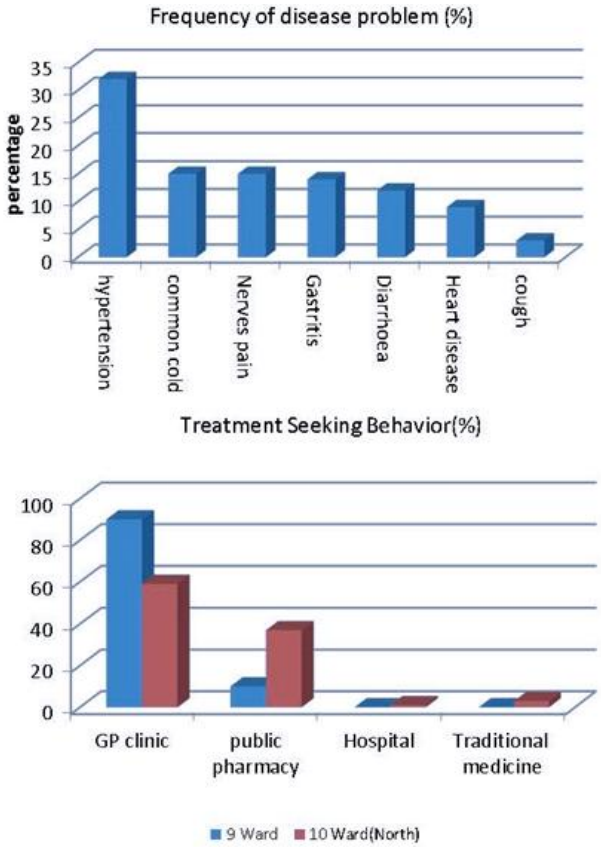


Figure 6.5-10 Frequency of Types of Health Problems and Treatment Seeking Behavior

The source of water for respondents are mainly artesian wells (51%) and lake and well (36%). For drinking water 45% boiled water and 40% use purified water. Power Plant Project could not intrude these sources of water although the possibility of reduction on artesian wells when the power plant utilizes these sources of water. (FIGURE 6-14)

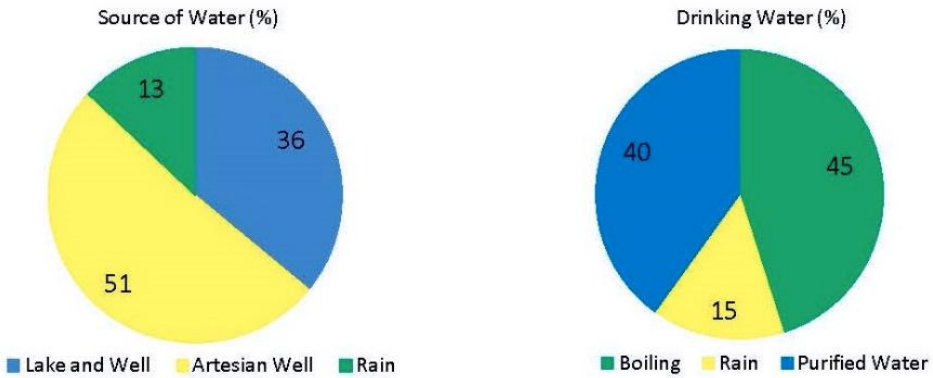


Figure 6.5-11 Source of Water and Drinking Water of the Project Area (%)

Respondents usually throw the garbage into the stream and discharge wastewater into the stream and public sewerage. The power plant project would not influence the existing system of waste disposal and wastewater

disposal. Most of the respondents disposed wastewater freely onto the ground and vacant lands although 77 percent of respondents disposed the garbage into the dump sites. (FIGURE 6-15)

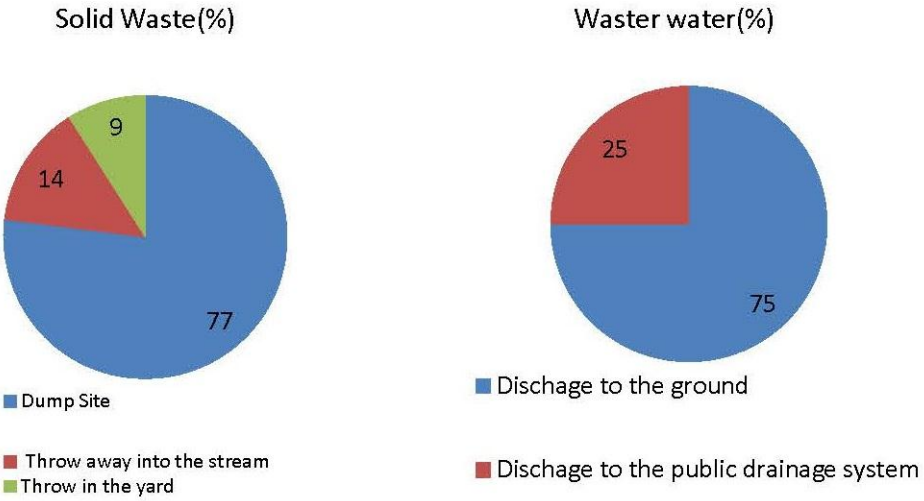


Figure 6.5-12 Solid Waste and Wastewater of Project Area (%)

CHAPTER VII

POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

7.1 Introduction

The summary of potential impacts on environmental, socio- economic, demographic and cultural context will be present in this section. While identifying the above key features, the section also discusses the type and range of impacts likely to result from the different project activities, measuring its extent and severity.

The specific purpose of this section is to;

- Identify and assess the range of potential impacts and extent of their severity;
- Explain the ways in which the project might affect environment, ecology, socio-economic resources, demographics, livelihoods, cultural patterns, as well as access and infrastructure issues;
- Suggest viable mitigation measures for the identified impacts;
- Develop a management plan based on the proposed mitigation measures.

These impacts have been identified through field surveys, onsite measuring, and enquire with the village community. Discussions with project proponents, district officials, and village representatives were undertaken along the study area. A mix of quantitative and qualitative methods i.e. sampling, questionnaires, interviews, oral histories, have been used to derive these impacts. Potential impacts have also been predicted based on experience of working in past similar assignments.

7.1.1 Impact Identification

The assessment process is based on available information, including the project description (as provided by Client), and social and environmental baseline data. The assessment considers all relevant social and environmental impact/risks, including issues identified in IFC Performance Standards 2 through 8, and those who will be affected by such risks and impacts.

Although the proposed project has been selected to minimize social or environmental impacts, there will, nevertheless, be some impact within and around the proposed project due to construction of gas turbine plant and transmission line and in setting up associated utilities.

This section presents a summary of the environmental impacts from the activities related to construction and operation of the Gas turbine project.

The proposed power plant is planned as 500MW in capacity, locates at Thaketa township that is 10km east to Yangon city and beside the existing gas turbine power plant.

The Project falls into two phases. Phase I will be built with **installed capacity of 74MW+32MW=106MW**, which consist of one 6FA Gas Turbine & Generator and one Steam Turbine & Generator, using one-drive-one combined cycle. Besides, under the local environment condition and present available natural gas, the actual output shall be **62MW+31MW=93MW at natural gas available volume of 18mmcf/d**.

Detailed description of the project has been provided in Chapter 3 of this report. The baseline environmental data surrounding the project site has been presented in Chapters 4-6. This Chapter presents an assessment of the potential significant impact of the proposed project on the surrounding baseline environment during both construction and operational phases. Mitigation measures for the most significant impacts have also been identified.

Table 7.1-1: Preliminary Identification of Impacts during Pre-Construction, Construction and Operation Phases

Phases	Pre-Construction	Construction		Operation	
Impact	**Site Clearance Activities**	**Casting & Foundation**	**Erection of Main Processing Buildings**	**Stringing of Electrification**	**Electricity Production, Transmission Process**
Soil	-	☑	-	☑	-
Waste disposal	☑	☑	☑	-	☑
Aesthetics	-	☑	☑	-	-
Surface water quality	-	☑	-	-	☑
Hydrology	-	☑	-	-	-
Biodiversity (Impacts on Flora and Fauna)	☑	☑	-	-	-
Traffic and transport	-	☑	☑	☑	-
Atmospheric emissions	☑	☑	☑	-	☑
Noise and Vibration	☑	☑	☑	-	☑
Socioeconomics	-	☑	-	☑	☑
Land use	-	☑	-	-	-
Community Health and Safety	-	☑	☑	☑	☑
Occupational Health and Safety	-	☑	☑	☑	☑
Hazards due to Natural disasters	-	-	-	-	☑
Major accident risks	-	☑	☑	☑	☑
Electromagnetic fields	-	-	☑	☑	☑

7.1.2 Impact Identification during Preconstruction Phase

7.1.2.1 Air quality

Most site clearance activities generate dust. The main environmental problem with dust that is generated from site clearance activities is that it settles on surrounding properties and land which is often more of a nuisance problem than a health issue. The site clearance activities are typically short period, and the pollutants are released close to ground level with little or no buoyancy which limits their dispersion and the potential impacts to the site.

7.1.2.2 Noise

Site clearance activities will have a noise impact lower than either the construction or operational phases. This is because site clearance activities normally take place during the day using minimal equipment (due to the decreased urgency of the Project). While there may be various activities, there is a very small risk for a noise impact.

7.1.2.3 Waste

Excavated material (e.g. rock, sand, vegetation) waste from the Project may arise from a range of sources during the site clearance. No waste material will remain on site or be disposed of or released to the environment as part of the Project activities. All wastes will be handled and transported in accordance with the relevant legislation.

7.1.2.4 Ecological Impacts

During the site preparation, some bush and small trees would have to be cleared.

7.1.3 Impact Identification during Construction Phase

The major activities during the construction phase of the proposed combined cycle power plant may be broadly classified into the following:

(i) mobilization of equipment, materials and personnel,

(ii) site preparation, and

(iii) civil construction and electromechanical installation/erection.

Some of these project activities would likely to have some adverse impacts on certain environmental parameters, while some other would have beneficial effects. In this study, the effects of the project activities on Physical, ecological and socio-economic (i.e., human interest related) parameters have been assessed separately.

7.1.3.1 Impacts on Biodiversity

The project site is located within the brownfield site with sub-urban setting. Depending upon the Baseline conditions in the Project area:

- Clearing of the vegetation on the proposed power plant site Habitat variety is limited and there are no wetlands or rocky outcrops present.
- The majority of mammals are smaller mammals and tolerant of habitat fragmentation.
- According to the baseline data collection survey, 12 reptiles have been recorded in the area, which corresponds well with distribution records from the literature As with mammals, a large proportion of these are not likely to occur at the site on account of a lack of suitable habitat and in particular the lack of any rocky outcrops.
- The site lies within or near the range of 6 amphibian species, which along with the general lack of water or wetlands at the site suggests that frog diversity is likely to be fairly low.

7.1.3.1.1 Impact on Flora

Based on the environmental baseline survey, the common terrestrial flora in the power plant area includes Kokko tree - *Mimosaceae*, Mango tree - *Anacardiaceae*, and *Moraceae* - Pein –hne etc. Three types of terrestrial floral habit - **tree, shrub and herb** exists in the project areas. Most floral species particularly the trees and shrubs are cultivated and planted.

Flora (the cultivated plant and bush) may be impacted in the following way during the construction phase of the Project:

• Clearing of the vegetation on the proposed power plant site

The vegetation within the project footprint area are permanently lost but the impact is low because these are not natural vegetation with high sensitivity.

7.1.3.1.2 Impact on Fauna

There are 17 butterfly species, 14 bird species, 4 small mammals, twelve reptilian species and six amphibian species were recorded at the proposed project site during the survey period.

Terrestrial undergrowth has great contribution to the existing ecosystem and clearing or removal of the undergrowth would also have minor impacts. But a few common amphibian species are available at or near the proposed project site and none of them are nationally threatened. Amphibians are more sensitive to the environmental changes due to their permeable skin and other biological features. Amphibians use both aquatic and terrestrial habitat for their survival and changes of those habitats have impacts for their survival.

The proposed project activities could have some impacts on existing amphibians such as (i) undergrowth or vegetation may be cleared for construction works, (ii) project vehicle and materials may enter into the saturated ground. These impacts may cause temporary or permanent disturbance of amphibian habitat.

However, the reptile species and amphibian species in the study area were identified as **least concern status in IUCN Red List.**

7.1.3.1.3 Impact on Ecological Parameters

The proposed power plant site will be built on the disposal site and the surrounding area is occupied by the residential area. TABLE 7.2-1 shows the effects of the project activities during construction phase on ecological parameters. The project area doesn't have the impact on sensitive ecological conditions and hence the impacts of project activities on ecological parameters are insignificant. Therefore, impacts of project activities on flora and fauna would be of "moderate" intensity.

Table 7.1-2 Effect of Project Activities on Ecological Parameters during Construction Phase

Ecological Parameters	Impact Rating				
	Nature of impact	Duration of impact	Impacted Area	Severity of impact	Significance of impact
Flora	Adverse	Short term	Localized	Moderate	Insignificant
Fauna	Adverse	Short term	Localized	Moderate	Insignificant

However, the possible construction of pipeline across the River (though not a part of the proposed power plant project) will have adverse impacts on the aquatic environment, including fisheries. Gas pipeline construction activities may destroy the benthic communities and the obliteration of spawning and nursery grounds for fish.

7.1.4 Impacts on Physical Environments

The important physio-chemical environmental parameters that are likely to be affected by the project activities during construction phase including water and soil quality, air quality, and noise level.

7.1.4.1 Impact on Water Quality

Waste and wastewater generated during the construction phase of the project include construction debris and wastes, and some other solid wastes (e.g., from construction activities), human wastes from people working at the project site (e.g., from labor sheds), and some liquid waste from construction processes. This waste/wastewater could lead to pollution of water and general environment, if not properly disposed.

7.1.4.2 Wastewater

Domestic wastewater, in the form of human wastes, will be generated mainly in the temporary labor sheds.

Calculation of Wastewater Discharge from the Workers

Estimated usage per person per day for greywater is seen below.

Water Use	Volume (L)	Description
Bathing	20	
Hand Washing	6	~1.5 L per wash about 4 times a day

Based on these estimated usages for 431 people using the facility, the volumetric flow rate for greywater is seen in below.

Volumetric flow rates (Q)	Greywater	Total (L/d)	Total (L/h)	Total (m^3/d)
Per person	26	26	1.08	0.026
Total into system	11206	11206	466.92	11.206

Similarly, the estimated usage per person per day for blackwater is seen below.

Type	Volume (L)
Urine (per person per day)	1.1
Feces (per person per day)	0.2
Water (per flush)	4.28

Calculations are based on an estimation of 2 flushes per person per day. The following volumetric flow rates for blackwater below is for an estimation of 431 people using the facility.

Volumetric flow rates (Q)	Blackwater	Total (L/d)	Total (L/h)	Total (m^3/d)
Per person	9.86	9.86	0.41	0.00986
Total into system	4249.66	4249.66	177.07	4.24966
Number of Uses		V(m^3)/d		
431		15.45566		

This could be a major source of pollution (water pollution) if not properly discharged. Use of un-sanitary latrines and improper disposal of human waste would create environmental pollution and adversely affect health and well - being of the people at the construction site by increasing the risk of disease transmission. Proper disposal of wastewater should therefore be ensured as suggested in Section 7.5 (Mitigation Measure). There is also risk of disease transmission from workers from outside who would come to work within the project area.

7.1.4.3 Drainage

Since the construction phase involves significant earthwork, there are chances of stagnation and ponding of storm water if care is not taken for proper drainage of storm water.

7.1.4.4 Solid waste

Construction debris and wastes to be generated during the construction phase would include scrap iron, steel, wooden frames, piping, and other solid wastes. Most of it will be generated toward the end of the construction phase during carrying out of the finishing works, while the site will be cleared of waste materials. The volume of such construction wastes is likely to be significant. Indiscriminate storage and disposal of these construction debris and wastes could create local water logging and ponding by blocking drainage lines and would be aesthetically displeasing. Proper disposal of these wastes, as described in Section 7.6 (Mitigation), is therefore necessary.

Solid waste of domestic nature that would be generated in the temporary labour sheds at the construction site is not likely to be significant in volume. But indiscriminate disposal of such solid waste would create environmental pollution and unhealthy situation at the project site.

These solid wastes should also be disposed of properly as outlined in Section 7.7.

During site preparation, the garbage will be removed from the ground and large amount of solid waste come out (2 or 3 meter thick).

7.1.4.5 Impacts on Air Quality

During the construction phase of the proposed power plant project, the important sources of emissions would include the dust emission (total suspended particulate matters) from the operations of construction equipment and machineries, vehicles carrying construction materials to the site and taking construction debris out of the site.

The emission of particulates into the atmosphere is through vehicle dust entrainment, excavation, ground levelling, etc. The main environmental problem with dust that is generated from these activities is that it settles on surrounding properties and land which is often more of a nuisance problem than a health issue. The dust is generally coarse but may include fine respirable particles (PM10) and these are known to be a risk to human health.

During the construction of the proposed power plant, air quality could deteriorate from the following various activities:

- Construction of buildings;
- Access road construction, if required;
- Transportation of materials to and from site by construction traffic; and
- Soil stripping and earthworks

It is also assumed that with the significant amount of natural gas being consumed, additional pipelines construction would be required to move the natural gas from the gas source to the power plant.

Since construction of the proposed power plant project would most likely involve significant earthworks, increase in particulate matter in the air from wind-blown dust is also a concern, especially considering the close proximity of the monastery (and also the residential area) to the project site.

Based on the baseline ambient air quality results, PM_{10} exceeds the standard limit but it may be temporarily and specific localized source during the construction phase.

7.1.4.6 Impact on Noise Level

During construction phase, major source of noise is expected to stem from transport vehicles. Also noise is expected to be produced from plant construction activities. The construction phase may be broadly classified into two different groups:

i. General Site and Plant Construction,

ii. Water and Effluent Treatment Plant construction, and

iii. Access Road Construction.

To assess the noise generated by different activities it is essential to identify the equipment to be used at various stages of the construction work. Therefore, an inventory of the probable equipment to be used and their reference noise generation data are of utmost importance.

General Site and Plant Construction

Construction of the phase 1 CCPP will involve numerous activities. The major construction activities are:

1. General plant construction
2. Loading and unloading of construction materials and equipment along with the power generation equipment;
3. Pile driving at the site;
4. Conventional earth-moving equipment, such as excavators, heavy trucks, off – road trucks, roller – trucks,
5. Concrete mixers and cranes.

Potential Impact

Activity

The sources of noise during construction activities include:

- Construction traffic; and
- Construction activities such as excavation, concreting, backfilling, use of pumps (for pumping excess water) and compressors, etc.;

The noise monitoring stations are located beside the car road and 100m to 500m away from the existing gas-fired power plant. The baseline noise levels are typical of sub-urban/rural settings with high noise levels at N3 in day time and all noise points in nighttime. The Project is located in a sub-urban/rural area and the project site is also situated in front of the existing power plant, nearby the industrial zone and other housing project. The dominant source of noise was from human and activities, including vehicle traffic from motorway and existing power plant in the nearby area.

Figure 7.1-1 Noise Monitoring Location

Table 7.1-3 Baseline Noise Level

Code	Location	Latitude	Longitude	Leq Day dB(A) 7:00 – 22:00	Leq Night dB (A) 22:00 – 7:00	Distance from the Existing Project site (kms)
N1	West of proposed plant site	16°48'39.52"N	96°13'37.60"E	55	57	140 m away from existing gas turbine
N2	South of proposed plant site	16°48'31.40"N	96°13'36.84"E	48	47	375 m away from existing gas turbine
N3	East of Proposed Plant Site	16°48'41.79"N	96°13'52.02"E	59	45	535 m away from existing gas turbine
	Industrial Limits*			70	70	NEQEG guideline is same as World Bank guideline.
	Residential Limits*			55	45	

The closest potential noise-sensitive receptors are located 35m, 220m and 240m to the south (See in FIGURE 7.3-1. The following measurements have been recorded at sites during environmental baseline data collection in close proximity to the Project site, see Table 7.3-1.

Impact Description

Noise levels are expected to increase as a result of construction activities on site. These activities include:

- Numerous road trucks that deliver various construction equipment;

- Earthworks using a combination of one or more graders, bulldozers, excavators and front-end-loaders for the clearing of vegetation, the levelling of the ground surface as well as developing access roads;
- The development of laydown areas for equipment and material;
- Dump or road trucks to deliver road building material as well as equipment used in road construction (grader, bitumen sprayer, paver, roller and water truck);
- The use of one or more backhoe-loaders for the digging of trenches, foundations and assist in the installation of security fencing;
- Piling activities if required;
- The development of onsite batching plants or the delivery of ready-mix concrete using trucks, formwork, rebar construction and the pouring of concrete;
- Construction of buildings and installation of power generation structure and components (road trucks, cranes, welding, various impulsive sounds); and
- Cleaning of site, loading and removal of unused construction equipment.

The planned construction program of the U Energy power plant will only take place during daytime period only (i.e. 6:00 am till 6:00 pm). The primary sources of noise generation during construction include the machines described in the following table:

Sl. No	Item name	Specification	Max Qty	Noise Level
1	Excavator	220hp	2	80.7
2	Mixing machine	/	2	78.8
3	Static pressure machine	800t	2	81.7
4	Hydraulic static probe	/	2	79.1
5	Truck crane	25t/50t	5	79.4
6	Crawler crane	50t/65t/120t/250t	4	80.6
7	Transportation truck	/	6	76.5
8	Bulldozer	/	3	81.7
9	Air compressor	/	2	77.7
10	Electric Power generator	/	6	80.6

During construction period, construction activities are highly variable, taking place at different locations, using various equipment, each piece of equipment operating under a different load. As a result, noises generated during the construction phase are highly variable and cannot be defined. The approach taken in this assessment is to assume a number of construction activities at numerous locations using various equipment, all operating at full load.

The location of activities that are likely to generate noise during the construction phase of the Project can be seen in Figure 7.1-2.

Figure 7.1-2 Major Noise Source and Sensitive Receptors during Construction Phase

7.2 Impact Assessment during Construction Phase

The anticipated ambient noise levels during the construction phase of the Project have been assessed based on the qualitative method. Based on the background noise measured during baseline data collection time at 2013 shows the day time noise value is range between 48dB and 59dB and night time noise value is between 45db and 57dB. This has been presented in this report for the night-time noise impact only given that noise generated during the day by construction activities may be masked by other noises from a variety of sources surrounding potentially noise-sensitive developments. The night-time noise impact has therefore been used as the worst case scenario. It should be noted however that construction during the night is not anticipated and working hours are likely to be 6am until 6pm. Noise levels from different activities can vary between 50 -100 dB(A) based on the data collection during construction period. It is anticipated that the change in ambient noise levels will be negligible.

The project site setting is actually sub-urban and partly industrial setting because the project location is nearby the existing gas fired power plant, industrial zone and other construction activities within the Thaketa Township. So, the ambient noise value generated by the construction activities within the industrial limit set by World Bank and National Environmental Quality (Emission) Guideline.

Table 7.2-1 Effect of Project Activities on Physical Environmental Parameters during Construction Phase

Physical parameters	Impact Rating				
	Nature of Impact	Duration of impact	Impacted Area	Severity of Impact	Significance of impact
Water & soil quality	Adverse	Short term	Localized	Very Low	Insignificant

Air quality	**Adverse**	**Short term**	**Localized**	**Very Low**	**Insignificant**
Noise level	**Adverse**	**Short term**	**Localized**	**Moderate**	**Inignificant**

7.2.1 Socioeconomic Impacts

In many development projects, the most significant loss of income results from loss of land (due to land acquisition) and income. However, for the proposed combine cycle power plant project, no land would have to be acquired, and hence there will be no loss of private land or property.

There will be no displacement of population and no resettlement will be required. Also, the proposed project site is not used for any income generating activity, and therefore, there will be no direct loss of income associated with proposed project.

However, a number of project activities will have some adverse impacts on certain socioeconomic parameters (e.g., traffic and communication, public health), while other will have beneficial impacts (e.g., employment). The impacts of the project activities during construction phase on important socio-economic parameters are summarized below.

7.2.1.1 Traffic and Transport

During construction phase, some additional traffic will be generated for bringing in construction material and equipment. This traffic will pass through heavily traveled the existing road. Road traffic flow to and from the project site is likely to increase during the construction phase due to increased movement of vehicles carrying construction materials, equipment and machinery, and personnel. However, possible adverse impact of increased traffic flow is likely to be limited, especially if mitigation measures, as outlined in Section 7.5, are adopted.

According to the result of the survey, there are three main bus lines passing through the project area. These are,

(1) No. 146 bus line from South Dagon Town,

(2) No. 42 bus line from Yuzana Garden Satellite City,

(3) No. 89 bus line and

(4) No. 34 bus line.

No.34 bus line started from the terminal near the Gas Turbine Project area and there are 34 buses in that line. The main road is Ayeyarwun Road. Buses from public passenger bus lines and trucks carrying heavy logs passed through this main road. Trucks carrying heavy logs mostly pass the project area during the dry season between February and March. These timber trucks mainly carry teak and hard woods. Vacant trucks have 8 tones in weight and 15 tones when they carry the logs. Therefore, these trucks gave so much trouble for the road in front of the project area. Moreover, 30 to 40 trucks regularly enter to the project area and about 50 trucks regularly go out from the project area. The road is destroyed by these trucks. Therefore, the most important thing to do in the project area is to renovate and upgrade the road.

7.2.1.2 Local Traffic Condition

Yangon is the general sea and land traffic hub of Myanmar, both inbound and outbound. There are twelve inland river routes leading to all parts of the delta and the midstream and upstream of Irrawaddy. The Yangon Port is only 34km to the seaport and with the largest throughput of Myanmar. 80% of the freight for the import and export trades of Myanmar around the year passes the port. All railway and highway trunk lines of the country converge here.

Located at the junction of the inland river and sea transportation, the inland river navigation of Yangon is developed. The Yangon River is 37km long and is deep and wide. There is the Twante Canal westward connected to the trunk flow of Irrawaddy and the Sittaung River system, constituting the busiest inland navigation network of the whole

Myanmar centered at Yangon. The Yangon port is deep and broad. It is the largest commercial port of the country and is capable of berthing the 10,000t large oceangoing vessel. It is the seaport of the largest throughput of Myanmar. Yangon is also the intersection of the national railway and highway with also 34 flight courses leading to the main cities of the country. The Mingaladon Airport 21km away in the north suburb is an important domestic and international airport, also one of the best civil airports of Asia.

At this stage, it is planned to import the equipment from China. After careful investigation, Yangon port has the capacity to anchor and crane the heavy cargos of this project. The distance from port to plant site is short, and there is no proper rail discharging station near the plant site, so it is suggested to transport them by truck. According to onsite path investigation, roads and bridges in Yangon can basically satisfy the requirements.

7.2.1.3 Public Health

The construction activities of the phase 1 power plant are likely to have some impact on human health and well-being due to increased noise pollution and vibration, and local air pollution within and around the project site. Construction activities will generate dust.

Noise pollution and vibration will be generated from additional traffic and operation of construction equipment. The school and the residential building located close to the project site will be affected by such noise pollution and vibration. Solid wastes generated by the construction activities and labors may create environmental pollution and thus affect public health, if not properly disposed. One possible impact on public health is that there would be no more offensive odor once the large waste disposal site has been removed and replaced by the proposed gas turbine project. Accident during construction phase is also an important issue. Proper measures including regular maintenance of equipment and use of protective gear are needed to reduce the risk of such accidents during the construction phase.

7.2.1.4 Cultural Heritage and Buildings

Around the project area, there was no officially defined cultural heritages and buildings and the project activities will have no relation to affect on any cultural component.

7.2.1.5 Employment

Some job opportunities will be created for labors as well as skilled manpower (including engineers) for construction of the proposed project. Installation of power plant will require relatively small number of skilled personnel and laborers; as such installation is highly automated.

7.3 Environmental Impact During Operational Phase

During operation of the phase 1 combined cycle power plant, certain environmental parameters will experience some adverse impacts while some others will enjoy beneficial effects. In this study, the effects of the project activities on ecological, physical, and socioeconomic parameters have been assessed. As noted earlier, since the project site is located beside a developed existing Gas turbine area and on the large disposal site (open dumpy site) that does not appear to be very sensitive, ecologically.

In the operational phase, there will be no adverse impacts on most ecological parameters. Since there will be no thermal discharge (or other forms of discharge from the power plant) in the Ngamoeyeik river, the operation of the power plant will not affect the water quality or the aquatic ecosystem of the river. The effects of project activities a number of Physical environmental parameters have been assessed. These parameters include noise level, water quality, and air quality. The potential impacts of the project activities on these Physical environmental parameters are described in this Section.

The impact of the power plant project at its operation phase on socio-economic parameters will be mostly beneficial. Increased power supply will promote well-being of the people suffering from lack of power supply or serious load

shedding; it is also likely to have positive impact on industrial activities and employment. The impacts of project activities on socioeconomic parameters are also described in this Section.

7.3.1 Air Emission Impacts during Operation Phase

Generally, in the CCPP technology, burning natural gas is a cleaner type of combustion process relative to coal or oil because:

- The formation of particulates is avoided.
- The ratio of carbon dioxide produced to electricity is the lowest that can be obtained as the plant efficiency is very high.
- There are no organic residues, such as benzopyrene; and
- There is no ash or similar residues.

The *gas turbine stack* is the primary source of air pollutant *emissions during operation phase. T*he main undesirable product of combustion from gas-based power plants is oxides of nitrogen (NOx). Other gases will be traces.

- NOx: principally nitrogen oxide (NO) and nitrogen dioxide (NO_2);
- Carbon monoxide (CO);
- Particulate matter (TSPM, PM_{10} and $PM_{2.5}$),
- Oxides of sulphur and unburnt hydrocarbons

The proposed power station will emit NOx which consists of (NO) and (NO_2). Only NO_2 has been shown to have the potential to cause detriment to health when present above certain threshold concentrations.

Approximately 80 % of the NOx emitted will be in the form of NO. Some of this will be converted to NO_2 by reactions in the atmosphere. The proportion converted is a function of dilution of the plume, background concentrations of nitrogen oxides and meteorology.

Monitoring Measurements show that 24-hour average concentrations of the proposed project site would be well within the WHO guidelines and USEPA standards.

A computer model has been used to estimate the proportion converted and the resulting ground level concentrations of NO_2.

Particulate matters, SO_2 and unburnt hydrocarbons will be negligible quantities for natural gas turbines and the potential impacts will be low significant. Although CO_2 is one of the principal products of combustion, it is a greenhouse gas and has been assessed accordingly in the Greenhouse Gas Assessment.

7.3.1.1 Modelling

The impact of NOx is considered for the Point source emission for the modeling purpose since it is the primary concern. Air Dispersion Model, SCREEN3, version 3.0 is run for the pollutant, oxides of Nitrogen (NOx). This model was developed by the USEPA 1995, (EPA-454/B-95-004) and could perform the effects of simple elevated terrain (i.e., terrain not above stack top) on maximum concentrations seen in FIGURE 7.4-1.

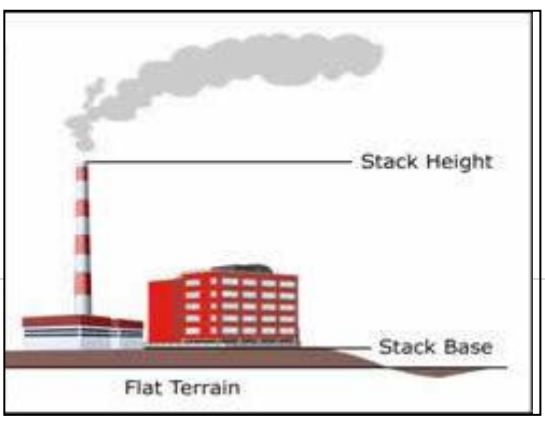


Figure 7.3-1 Sample for Simple Flat Terrain

Siemens Gas Turbine (SGT5-4000F) combined cycle arrangement SCCG-4000F which has a capacity of approximately 420 MW per unit (two units in total) and could be regarded as a 'benchmark against which other manufacturer options could be assessed. **(**Consulting Air pollution Modelling & Meteorology (CAMM), Report No. 25/09 December 2009). FIGURE 7.4-2 shows SGT5-4000F CCPP arrangement.

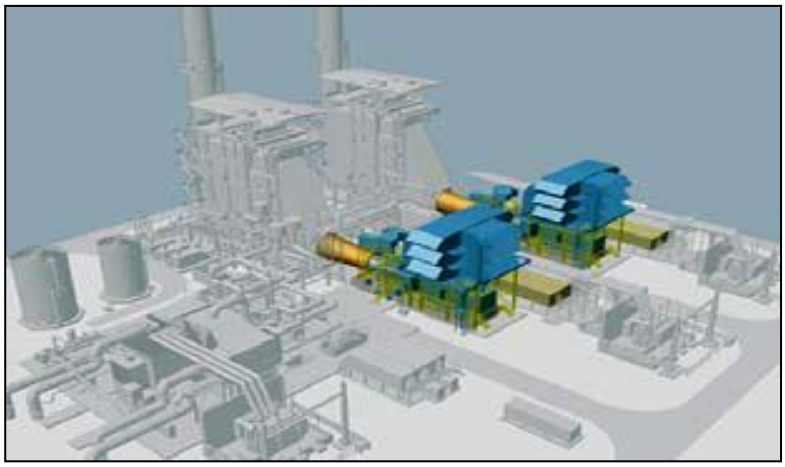


Figure 7.3-2 Siemens Gas Turbine Package in CCPP

The configuration will comprise a gas turbine, heat recovery steam generator (HRSG), steam turbine, hydrogen cooled generator and air-cooled condenser using fin-fan technology. FIGURE 7.3-3 shows the lay out plan of CCPP.

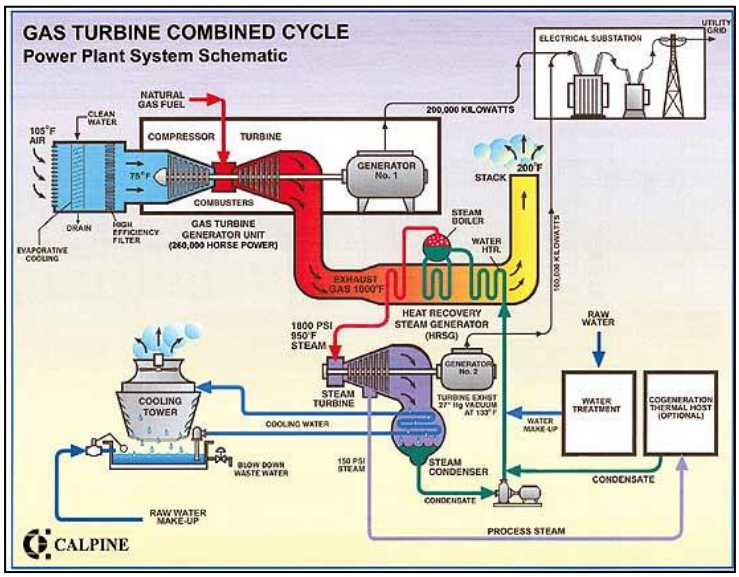


Figure 7.3-3 Lay Out Plan of Gas Turbine CCPP System

Considering Buildings Design and Dimensions, the final design will be dependent upon the appointed contractor's designs, however, the worst-case dimensions have been used for impact assessment.

The GT/HRSG units are expected to be located in a side-by-side configuration. Turbine buildings are estimated to be approximately (130m - 180m) long, and (45m and 55m) in width and typically around 25m high.

The HRSG plant will be the "outdoor type". The final design may incorporate a boiler house structure, either on a unitised or combined basis, which would be typically up to 45m in height, 181 in length and 44m in width. HRSGs are typically of a "vertical" or "horizontal" orientation.

A vertical type is likely to have the stack mounted on top whereby the exhaust gases are directed to flow upwards through the boiler elements inside and exit at the top of the HRSG. Some manufacturers may opt for a "horizontal" design, in which the gases flow horizontally and exit at the back. In the case of the horizontal design, the stacks may be located adjacent to each HRSG instead of being mounted on top.

The height of the stacks is estimated to be approximately ranging from 40-80 m. The emission scenarios assessed are under the following conditions:

i. 'Normal' conditions (100% load).
ii. Start-up' conditions.

The calculation of 24-hour emission rates shall be based on both normal operating loads, and during startups. Without taking into consideration on start - up condition will not be accepted technically.

TABLE 7.4-1 presents the details for various operating conditions.

Table 7.3-1 Stack and Emission Characteristics for Phase 1 CCGT

Sr	Parameter	Unit	Operating Condition	
			Normal	Start-Up
1	No of stack	No	**2**	**2**
Discharge data per stack				
2	Stack Diameter Meter	Meter(M)	**6.4**	**6.4**
3	Flue Gas Exit Velocity	m/sec	**19.8**	**15.0**
4	Flue Gas Exit Temperature	C to °K	**99 /372.15**	**91/364.15**
Emission rates per stack				
5	Mass flow rate for each stack	Kg/ Sec	**648**	**648**
6	Emission rate NOx at 50ppm	g/sec	**30.6**	**36.7**
7	Emission rate CO	(g/sec)	**7.5**	**36.1**
Emission rate Total				
8	NOX	(g/sec)	**61.2**	**73.4**
9	CO		**15.0**	**72.2**
8	Ambient Air Temperature	K	**293**	293
9	Receptor Height Above Ground	M	**0**	**0**
10	Building height	M	**45**	**45**

11	Min Horiz Bldg Dim	M	**180x55x25**	**180x55x25**
12	Max Horiz Bldg Dim	M	**181x44x45**	**181x44x45**
13	Urban/Rural option		**Urban**	**Urban**

A very conservative approach has been adopted for modelling start-up conditions. In particular:

The emission scenario selected corresponds to the low load condition during start-up at which the peak NO_X concentration occurs.

- It has been assumed that all units are simultaneously operating in this start-up mode

  throughout the entire year (i.e., 24 hours per day, 7 days per week) whereas this operating mode is likely to be infrequent and only occur for short time periods, with multiple units unlikely to be started up simultaneously.

Regarding meteorology, it is calculated as all stability classes and wind speeds as the major case of meteorology situation.

7.3.1.2 Estimation of Concentrations

Ground level concentrations have been calculated on the automated distance array option extending from within 200 m to 50 km radius from the point source. The spacing between points are increments of 100m was used out to 3,000m, with 500m increments from 3,000m to 10 km, 5 km increments from 10 km to 30 km, and 10 km increments out to 50 Km.

The modelling results indicate that the predicted GLC of NO_2 arising as a result of the stack emissions will not exceed any of the reference standards and guidelines for ambient air quality except only around 200m radius from the proposed CCPP. For the predicted GLC of CO, all results are well below the standards and negligible quantities.

The modelling analysis has shown that the proposed CCPP will lead to significant improvements in the dispersion of air pollutants from the site with large reductions in the predicted contributions of pollutants from the site.

The reference standards and guideline values have been designed for the protection of human health and the environment.

Therefore, atmospheric emissions from the proposed plant are not predicted to have a significant impact on ambient air quality, human health and the environment including vegetation and ecosystem.

The modelling has calculated 24 hours ground level concentration (GLC) of NO_2 and CO emitted from the stack in the surrounding area. These results are then compared to the relevant air quality standards. TABLE 7.4-2 and TABLE 7.4-3 present the comparison between the calculated GLC results and the relevant standards.

Table 7.3-2 Calculated 24 hours Ground Level NO_2 Concentration Compared to Relevant Air Quality Standards

Sr	Distance (m)	Stack Ht (m)	Predicted Concentration (µg/m³)		Baseline (µg/m³)	Total (Stack Emission + Baseline)		Remarks	Relevant Standard (std) (WHO/World Bank) /USEPA, (µg/m³)
			Normal	Start up		Normal	Start up		

1	**200[a]**	**50**	128.8	185.6	**28.36±**	**157.16**	**213.96**	**Maximum, >all stds**	**(150)/100**
2	**500**		56	78		84.36	106.36	**< std**	
3	**1,000 (1Km)**		22	34.4		**50.36**	**62.76**	**< std**	
4	**5,000 (5Km)**		18.4	32.4		46.76	60.76	**< std**	
5	**10,000 (10Km)**		14	20.8		42.36	49.16	**< std**	
6	**50,000 (50Km)[b]**		3.6	4.8		**31.96**	**33.16**	**Minimum , < std**	
1	**200 [a]**	**65**	88	121.6	**28.36±**	**116.36**	**149.96**	**Maximum,<WHO/ World Bank, > USEPA**	**(150)/100**
2	**500**		46	64		74.36	92.36	**< std**	
3	**1,000 (1Km)**		18.4	25.2		**46.76**	**53.56**	**< std**	
4	**5,000 (5Km)**		15.2	21.6		43.56	49.96	**< std**	
5	**10,000 (10Km)**		12.4	16.4		40.76	44.76	**< std**	
6	**50,000 (50Km) [b]**		3.6	4.4		31.96	32.76	**Minimum , < std**	
1	**200 [a]**	**80**	8.50	12.8	**28.36±**	**36.86**	**41.16**	**Maximum, <std**	**(150)/100**
2	**500**		15.2	26.8		43.56	55.16	**< std**	
3	**1,000 (1Km)**		10.8	15.2		**39.16**	**43.56**	**< std**	
4	**5,000 (5Km)**		12.4	18		40.76	46.36	**< std**	
5	**10,000 (10Km)**		10.8	14.4		39.16	42.76	**< std**	
6	**50,000 (50Km) [b]**		3.2	4		**31.56**	**32.36**	**Minimum , < std**	

Note: [a] and [b] show the maximum and minimum values respectively.

Table 7.3-3 Calculated 24 hours Ground Level CO Concentration Compared to Relevant Air Quality Standards

Sr	Distance (m)	Stack Ht (m)	Predicted Concentration (µg/m^3)		Baseline (µg/m^3)	Remarks	Relevant Standard (std) (WHO/World Bank) /USEPA, (µg/m^3)
			Normal	**Start up**			
1	**200[a]**	**50**	**31.60**	**182.6**	**NA**	**Maximum, <std**	**10,000**
2	**500**		13.68	76.4		**< std**	
3	**1,000 (1Km)**		**5.38**	**34**		**< std**	
4	**5,000 (5Km)**		4.51	32		**< std**	
5	**10,000 (10Km)**		3.48	20.4		**< std**	
6	**50,000 (50Km)[b]**		**0.96**	**4.8**		**Minimum , < std**	
1	**200 [a]**	**65**	**21.6**	**119.6**	**NA**	**Maximum, <std**	**10,000**
2	**500**		11.2	63.2		**< std**	
3	**1,000 (1Km)**		**4.4**	**24.8**		**< std**	
4	**5,000 (5Km)**		3.6	21.2		**< std**	
5	**10,000 (10Km)**		3.2	16		**< std**	
6	**50,000 (50Km) [b]**		**0.8**	**4.4**		**Minimum , < std**	
1	**200**	**80**	2	12.8	**NA**	**< std**	**10,000**
2	**500 [a]**		**3.6**	**26**		**Maximum, <std**	
3	**1,000 (1Km)**		**2.8**	**14.8**		**< std**	
4	**5,000 (5Km)**		3.2	17.6		**< std**	
5	**10,000 (10Km)**		2.8	14		**< std**	
6	**50,000 (50Km) [b]**		**0.8**	**4**		**Minimum , < std**	

Note: [a] and [b] show the maximum and minimum values respectively.

NA – not available

7.3.1.3 Total Emission and Limit Value of Air Pollutant in Project Site

In the absence of national legislated ambient air quality standards in Myanmar, the UREC shall demonstrate, through air dispersion modelling, plant compliance with the World Health Organization (WHO) Ambient Air Quality Guidelines as specified in WBG EHS General Guidelines.

Phase I air emission data are listed as follows.

Parameter	Averaging Period	Thaketa Combined Cycle Plant Data	Guideline Value (WHO)	NEQG Guideline Value
Sulphur dioxide (SO_2)	24-hour	0	20μg/m^3	-
	10 minute	0	500μg/m^3	-
Nitrogen dioxide (NO_2)	1-year	-	40μg/m^3	-
	1-hour	50μg/m^3	200μg/m^3	100
Particulate matter (PM10)	1-year	-	20μg/m^3	-
	24-hour	25μg/m^3	50μg/m^3	-
Particulate matter (PM2.5)	1-year	-	10μg/m^3	-
	24-hour	10μg/m^3	25μg/m^3	-
NOx	-	35 mg/Nm^3	51 mg/m^3	100 mg/Nm^3
CO	-	35 mg/Nm^3	51 mg/Nm^3	-
Greenhouse gas emission	-	Phase I：300,000t/y	-	-

However, Table 7.3-4 showed the actual stack emission with the continuous monitoring results from the stack current stack with the height of 40 m as shown in the following figures. The references guideline values are from IFC standard for Natural gas turbine and NEQG standard from Myanmar (Air Emissions from Thermal Power of Natural gas for all turbine type).

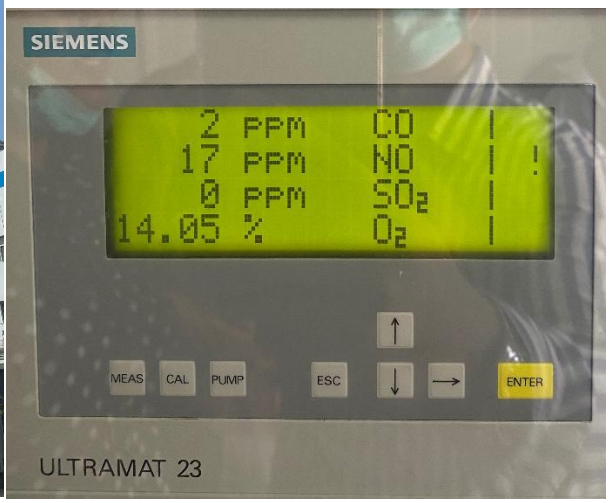


Table 7.3-4 Air Emissions from Gas Turbines Stack

Pollutant	Unit	UREG Stack Emission	IFC Standard	NEQG (Myanmar)
NOx	mg/Nm^3	23	51(25ppm)	100 (Natural gas for all turbine type)
CO	mg/Nm^3	3	not specified	not specified
O_2	mg/Nm^3	14.06	not specified	not specified
SO_2	mg/Nm^3	0	not specified	not specified

7.3.2 Noise Impacts during Operational Phase

Prolonged exposure to high level of noise may cause significant damage to human hearing organ and may cause neurological damage. The IFC's General EHS Guideline recommends that the noise prevention and mitigation measures should be applied where predicted or measured noise impacts from a project facility or operations exceed the applicable noise level guideline at the most sensitive point of reception. To be able to apply the necessary measures as requested, first the receptor should be determined. Receptor is, according to the IFC Guideline, "*a point of reception or receptor may be defined as any point on the premises occupied by persons where extraneous noise and/or vibration are received. Examples of receptor locations may* include*: permanent or seasonal residences; hotels / motels; schools and daycares; hospitals and nursing homes; places of worship; and parks and campgrounds".*

7.3.2.1 Infrastructure and Development Project surrounding of the Plant Site

Figure 7.3-4 shows the locations of infrastructure that situated around the project site. The followings are the list of infrastructures.

No.	Infrastructure and Development Project near Plant Site	Distance from the plant site (km)
1.	Five Star Jetty	3.58km
2.	Tharketa Industrial Zone	2.81km
3.	50MW (GE Gas Engine) IPP Max Power Plant	0.21km
4.	J and M Steel Factory	1.47km
5.	Yuzana Housing Complex Project (YCDC)	

7.3.2.2 Sensitive Receptors

The following table provide the sensitive receptors that located surrounding of the power plant.

No.	Sensitive Receptors	Distance from noise source (meter)
1.	School (BEHS 1)	3 km
2.	School (BEHS 4)	1.5 km
3.	School (BEHS 11)	1.4 km
4.	Central High School	2.5 km
5.	Horizon International School	2 km
6.	Tharketa Township Hospital	1.3 km
7.	National Race Village	1.1 km
8.	Thirimingalar Monastery	126 m
9.	Muslin Youth School	300 m
10.	Primary School	400 m

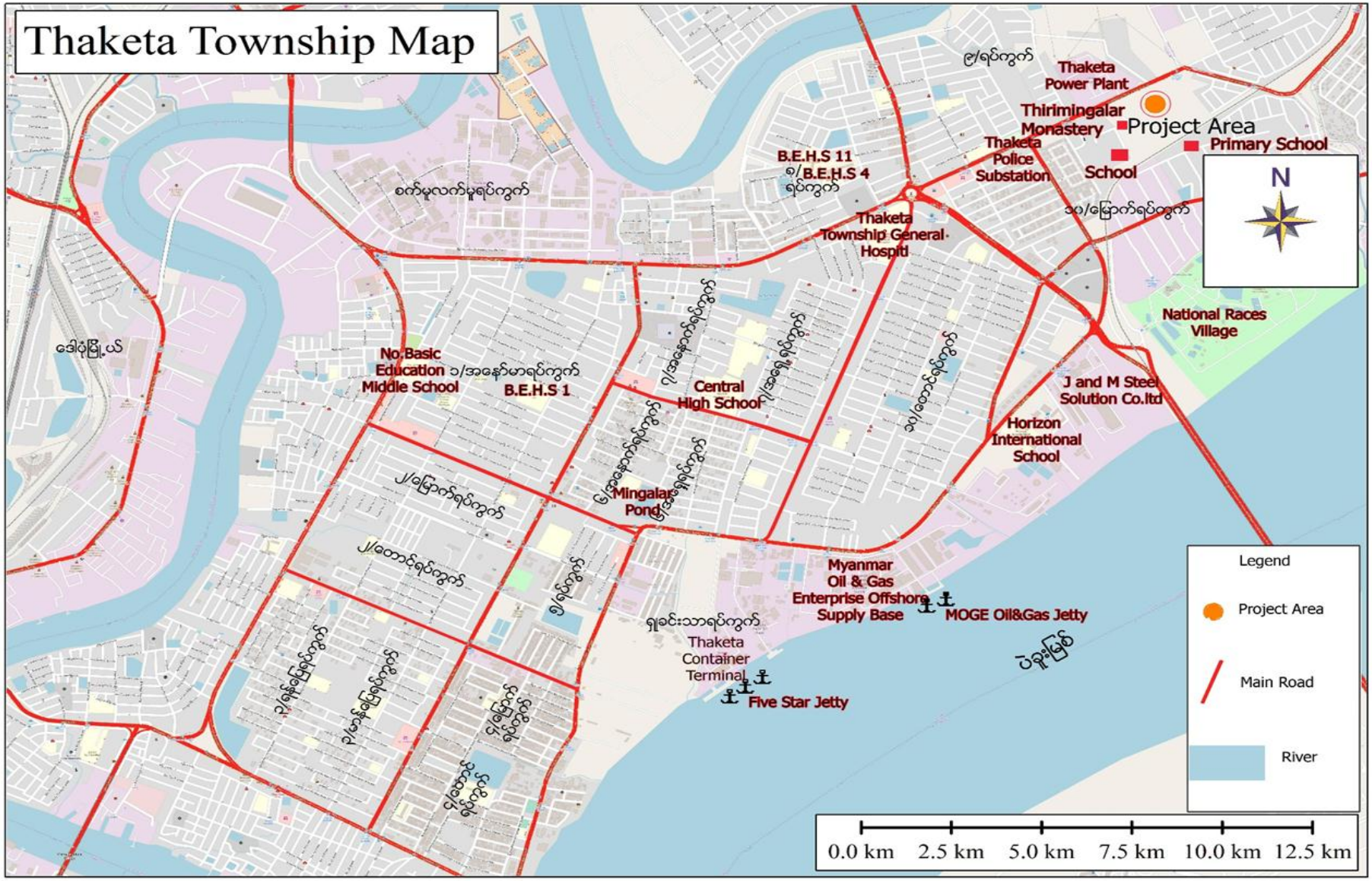


Figure 7.3-4 Infrastructure around the Project Site

7.3.2.3 Impact Description

The site is between Ayeyarwun Road at north and railway at south, and the existing Tharkayta Combined Cycle power plant is opposite to this project site (north). There is a monastery close to the power plant fence in south-west corner， there is a residential small area in south-east corner.

Noise Guarantee

According to the EPC project contract, noise control will meet the following requirements.

Table 7.3-5 Noise Guarantee

Item	SPL, dB(A)
Near field noise guarantee for equipment	85
One (1) meter outside Plant Boundary Fence	70
Inside central control room	50
Administrative Building	50
One (1) meter outside steam turbine house wall	80
One (1) meter outside Plant Boundary Fence during construction stage	85

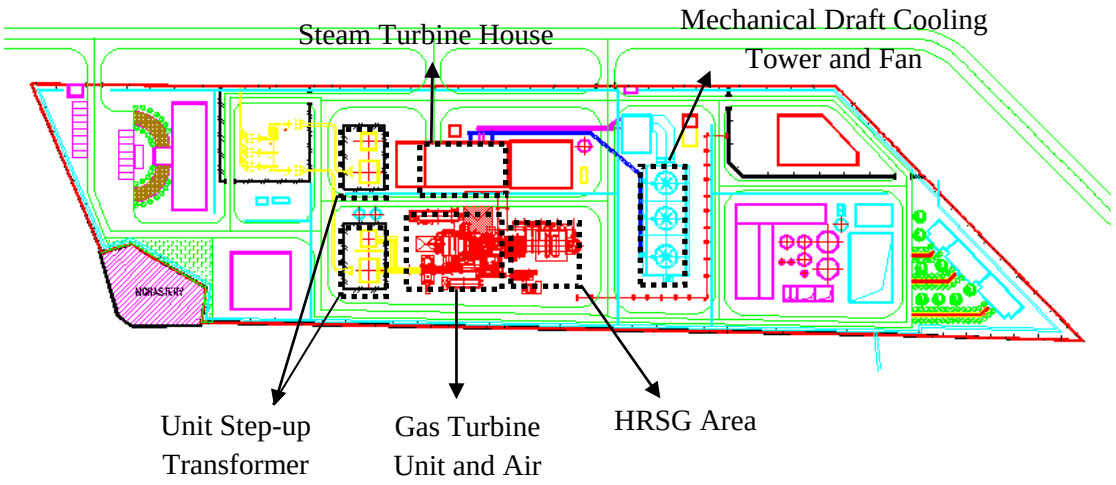
Note：

1） The noise guarantees are based on the Plant/System/Equipment operating at steady state base load.

2） Background noise and any other environment influence are excluded.

Noise Sources Distribution

Based on the general layout of this project, the main noise sources distribution are shown in the figure below:



For the First phase of the project (106MW), there have been assessed for the operational phase impact and the following noise sources have been identified:

- The air intake fans;
- Fans located on the air and steam condensers;

- Gas turbine, steam turbine and generator (normally within building);
- Ventilation fans located on the turbine generator building; and
- Exhaust and flue stacks.

7.3.2.4 Impact Assessment (Early Phase 2013)

The anticipated ambient noise levels during the operation phase of the Project have been assessed using a calculation method. Since the proposed Project will be implemented near the existing facility; and since planned area is in the industrial zone, the plant site will be constructed 200 meter far from nearest communities (See Figure 7.4-4).

According to the measurement results, the average background noise was found between 48-59 dBA at daytime and 45-57dBA at nighttime.

To see the cumulative noise pollution including the plant's noise; the noise level of the plant was also calculated.

The average voice power of the equipment to be in the facility is calculated by using the following formulas:

W = F*Wm

W: Approximate voice power of the device

F : Reduction coefficient according to the type of the machine

(For electric motors F:1*10-8, for pumps F:1,1*10-6)

Lw = 10 * log W/W0

Lw : Voice power level, dB

W : Average voice power of machine

W0 : 10-12 watt

Figure 7.3-5 Principal Noise Sources During Operation Phase Compare with The Surrounding Noise Receptors

The following equipment will be used in operation of CCPP power plant. Therefore, no negative impact is expected in vicinity of the proposed Project.

Equipment	Number	Engine Power (kW)	Lw
Gas Turbine Generator	2	138750	91.42
Gas Turbine	2	104210	90.18
Gas Compressor Engine	1	1400	71.46
Turbine Pumps	4	450	86.94
Cranking Motor	1	149	61.73
Lubrication Motor	1	75	58.75
Fans	2	7.2	48.57
Air compressor	3	90	59.54
Water Pump	8	400	86.43

$$L_{wt} = 10.\log \left\{ \begin{array}{l} 2.10^{91.42/10} + 2.10^{90.18/10} + 1.10^{71.46/10} \\ + 4.10^{86.94/10} + 1.10^{61.73/10} + 1.10^{58.75/10} \\ + 2.10^{45.87/10} + 3.10^{59.54/10} + 8.10^{86.43/10} \end{array} \right\} = 98.8 \text{ dBA}$$

From the calculation and the measurements above, the total noise level expected in the plant is found as 98,8000465dBA.

Table 7.3-6 The Noise Level According to the Distances

Distance (m)		5	25	50	150	500	1050	2000	3000	5000	10000
	Hz	**Sound Level (dB)**									
Noise Levels (dB)	125	73.8	59.9	53.8	44.3	33.8	27.4	21.8	18.2	13.8	7.6
	250	73.8	59.8	53.8	44.3	33.8	27.3	21.7	18.1	13.5	7.2
	500	73.8	59.8	53.8	44.2	33.7	27.1	21.3	17.5	12.5	5.2
	1000	73.8	59.8	53.8	44.1	33.3	26.3	19.7	15.2	8.7	-2.5
	2000	73.8	59.7	53.6	43.7	31.8	23.1	13.6	5.9	-6.7	-33.3
	4000	73.7	59.4	53.0	41.8	25.6	10.1	-11.1	-31.1	-68.4	-156.6
SOUND LEVEL (dBA)		80.0	65.9	59.8	49.7	37.9	**30.2**	23.3	18.8	13.0	4.8

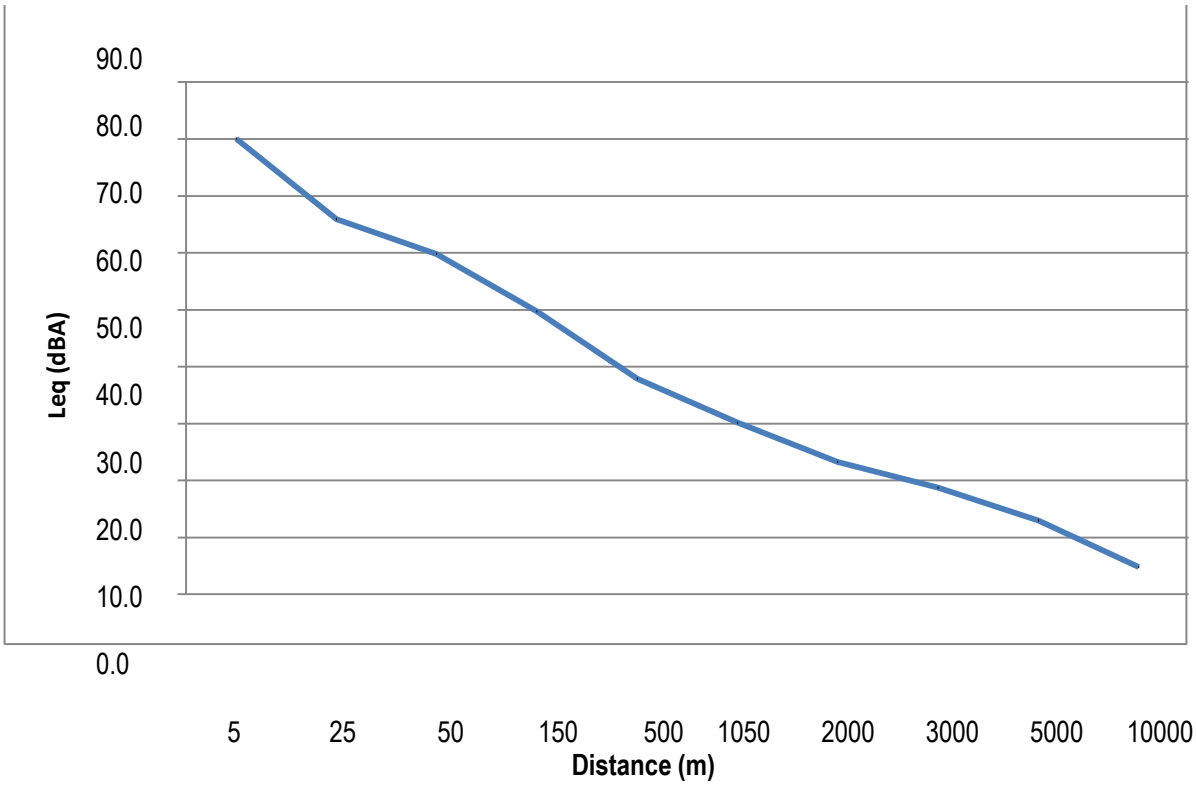


Figure 7.3-6 Impact Distances of Equivalent Noise Levels

The Residential Area closest to the project area where the facility is to be installed, which is closest to the facility is at a distance of about 200 m. The value of the noise which would reach the house in question would be 40 to 44 dBA (within 150 -200m) and this value remains below the daytime, evening and night limit values, which are respectively L_{day} (dBA) 55 and L_{night} (dBA) 45, set forth by the IFC standard and NEQE Guideline.

For the closet Thirimingalar Dhama Jaitha, which is located 60m away from the main noise source, the value of noise would reach the Dhama Jaitha would be less than 50 dBA and this value remains below the daytime values, which are respectively L_{day} (dBA) 55 and exceed nighttime value L_{night} (dBA) 45, set forth by the IFC standard and NEQE Guideline.

The proposed project is located near the existing gas turbine and car road that has moderate to high traffic flow. Therefore, the noise level guideline should be set up as industrial (See in Table 7.4-7).

Table 7.3-7 Noise Level Guidelines of IFC General EHS Guideline and NEQE Guideline

Noise Level Guidelines		
Receptor		**One Hour $L_{Aeq(dBA)}$**
	Daytime (07.00-22.00)	Night time (22.00-07.00)
Industrial, Commercial	70	70
Residential	55	45

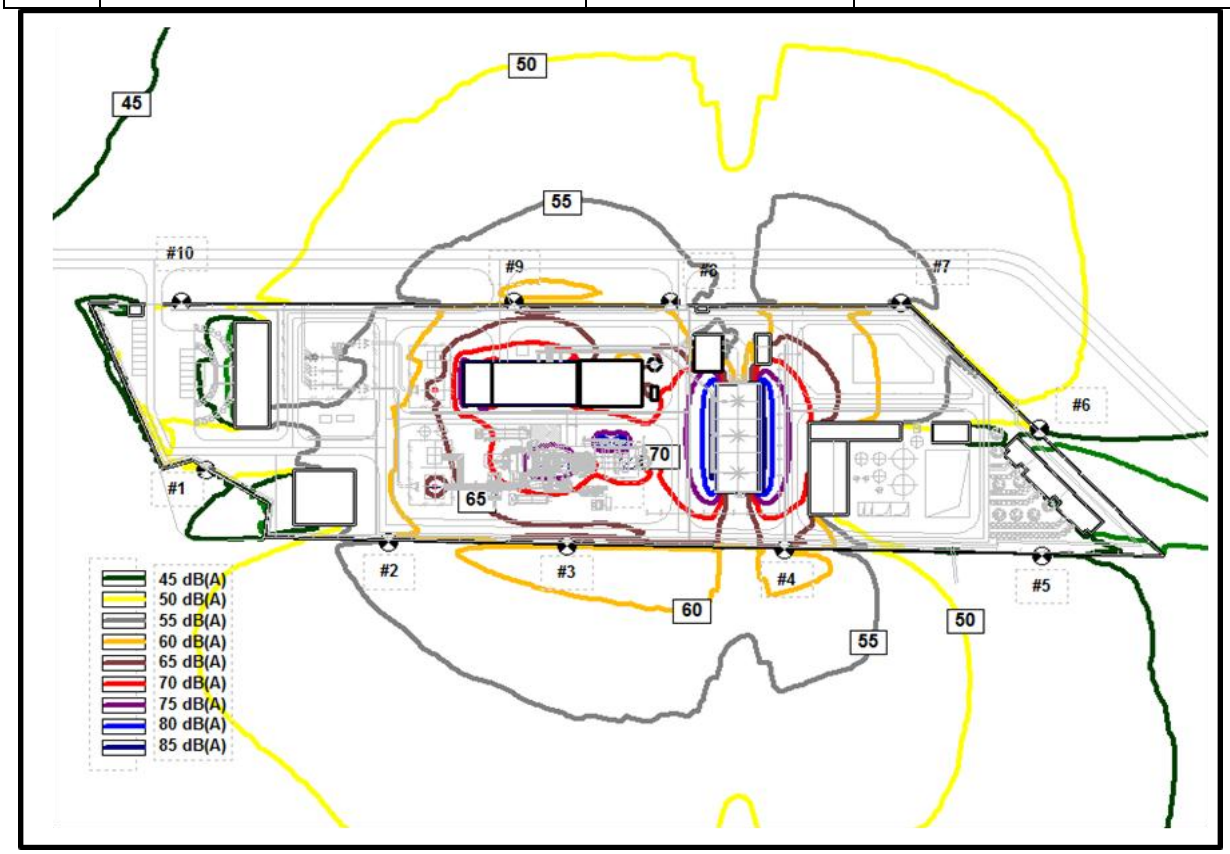
Given that the anticipated impact to be Minor, monitoring measure is proposed if there are noise complaints from the surrounding communities.

7.3.2.5 Impact Assessment Noise Prediction (After Operation Phase 2018)

The professional noise impact prediction software-CadnaA is applied to the simulation calculation. Outdoor industrial noise prediction model is used according to the technical guidelines for environment impact appraisal-sound environment (HJ2.4-2009). Considering the brick wall as plant boundary, the height of noise prediction is 1.2m from the ground and computing gird is 2m×2m. The Sound Pressure Level (SPL) of noise sources are shown in Table 7.4-8 and the contour plot of noise predictions are shown in the figure below.

Table 7.3-8 SPL of Noise Sources

S.N.	Noise Source	Type	SPL/dB(A), Near Field Noise
1	Mechanical draft cooling tower	Vertical area source	85
2	Mechanical draft cooling tower fan	Point source	85
3	Gas turbine unit	Area source	85
4	Gas turbine unit air inlet	Vertical area source	85
5	Steam turbine house	Area source	80
6	HRSG	Area source	85
7	HRSG stack	Area source	85
8	Unit step-up transformer	Point source	75
9	Feed pump	Point source	85



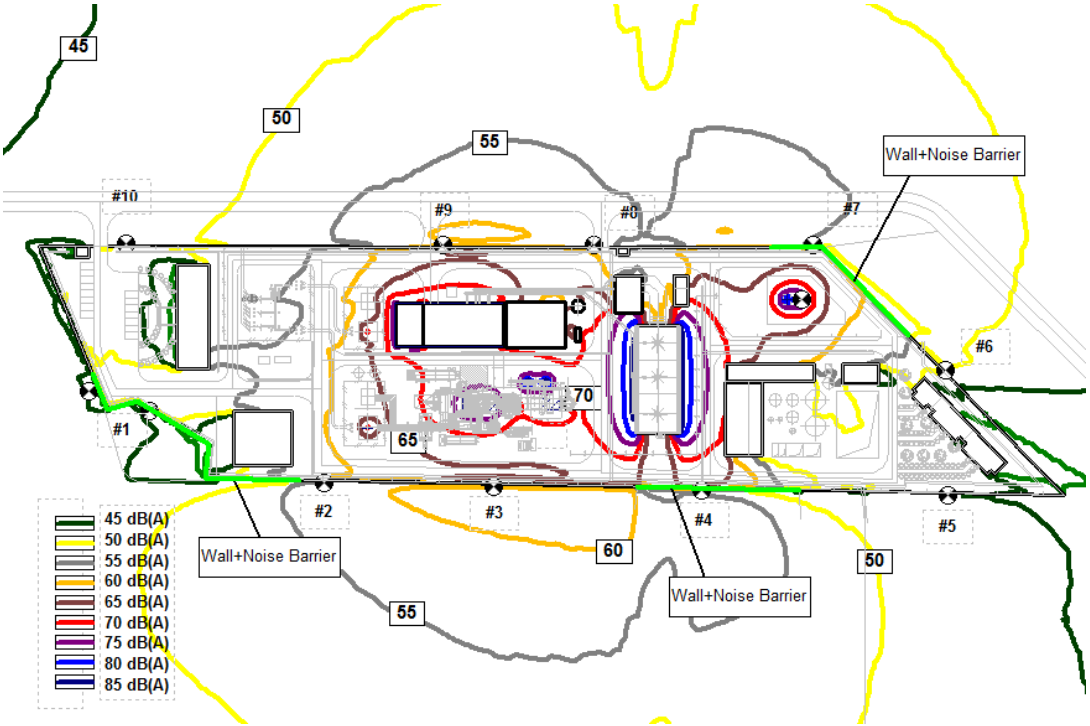
The results of SPL of boundary (considering the brick wall as plant boundary) are shown in Table 7.4-8. The predicted values of SPL of boundary are between 44.9~59.4 dB (A) and maximum value is 59.4 dB (A). The predicted results meet the requirement of attachment 16-performance guarantee in EPC contract which stipulates the noise

guarantee of plant boundary (70 dB (A)). The noise impact prediction is a preliminary result, the final result is subject to EIA document.

Table 7.3-9 SPL of Plant Boundary

S.N.	Name	SPL/ (dB(A))
1	#1 （monastery）	47.8
2	#2	55.4
3	#3	59.4
4	#4	59.1
5	#5 （residential small area）	45.2
6	#6	44.9
7	#7	54.5
8	#8	59.1
9	#9	57.8
10	#10	46.1

But the results of SPL of residential areas (near #1、#4、#7) are greater than 55 dB (A). In order to reduce the influence of noise, noise barriers at the top of wall (total height 4m) will be used and the lengths of three sections are 123m, 78m, 78m. The contour plot of noise predictions are shown in the figure below and the predicted values of SPL of residential area are lower than 55 dB (A).



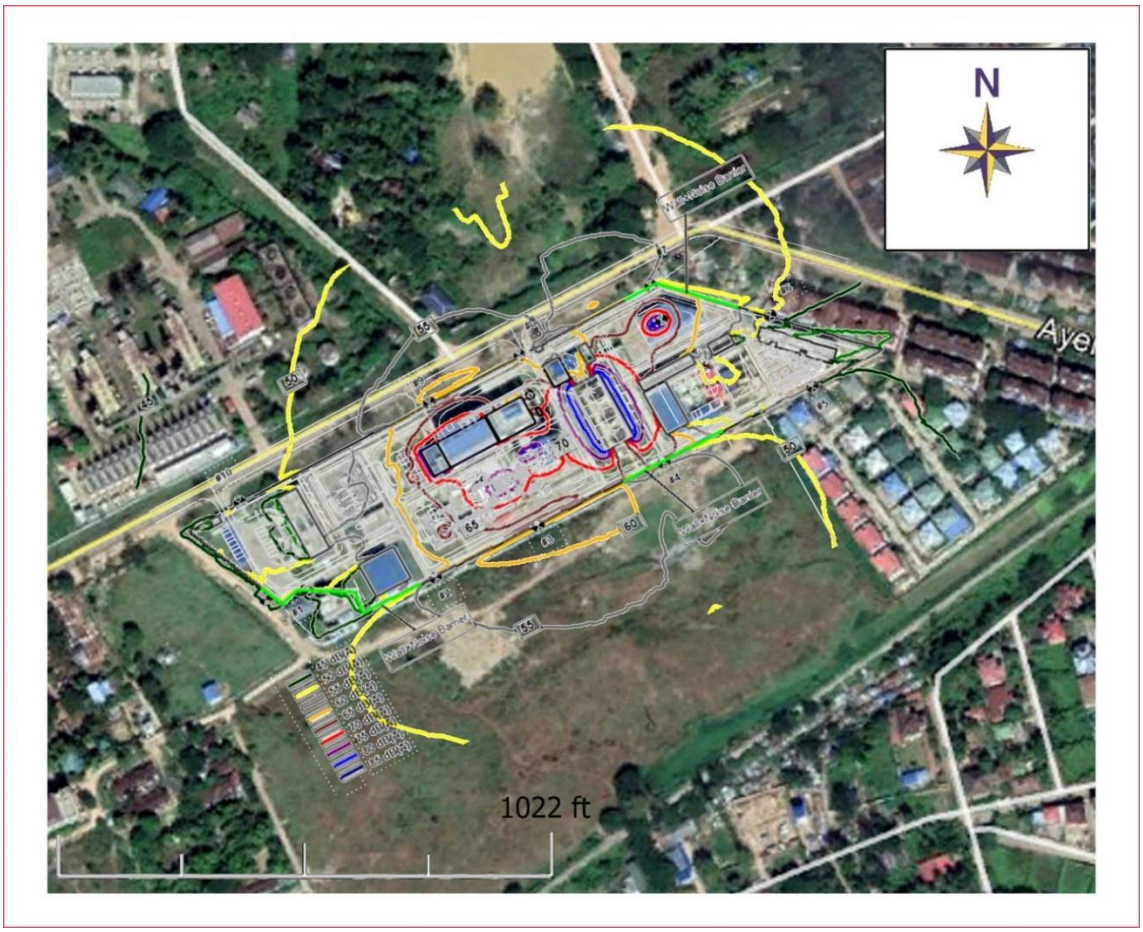


Figure 7.3-8 SPL of Plant Boundary (Yellow line is 50 dB(A)

7.3.3 Surface Water and Hydrogeology

Operation of the Gas Power Plant would have impact on surface water and ground water principally because of taking water for cooling system in Gas Turbine. Discharge of water from the nearby river will have impact on flow of regular current while taking from ground water well will have impact on lowering of the water table. Also, direct disposal of water into nearby river will have impact on change in water quality. Heat in disposed water will have direct effect to river dwellers and the people who use water.

The gas turbine component along with the 106 MW steam turbine component of the power plant does not generate any thermal effluent which needs to be discharged in the environment. This is because a closed cycle cooling system using cooling towers and condensers which will dissipate the waste heat into the ambient air rather than the surface water body. Only the intermittent losses of water from the system will be supplemented from the intake water and there will not be a discharge of water out of the system into the river unless there is an accident or a temporary shutdown due to operational maintenance.

Table 7.3-10 Potential impacts of the Ngamoeyeik River system

Sr. No.	Phase	Activities	Criterion	Possible impacts	Impact Duration	Impact Intensity	Remark	Mitigation Measure
1	Operation Phase	River water pumping/ water intake by power plant	Characteristics of river flow	Changes in flow regime nearby water extraction structure	Permanent	Low	Impact on distribution of nutrients, gases and small organisms like planktons	Application of appropriate civil engineering design of water extraction structure is required to reduce the impact on flowing water.
2			Mortality of aquatic life forms	Mortality of aquatic life forms (fish eggs, fish juvenile, fry, fingerlings, eel, crab and etc.) and leading to deterioration of food web ecosystem.	Permanent	High	Aquatic life forms from estuary and marine may reach to the water extraction place due to inundation and should be protected from entering water intake.	Appropriate fish-protection systems (i.e., mesh screen, acoustic screen, intense modulated light, bubble curtain and etc.) should be included in the proposed design.
3		Discharge of effluent water	Effluent Toxicity	Harmful to aquatic life forms	Permanent	High	Toxic substances may result from chemical dosing system used by the	Chemical constituent in wastewater is necessary to be identified. Wastewater has to be treated in a proper treatment

							proposed project	system and effluent water quality is required to be monitored.

7.3.4 Biodiversity

The impact on flora and fauna during operation phase will be negligible. The extent of impacts on river ecology depends on the choice of the technology in use of river water. Water flow is the key factor in lotic systems influencing their ecology.

The possible impact on river (Ngamoe Yeik river) is temperature effect based on the discharged cooling water. The temperature of Ngamoe Yeik river was 27º to 29ºC according to the baseline data survey of November 2012 and the discharge water will not be exceed more than 3ºC of the normal river temperature.

7.3.5 Waste Disposal

To ensure that impacts from solid waste generation and disposal are successfully avoided, the following mitigation measures will be undertaken during plant operation:

All the waste taken off site will be carried out by a skilled waste contractor.

• All solid waste will be segregated into different waste types, collected and stored on site in designated storage facilities and areas prior to release to off-site disposal facilities;

• All relevant consignments of waste for disposal will be recorded, indicating their type, destination and other relevant information, prior to being taken off site; and

• Standards for storage area, management systems and disposal facilities will be agreed with the relevant parties.

An engineer with responsibility for environmental aspects will be responsible for solid waste management at the site and will ensure that all wastes are managed to minimize any environmental risks.

7.3.6 Occupational Health and Safety

The national regulations and IFC EHS Guidelines (Section 2.0) will be achieved for whole operation phase.

The protecting measures determined in the mentioned section (Section 2)of the guideline;

• *Eliminating the hazards will be by removing the activity from the work process. Examples include substitution with less hazardous chemicals, using different manufacturing processes, etc;*

• *Controlling the hazard at its source through use of engineering controls. Examples include local exhaust ventilation, isolation rooms, machine guarding, acoustic insulating, etc;*

• *Minimizing the hazard through design of safe work systems and administrative or institutional control measures. Examples include job rotation, training safe work procedures, lock-out and tag-out, workplace monitoring, limiting exposure or work duration, etc.*

• *Providing appropriate personal protective equipment (PPE) in conjunction with training, use, and maintenance of the PPE* will be meet as necessary.

All kinds of waste generated in the plant will be treated in accordance with the standards determined by related regulations and in a way that would not threaten human health.

Health and safety impacts of the project on workers and communities in the area of influence of the project will be reasonably managed according to the national Occupational Health and Safety Regulation (Date: 9.12.2003, No: 25311) in order to reduce the likelihood of accidents and work-related illnesses on the job as well as accidents occurring between construction-related equipment and local vehicles.

7.3.7 Socioeconomic Impacts

During operation phase, no significant negative impact is anticipated on socio-economic environmental parameters. Significant positive impacts are expected due to improvement in power supply. This will add power to national grid and contribute to the Yangon city. Well-being of the surrounding population, especially Thaketa Township, will be significantly improved due to generation of electricity during peak hours.

Industrial Activities:

The power plant is located beside the existing gas turbine area. Thilawa industrial zone is about 25 km away from the power plant. So these industries will benefit from additional and uninterrupted power supply from this proposed plant. Other industry zones that located periphery of the present proposed power plant will also be supplied by electric power and will in turn increase socioeconomic growth of the region.

Employment:

Employment will be generated in the industrial sector. Besides, some employment will be generated for the operation and maintenance of the proposed power plant.

National Economy:

National economy will be benefited by the availability of additional supply of power to industrial sectors. Industries will be able to use more of their capacity, which now frequently suffers from power outage. Industries will also be able to reduce their dependence on diesel for back-up power generation, which will save additional expenditure and foreign currency.

Given the current load shedding situation, impact of this additional power generation on national economy will be significant.

7.4 Risks and Hazards Assessment

7.4.1 Fire Hazard

7.4.1.1 Analysis on Hazard Factors

In the Project, the natural gas pressure regulator station and gas turbine belong to the major hazard installations, the main body and main oil tank of gas turbine and cable system belong to the places and systems prone to major accidents. The pressure regulator station and gas turbine are defined as the major hazard installations in this assessment.

Explosion: a large number of explosive substances and devices exist in the production system of energy station, such as high pressure vessel and gas burning system with potential explosive risk. Fire hazard: in the energy station, the facilities or areas where combustible media are stored and used, the cable combustion caused by poor heat dissipation, short circuit and overheating in the dense cable area and medium leakage subject to possibility of explosion are potential factors of fire hazard.

Electric shock accident and mechanical injury: a large number of motor machines, various HV and LV power distribution units and electrical equipment, various kinds of machinery and equipment such as fans, water pumps and cranes and a large number of high-level platforms, staircases and barriers are arranged in the energy station. During the operation and maintenance, the injury such as electric shock, falling of heavy, falling of personnel or stirring in the

rotary machinery may be caused by carelessness.

According to the materials used in the process flow and production process of the Project, the possible toxic and hazardous materials mainly include natural gas, oil and sodium hydroxide, hydrochloric acid, sulfuric acid, ammonia and sodium hypochlorite used in the chemical water treatment system.

7.4.1.2 Process and Places of Power Plant Where Safety Measures Applications

(1) Explosion prevention for gas turbine, Heat Recovery Steam Generator, pressure vessel and pressure pipe;

(2) Fire prevention for facilities of oil system and electrical appliances of various structures;

(3) Incidents of electrical equipment;

(4) Injury accidents of various kinds of rotary machinery;

(5) Acid and alkali injury accidents of chemical water treatment system;

(6) Safety facilities of platforms, staircases and lifting holes;

(7) Emergency lighting measures.

7.4.1.3 Fire Safety Measures

Fire Design Principles of Building (Structures)

In order to prevent fire and control fire spreading, the fireproof and fire extinguishing schemes are taken into full account in design of the Project, and effective measures are taken, such as, the facilities of the power plant subject to high fire risk are individually laid out, and in addition, the safety operation regulations are strictly followed and various management measures are implemented during the production, so as to radically prevent the fire hazard.

At four sides of the key fireproof areas of the power plant (including natural gas pressure regulator station, transformer area and power distribution unit area), safety fences and solid enclosures are respectively arranged inside and outside the plant area. The separation distance between adjacent structures in the transformer area is set in accordance with the *Technical Code of General Plan Transportation Design for Fossil Fuel Power Plants* or firewalls are arranged as regulated.

The fire risk and the minimum fire resistance grade during the production for each part of structure of the Project shall conform to the *Code of Design on Building Fire Protection and Prevention*, the *Code for Design of Fire Protection for Fossil Fuel Power Plants and Substations* and the *Design Rules for Combined-cycle Power Plants.* The main powerhouse is categorized into Class D in fire risk and Class II in fire resistance grade. The general layout of the plant area shall be arranged according to functions of each area, the fire risks and the minimum fire resistance grades of each part of structure shall be determined properly, and the layout shall meet the requirements of the minimum separation distance, the fire exit, the exit passageway and the fire prevention of cable.

As regulated by the *Code of Design on Building Fire Protection and Prevention* and the *Design Rules for Combined-cycle Power Plants,* the fire resistance grades of the major structures of the Project shall not be below the limits listed in the table.

Table 7.4-1 Fire Risk Categories and Fire Resistance Grades of Buildings

No.	Description of Structure	Fire Risk Category	Minimum Fire Resistance Grade
1	Gas Turbine	D	II
2	Turbine house	D	II

3	Central control building	D	II
4	Heat Recovery Steam Generator	D	II
5	Air compressor station	D	II
6	Gas boost station	A	II
7	Material storage &Complex maintenance house	B	II
8	Chemical water treatment building	E	II
9	Mechanical draft cooling towers	E	II

7.4.1.4 Fire Design Measures of Buildings (Structures)

The facilities and places storing and producing the combustible media are the major potential hazards of fire hazard of the gas-steam combined circulating unit power plant, such as the natural gas pressure regulator station, the transformer, etc. The natural gas is combustible medium, the insulation oil and turbine oil are combustible media, and the cable tunnel and overhead cable may be subject to combustion under the conditions of poor heat dissipation or insulation or fire hazard caused by other reasons, and subject to worse situation caused by spreading of combustion and fire along the cable. In addition, the fire hazard is occasionally caused by the combustible medium leaking or falling on the high-temperature pipe. The following fire prevention measures are to be taken in the Project:

(1) Building shall be laid out reasonably and necessary safety distances shall be kept as required by regulations and norms.

(2) Not less than two fire exits shall be arranged respectively among each structure, centralized control building, cable interlayer and power distribution unit as regulated, and corresponding exit passageways leading out of the building shall be arranged.

(3) The whole plant shall be provided with water fire-fighting system, gas fire-fighting system and sprinkler and water spray fire extinguishing system. Movable fire extinguishers shall be arranged so as to meet the fire extinguishing requirements for different structures, equipment, facilities and media.

(4) Fire detection alarm system shall be installed as required by relevant specifications, and the control panel of the alarm system shall be arranged inside the centralized control room.

(5) Firewall is arranged between the main transformer and the plant service transformer. The transformer is provided with oil storage pit and oil discharge facility. For the oil discharge in emergency, the emergency oil in the oil storage pit shall be discharged into the emergency oil pool through the oil discharge pipe at the bottom of the pit.

(6) Fine insulation equipment, flame retardant cables, segmented fireproof partitions and fireproof materials shall be adopted as the fire prevention measures of electrical equipment and cables, so as to prevent fire and control fire spreading.

(7) For the fire hazard in gas turbine or main power house, the emergency pneumatic ball valve will automatically close so as to prevent the natural gas from entering into the gas turbine. In order to ensure the safety relief of the natural gas pipeline, the natural gas pipeline is installed with a diffusing system.

7.4.1.5 Fire and Explosion Hazards of Natural Gas Pressure Regulator Station

The natural gas pressure regulator station is categorized into Class A in fire risk and Class II in the minimum fire resistance grade. The natural gas fed into the power plant through the main natural gas pipeline shall be adjusted by the natural gas pressure regulator station in pressure for use. In the case of the leakage of pipeline and equipment during the pressure adjustment and the gas delivery, fire hazard may be caused by open flame. The mixed explosive

gas may be formed from the combustible gas spreading to air around and being mixed with the air. The explosion may be caused by open flame and high temperature, with a more serious consequence.

7.4.1.6 Fire and Explosion Hazards of Gas Turbine

The gas turbine is categorized into Class D in fire risk and Class II in the minimum fire resistance grade. If there are major mistakes of operation or unit is partly or completely out of control, and the interlock protector is partly or completely out of control, the gas turbine with natural gas as the fuel will be a major fire and explosion hazard.

7.4.1.7 Fire and Explosion Hazards of Transformer

The transformer is categorized into Class C in fire risk and Class I in the minimum fire resistance grade. Adequate sets of oil-immersed electrical equipment, such as transformers and reactor switches, are arranged for the Project. Once these sets of oil-immersed electrical equipment are in failure, the electric arc produced may cause the rise of temperature and pressure of insulation oil in the box, so that the insulation oil will spray or even burst out, besides, the electric arc may cause fire on the insulation oil, and the fire may spread quickly to bring about a serious consequence if no effective measures are taken.

7.4.1.8 Fire Hazard of Power Cable

The power cable is categorized into Class C in fire risk and Class II in the minimum fire resistance grade. A large number of power cables are provided for the Project, laid out at the cable tunnel, bent structure, vertical shaft and interlayer of control room, and connected with each set of electrical equipment and to the centralized control room. The insulating material and sheath of the cable which catch on fire due to the electric arc produced in the failure of the cable and fire around the cable are characterized by spreading along the cable. If no reliable inflaming retarding fire prevention measures are taken, the fire will spread to the major tunnel, the vertical shaft, the interlayer and the control room, thereby expanding the area of fire and increasing fire damage. Besides, the cable interlayer and the dense cable area may be degraded in electric insulating and heat insulating performances due to the aging of the cable. The drop of heat dissipation or heat insulation performances of the cable layer may cause combustion, or fire hazard of the cable may be caused by other external reasons (for example, the oil leaked from the oil pipeline catches on fire in the high-temperature pipeline or due to other unexpected reasons).

The fire hazard of cable may bring about lots of toxic and harmful gas, which is relatively dangerous to the personnel in the area of fire and firefighter fighting the fire.

The mismanagement and improper use of the turbine oil, insulating oil and lubricating oil during the storage and use for the Project may cause combustion and fire hazard.

7.4.1.9 Fire Hazard of Electrical Equipment and Material

The overload and short circuit of electrical equipment or overload, aging or poor heat dissipation of the material such as cable may cause fire hazard.

The power distribution unit, motor and various kinds of illumination equipment in the places subject to risk of fire and explosion without meeting the requirements of hazardous areas may cause fire and explosion.

The fire-fighting system is presented in Appendix-8.

7.4.1.10 Explosion Safety Measures

Explosion Design Principles

The explosion design is carried out in accordance with the current *Design Rules for Combined-cycle Power Plants* (DL5174-2003), *Code of Design on Building Fire Protection and Prevention* and *Code for Design of Fire Protection for Fossil Fuel Power Plants and Substations.* For the process design and civil design of equipment and process system (such as various pressure vessels) and their electrical facilities and powerhouse subject to the risk of explosion,

corresponding explosion measures shall be taken according to different types of explosion sources and hazard factors. All pressure vessels in the power plant are provided with safety valves so as to prevent explosion caused by overpressure. As required by the safety testing rules, the boiler equipment is provided with emergency exit, the main steam pipeline is provided with safety monitoring points, and hazardous articles and inflammable and explosive articles are stored in the special warehouse in limited quantity.

The electrical equipment in the place subject to risk of explosion shall conform to the *Specifications for the Design of Electric Systems in Places with Explosion and Fire.*

Explosion Design Measures

The places subject to possibility of explosion of the power plant of gas turbine mainly include the natural gas system, the pressure vessels and the places where explosive gas is produced, such as natural gas pressure regulator station, natural gas booster and fuel module of gas turbine. The following major preventive measures shall be taken for the potential explosion hazards of these systems or equipment during the design.

(1) Leakage detection alarm shall be arranged at the place subject to possibility of leakage of natural gas so as to timely find and remove the leakage.

(2) The pressure vessel manufacturer selected shall be granted with the corresponding pressure vessel design and manufacture certificate.

(3) The Heat Recovery Steam Generator, other pressure vessels and natural gas system in plant shall be provided with corresponding safety valves.

(4) The steam exhaust pipe of each safety valve is led out of the powerhouse or to the appropriate height so as to prevent the injury due to the action of the safety valve and ensure the unobstructed exhaust.

(5) As regulated, the creep expansion monitoring sections and the creep expansion measuring points shall be set on the main steam pipeline and the high-temperature reheating pipeline and monitoring platforms shall be arranged at the creep expansion monitoring sections for the high-temperature and high-pressure pipeline.

7.4.1.11 Overpressure Pipe Explosion Hazard of Steam and Condensate System of Heat Recovery Steam Generator

The steam and condensate system of Heat Recovery Steam Generator is categorized into Class D in fire risk and Class II in the minimum fire resistance grade. If the pressure parts of the Heat Recovery Steam Generator are subject to defects (such as problem of material or welding quality) and used at excess temperature, overpressure or over ageness, or, the pressure bearing parts and pipes are used at high temperate and high pressure or in particular higher parameters for a long time, the fatigue or crack of metal material may be easily caused, thereby bringing about the hazard of explosion after leakage. In order to prevent the pipe explosion of steam and condensate system of Heat Recovery Steam Generator, a certain number of safety valves are arranged at the steam drum, the header at the outlet of the over heater and the header at the outlet of the reheater. However, the action failure or overage service of the safety valve may also cause the explosion accident.

Explosion and Blasting Hazards of Various Pressure Vessels and Penstocks

Various pressure vessels and penstocks are subject to hazards of explosion and blasting due to the failure or overload of safety accessories or fatigue of metal material and crack of creep age.

7.4.1.12 Fire Fighting System

The guideline of putting prevention first and combining prevention with fire-fighting should be applied in the design of fire-fighting system.

Meanwhile the system should promote production, assure security and be user-friendly and economic.

An alarm signal will be sent out by the fire-fighting system at fire initial stage and makes central, zone and local monitoring of fire and remote and local control of fire-fighting equipment possible. The system should enough capacity to extinguish fire. The fire-fighting capacity is designed on the basis of one fire at the same time.

The fire-fighting system consists of the following content:

a) Indoor/outdoor hydrant fire system;

b) Carbon dioxide fire extinguishing system for gas turbine(designed and supplied by gas turbine manufacturers) ;

c) Mobile chemical fire-extinguishing installation. An independent automatic water fire-fighting system is set in this project.

A set of fire-fighting pumps i installed in the comprehensive water pump house. There are 2 main fire pumps (1 operation 1 stand by). For maintaining the pressure in the pipe and saving energy, a set of frequency converter is add to pressure maintaining fire pump.

Independent fire-fighting network is laid in the plant. Loop network is paved around main buildings. There are 2 industrial fire-fighting tanks.

7.5 Cumulative Impacts Assessment

The assessment of cumulative impacts requires a holistic and integrated view of the Project and other known projects in the area.

The Project is located in Thaketa Township and it composed of industrial zone, existing gas fired power plant (92MW) and other industrial. The followings are the list of the projects in the township.

A selection of developments (see Figure 7.4-10) that may contribute to the cumulative impacts on similar natural or social resources and those either confirmed or most likely to come to fruition have been considered in this cumulative impact assessment, including:

I. Paint Factory (Government Own)
II. MOGE Oil and Gas Jetty
III. Five Star Jetty
IV. Housing Development Project
V. Thaketa Industrial Zone (Paper product, Food and Beverage, Motor Car Assembly Factory)
VI. J&M Steel Factory
VII. IPP Thaketa Thermal Power Plant (50MW)

J&M Steel Solutions Co., Ltd. (Head Office, Yangon, Myanmar; President: Yasuo Shoji), which was established by JFE Engineering Corporation (Head Office: Chiyoda-ku, Tokyo; President and CEO: Hisanori Kanou) as a joint venture with the Ministry of Construction of Myanmar, completed the expansion of its steel structure fabrication plant in Thaketa Township, Yangon City, and held the Grand Opening Ceremony for the new facility on May 8.

To support infrastructure development in the rapidly-growing country of Myanmar, J&M Steel Solutions began operation of a plant which fabricates steel bridges and other steel structure products in 2014, and the plant has been operating at full capacity since opening. Against this background, the company carried out a plant expansion project, which began in March of last year, in order to expand the annual production capacity of the plant from 10,000 tons/year to 20,000 tons/year. The facility expansion was completed recently.

In this plant expansion project, the site area was more than doubled, from 32,000 m2 to 65,000 m2, and areas for outdoor storage of members and temporary assembly were expanded. At the same time, the building area was also increased from 8,000 m2 to 12,000 m2, and state-of-the-art equipment was expanded in all fabrication processes, including the introduction of blasting equipment and painting equipment, etc. which will enable rustproofing and

corrosion protection in accordance with Japanese specifications. As a result, it will also be possible to fabricate steel bridges, steel jackets and other structures with the high durability specifications required for ODA projects, etc. The plant is expected to produce the steel jacket piers for the Thilawa Port in Myanmar, bridges for Bangladesh and other large-scale projects.

In the future, active infrastructure development is foreseen in the Indian Ocean Rim region. J&M Steel Solutions will contribute to the development of the region, beginning with Myanmar, by supplying high quality structures to meet this demand.

According to the tender document of IPP project, the concession period for the power is set for 5 years from commercial operation date. Since the IPP project has started from March 2013, the IPP project will be finished in the year 2018. Thus, as the operation period of these projects will not overlap, cumulative impact will not occur.

The main air pollution sources in the area are primarily the power plant and secondarily the traffic on the nearby roads.

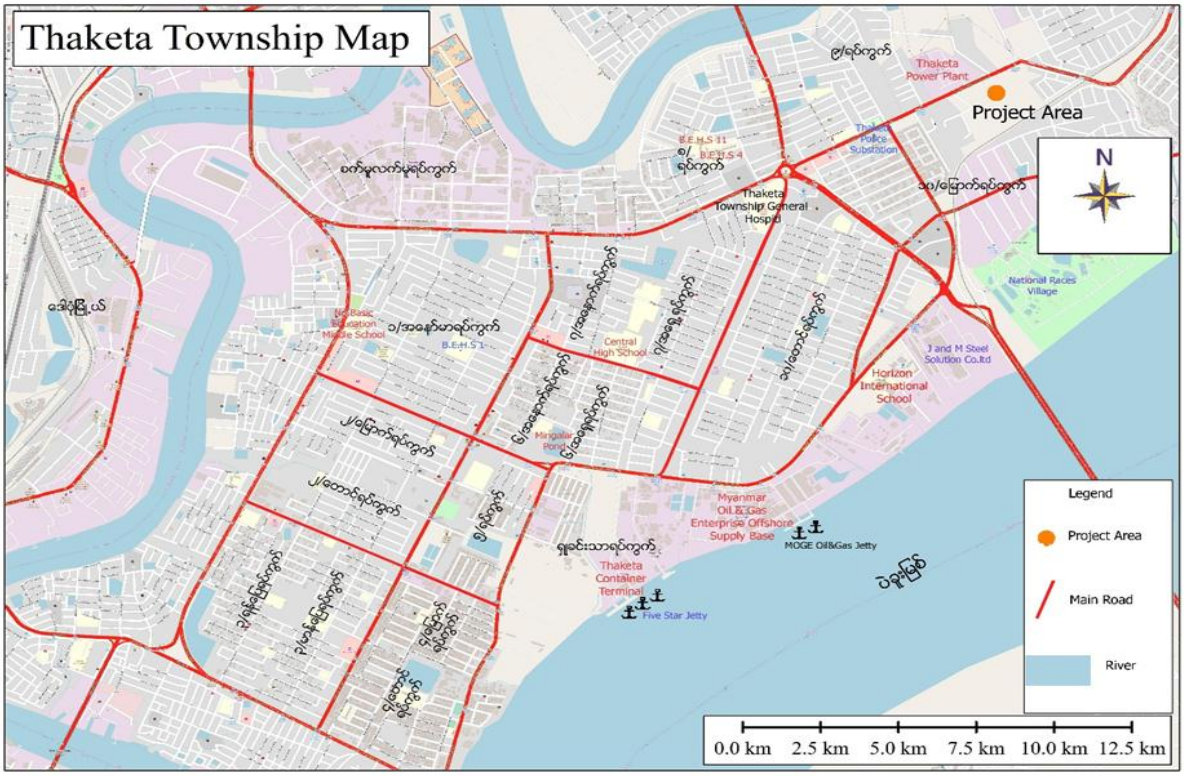


Figure 7.4-10 Know Development Projects Vicinity of the Project Site

7.5.1 Air Quality

In this study, efforts have been made to assess cumulative impacts of the proposed power plant on air quality. There are a large number emission sources (e.g., existing power plants, and another 93MW CCPP) surrounding the proposed project area, all of which contribute to air pollution. Data on the nature and rate of emissions from these diverse sources are almost nonexistent.

Similarly, there are significant uncertainties regarding future developments in this area and potential emissions from such sources. Therefore, in this study, the cumulative impact on ambient air quality has been assessed by considering background concentrations of the pollutants (which represent effects of existing emissions) reported in previous chapter.

Available data shows NOx concentration in the ambient air to vary from a low of about 24.04 ppb to a high of about 27.24 ppb. Considering these background levels and the predicted maximum (1-hr) concentration (for worst-case Stability Class "F"), the total ambient NOx remains well below the yearly average WHO guideline (40 µg/m^3/ppb). Thus, NOx emissions from the proposed power plant do not appear to pose a significant threat to the ambient air quality around the project area.

Measurements carried out in April 2013 at the project site show CO concentration varying from 0.37 ppm to 0.41 ppm. The predicted ground level CO concentrations due to emissions from the proposed power plant are almost two orders of magnitude smaller than the existing levels. Hence CO emission from the proposed power plant is not a threat to the ambient air quality around the project area.

Measurements carried out in April 2013 at the project site show relatively high PM10 concentrations, varying from 56.96 to 63.56 µg/m^3 (Compared to WHO (guideline) in Guidance Value). The exceedance of PM10 level of background in the project site is due to vehicle movements in car road under maintenance located in front of the project site.

The emission of particulates into the atmosphere is through vehicle dust entrainment, excavation, ground levelling, etc. The main environmental problem with dust that is generated from these activities is that it settles on surrounding properties and land which is often more of a nuisance problem than a health issue. The dust is generally coarse, but may include fine respirable particles (PM10) and these are known to be a risk to human health.

Air quality impacts during construction, operation and decommissioning are predicted to be of *local* extent for all pollutants since these pollutants are released close to ground level, which limits their dispersion and the potential impacts, as described above.

Section 7.4.3 demonstrate through air dispersion modelling, the plant compliance with the World Health Organization (WHO) Ambient Air Quality Guidelines as specified in WBG EHS General Guidelines. Therefore, the cumulative impact in this case would be low based on the existing situation in the area.

The scale of the impact has been rated as Low as in the case of dust, SO_2, NO_2, PM10, CO and PM2.5, impacts are expected to be within the site and ambient concentrations are expected to be well below the WHO guideline (See in section 4.7.3). The existing gas turbine and IPP project which is closer to the present power plant will be decommissioned and therefore its contributions to the air shed will be eliminated.

The following mitigation is proposed to minimise the cumulative impact:

• Covering of vehicle loads;

• Loading and unloading materials in wind-sheltered areas;

• Speed restrictions on site;

• Revegetation as soon as possible;

• Spraying of roads to minimise dust;

• Maintenance of vehicles and equipment.

During operation phase monitoring measures will be conducted and continually share monitoring data each other (EPC contractors).

7.5.2 Noise Level

The cumulative effect of the noise to be generated by the proposed phase 1 CCPP at a distance of 200m from the major plant site is expected to be about 40 -44dBA. The existing noise level monitored near the proposed plant site is between 47.97 to 60.63dBA in day time and between 45.35 to 57.4dBA in night time. Since there are a number of buildings as well as trees and boundary walls the receptor is expected to experience noise much less than this value.

The cumulative effect of both of these proposed plants at a common point is expected to be dominated by the noise generated by the plant nearest to the receptor.

The ambient noise values generated during the construction phase were noted within the industrial limit set by World Bank and National Environmental Quality (Emission) Guideline.

During operation phase, the predicted values of SPL of boundary are between 44.9~59.4 dB (A) and maximum value is 59.4 dB (A). The predicted results meet the requirement of attachment 16-performance guarantee in EPC contract which stipulates the noise guarantee of plant boundary (70 dB (A)). During Phase II operation, according to the EPC project contract, noise control will meet the guarantee noise value is same as phase I. Similarly with the phase I, noise modeling and compliance during phase II (background plus 3dB(A)) was based upon noise baseline data which already takes into account the existing operation. The present noise level during phase I at the nearest communities were below 50 dB (A) and it is therefore unlikely that these levels would be exceeded caused by the cumulative noise sources.

The noise control measures will be the same as phase I to mitigate the cumulative noise impact.

7.6 Impact Evaluation

This section provides an evaluation of the impacts of project activities on the Physical, ecological and socio-economic parameters, both during construction and operation phases of the project.

7.6.1 Impact Evaluation Criteria

The criterion that has been used to evaluate impacts on various environmental and social aspects is as following:

7.6.1.1 Potential Impacts

The proposed development will be considered in the context of the policy and guidance documents identified in chapter 3. Where the development is supported by policy and guidance documents, this will be identified, and where there is any conflict this will also be identified and the issues will be discussed with the relevant specialist (e.g. ecology team) with a view to developing appropriate avoidance, mitigation or compensation measures.

The context refers to spatial or geographical extent of impact due to proposed small area. In this study, impacts were classified as per the following context:

The impact is Local (low spread), when an impact is restricted within 3 to 5 square km.

7.6.1.2 Scope of Assessment

The assessment will consider the pertinent planning policy framework, and will be bound by the associated extents of these areas. Where appropriate, policy relating to adjacent areas may also be considered.

The above context has been selected based on the understanding of the low spread project and prevailing environmental and social baseline conditions.

7.6.1.3 Duration

The duration of impact considers whether the impact would be short-term, medium-term or long-term and has been assessed based on the time taken to recover back to its pre-project state. For the construction of Gas turbine project, impacts were classified based on their existence in temporal scale as follows:

- Short term (low duration) when impacting for a duration of six months (other than for ecology); this will result in the recovery of the effected environmental component (other than for ecology) within a year;
- Medium (medium duration) when impacting between six months and three years; this will result in the recovery of the effected environmental component (other than for ecology) within 1 to 10 years; and

• Long term (high duration) when impacting beyond three years (other than for ecology); and will result in recovery of prevailing conditions within 10 years or beyond.

For ecology [faunal species or floral species of ecological significance and trees(of girth size 30 cm or more)], impacts will be short term if limited to less than one generation, while impacts will be medium if limited to one generation and long term if limited to more than one generation.

7.6.1.4 Intensity

Indicators of the intensity of an impact, whether it is insignificant, minor, moderate, or major, was based on the following criteria for impact intensity:

• Insignificant intensity when resulting in changes in the environmental baseline of less than 20% in regional context or 20 to 30% in medium context or up to 30% in local context but for short duration;

• Minor intensity when resulting in changes in the baseline up to 20% in regional context or up to 30% in medium context or more than 30% in local context or for ecology minimal changes in the existing ecology in terms of reproductive capacity, survival or habitat suitability;

• Moderate intensity when resulting in changes in the baseline for up to 30%in regional context or more than 30% in medium context or for ecology changes are expected to be recoverable in terms of medium duration; and

• Major intensity when resulting change in the baseline beyond 30% in regional context or for ecology changes serious impairment to species, productivity or their habitat.

7.6.1.5 Type

The type of impact refers to whether the effect is considered beneficial or adverse. Beneficial impacts would improve resource conditions. Adverse impacts would deplete or negatively alter resources. The significance assessment matrix is provided in TABLE 7.6-1.

Table 7.6-1 Impact Significance Criteria for Environmental and Social Components (other than for Ecology)

Significance	Context	Duration	Intensity
Insignificant	Local	Short	Low
	Local	Short	Moderate
	Local	Medium	Low
	Local	Medium	Moderate
	Medium	Short	Low
	Local	Long	Low
Moderate	Local	Medium	High
	Local	Long	Moderate
	Medium	Short	Moderate
	Medium	Medium	Low
	Medium	Medium	Moderate
	Medium	Long	Low
	Medium	Long	Moderate

	Regional	Short	Low
	Regional	Short	Moderate
	Regional	Medium	Low
	Regional	Medium	Moderate
Major	Local	Short	High
	Local	Long	High
	Medium	Short	High
	Medium	Medium	High
	Medium	Long	High
	Regional	Short	High
	Regional	Medium	High
	Regional	Long	Low
	Regional	Long	High
	Regional	Long	High

Note: Positive impacts are termed as beneficial while negative ones are adverse

7.6.2 Impact Evaluation on Construction Phase

7.6.2.1 Impact Evaluation on Physical Parameters

TABLE 7.5-2 summarizes the effect of project activities on Physical environmental parameters during construction phase of the project. The Physical environmental parameters that could be affected by the project activities include water and soil quality, air quality and noise level. Water and soil quality could be affected mainly by project activities such as mobilization of equipment and personnel (e.g., solid and liquid waste from labor sheds), and site preparation. Effects of solid and liquid wastes generated during construction phase would not be very significant, especially if mitigation measures as outlined in Section 7.5 are adopted. The overall negative impact of such activities is likely to be “short-term (Sh)” and of “low” intensity.

Table 7.6- 2 Effect of Project Activities on Physical Environmental Parameters During Construction Phase

Physical parameters	**Impact Rating**				
	Nature of Impact	**Duration of impact**	**Impacted Area**	**Severity of Impact**	**Significance of impact**
Water & soil quality	**Adverse**	**Short term**	**Localized**	**Very Low**	**Insignificant**
Air quality	**Adverse**	**Short term**	**Localized**	**Very Low**	**Insignificant**
Noise level	**Adverse**	**Short term**	**Localized**	**Moderate**	**Insignificant**

7.6.2.2 Impact Evaluation on Ecological Parameters

TABLE 7.5-3 shows the effects of the project activities during construction phase on ecological parameters. The project area is not very sensitive ecologically and hence the impacts of project activities on most ecological parameters are not very significant. Therefore, impacts of project activities on flora and fauna would be of "moderate" intensity.

Table 7.6-3 Effect of Project Activities on Ecological Parameters During Construction Phase

Ecological Parameters	Impact Rating				
	Nature of impact	Duration of impact	Impacted Area	Severity of impact	Significance of impact
Flora	Adverse	Short term	Localized	Moderate	Insignificant
Fauna	Adverse	Short term	Localized	Moderate	Insignificant

However, the possible construction of pipeline across the River (though not a part of the proposed power plant project) will have adverse impacts on the aquatic environment, including fisheries. Gas pipeline construction activities may destroy the benthic communities and the obliteration of spawning and nursery grounds for fish.

7.6.2.3 Impact Evaluation on Socioeconomic Parameters

TABLE 7.5-4 shows the effects of the project activities during construction phase on socio-economic parameters. The project activities during construction phase will have some adverse impact on public health, transport and communication, and well-being due to increased noise pollution and vibration, and local air pollution within and around the project site.

The transportation sector will also face some short-term adverse impacts due to additional traffic that will be generated for bringing in building construction material and equipment to the site and hauling construction debris away from the site through existing car road. The negative impact of the traffic flow resulting from increased movement of vehicles carrying construction materials and personnel to the site and construction debris away from the site would be mostly concentrated primarily within the plant complex, affecting people in residential areas and the school located nearby the project site.

Some beneficial effect of "low" intensity will come from job opportunities to be created for labors for construction of the proposed project.

Table 7.6-4 Effect of Project Activities on Socio-Economic Parameters During Construction Phase

Socio-economic Parameters	Impact Rating				
	Nature of impact	Duration of impact	Impacted Area	Severity of impact	Significance of impact
Health & well being	Adverse	Short term	Localized	Moderate	Insignificant
Transport & Communication	Adverse	Short term	Localized	Moderate	Insignificant
Employment	Positive	Short term	Localized	Low	Insignificant

7.6.3 Impact Evaluation on Operation Phase

7.6.3.1 Impact Evaluation on Physical Parameters

TABLE 7.5-5 summarizes the effect of project activities on Physical environmental parameters during operation phase of the project. Effect of project activities during operation phase on Physical environmental parameters will be mostly of "low" intensity. The noise level at the monastery and school resulting from the operation of power plant has been predicted to be in the range of 40 to 50 dB (A).

Physical parameters	Impact Rating				
	Nature of Impact	Duration of impact	Impacted Area	Severity of Impact	Significance of impact
Water & soil quality	Adverse	Short term	Localized	Very Low	Insignificant
Air quality	Adverse	Long term	Localized	Moderate	significant
Noise level	Adverse	Long term	Localized	Moderate	significant

7.6.3.2 Impact Evaluation on Ecological Parameters

Most ecological parameters will not be affected by the project activities during operation phase.

7.6.3.3 Impact Evaluation on Socioeconomic Parameters

As shown in TABLE 7.5-5, the project will mostly have beneficial impacts on socio-economic parameters during operation phase. National economy will be benefited by the availability of additional supply of electric power to industrial sectors. Since the power plant is located nearby industrial zone, the industries will benefit from additional and uninterrupted electric power supply from this proposed plant. New industries will also come up, which will in turn increase socioeconomic growth of the region; employment is also likely to increase in the industrial sector.

Table 7.5-5 Effect of Project Activities on Socio-Economic Parameters during Operation Phase

Socio-economic Parameters	Impact Rating				
	Nature of impact	Duration of impact	Impacted Area	Severity of impact	Significance of impact
Health & well being	Positive	Long term	Localized	Moderate	Moderate
Transport & Communication	No impact				
Employment	Positive	Long term	Medium	Moderate	Moderate
Industrial activities	Positive	Long term	Medium	Moderate	Moderate
National economy	Positive	Long term	Regional	Moderate	Moderate

7.7 Decommissioning Phase of The Project

No detailed assessment of environmental impacts associated with decommissioning can be made at present. The proposed Project is planned to implement on BOT basis. In accordance with BOT contract, the plant will be transferred to the Republic of the Union of Myanmar.

In broad terms, the process of decommissioning is likely to give rise to impacts similar to those experienced in the construction phase. The methods and techniques selected are expected to be in accordance with national and international standards prevailing at the time of decommissioning. Decommissioning will require the following activities:

- Removal of all surface equipment and units;
- Potential removal of hard standing and surface cover;
- Reinstatement of the site and all project areas to pre-construction conditions.

7.8 Mitigation Measures

7.8.1 Pre-construction Phase

7.8.1.1 Air Quality

Vehicle movement to and from the site should be properly managed to ensure that is does not significantly aggravate the traffic problem and air pollution. The following mitigation measures will further reduce the impact of emissions:

- Sprinkling of water on dust generating areas;
- Restricting the speed limits of vehicles during movement on unpaved roads; and
- Covering of vehicles carrying loose soil/construction material.

7.8.1.2 Noise

Site clearance activity will be undertaken only during daytime. There will be some noise generated from the movement of vehicles transporting the materials but the traffic volumes are expected to be occasional and insignificant.

7.8.1.3 Waste

The wastes will be transported to dispose in municipal land fill area.

7.8.2 Construction Phase

7.8.2.1 Construction debris and waste

Project construction activities will result in generation of considerable amount of solid wastes, including lumber, excess concrete, metal and glass scrap, and empty containers used for non- hazardous substances. Management of these wastes will be the responsibility of the Contractors. Typical management practices include recycling, proper temporary storage of waste and debris, and housekeeping of work areas. The wastes left after recycling will be transported to disposal in municipal land fill area. No part of this type of construction waste should be mixed with the domestic solid waste generated within the project site these solid wastes should be handled separately.

7.8.2.2 Solid waste

The solid wastes of domestic nature generated mainly in the labor sheds should be collected and stored separately (i.e., without mixing it with construction wastes/debris) in appropriate containers within the construction site. The solid wastes especially removal of garbage for foundation purpose (see section ---) should be disposed of away from the site (e.g., in a municipal landfill/waste dumping ground) outside the project site, at the responsibility of the Contractor. For assessing quantity of solid waste (of domestic nature) to be generated at the construction site. It should be noted that at present, solid waste generated within the project compound are collected in drum, where the solid waste from the surrounding residences is disposed of.

The current practice of open disposal of solid waste is not a sound and acceptable practice. If open dumping of solid waste is continued disease vectors may grow in number and spread diseases among the inhabitants within and outside the project compound.

Hazardous, Non-hazardous, Inert and municipal waste such as garbage, refuse, etc. produced during the construction stages shall be disposed in compliance with the local waste management regulations.

7.8.2.3 Liquid Waste

The human wastes at the construction labour should be appropriately disposed of through construction of sanitary latrines connected to appropriately designed septic tank system (consisting of septic tank and soakage pit). However, care should be taken in designing the septic tanks and soak pits as the groundwater table in the area remains close to the surface during wet season.

Wastewater generated from different construction activities is not likely to be significant in volume. Disposal of such wastewater may be carried out by draining them in shallow pits (1 to 1.5 m deep) dug in the ground at appropriate locations, and filling them up with sand at the end of the construction phase. In all cases, the wastewater streams should be separated from the storm water stream, which will be disposed of separately utilizing the existing storm water disposal system at the existing plant.

7.8.2.4 Traffic flow

Special care should be taken while transporting the equipment through existing public road. Where routes pass through sensitive sites it is recommended to install barriers to protect sites from noise and emission. Maintenance of engines and exhaust systems are recommended to minimize emission. In order to prevent noise and air pollution it is recommended to construct permanent hard surfaces in the roads connecting to the construction site. It is also recommended to inspect the roadway regularly.

Moreover, unpaved roads should be well compacted and maintained through sprinkling using binder and additives.

7.8.2.5 Air Quality

Vehicle movement to and from the site should be properly managed to ensure that is does not significantly aggravate the traffic problem and air pollution. Stone (aggregate) crushing activities should not be allowed within the plant construction site. Health status of school children should also be monitored regularly at the Health Center of the plant construction site.

Notwithstanding the potential of atmospheric emissions from construction and related activities the environmental impact of the project is low; the following mitigation measures will further reduce the impact of emissions, leading to insignificant impacts:

- Sprinkling of water on dust generating areas;
- Restricting the speed limits of vehicles during movement on unpaved roads; and
- Covering of vehicles carrying loose soil/construction material.

7.8.2.6 Noise Level

It should be noted that these noise sources are point sources and will be used for a short duration during the initial stages of the construction works. However, to a receptor (monastery and school) at a distance of 150 m to 200 m away from these sources the cumulative effects of the generated noise may cause annoyance.

The major noise generating sources during the construction phase are vehicular traffic, construction equipment like dozers, scrapers, concrete mixers, cranes, generators, compressors etc. All the machinery will comply with the relevant international noise protection standards. As far as necessary, times and conditions of operation will be fixed in detail in co-operation with the competent authorities.

Construction activities will be concentrated and done sequentially so that no area is prone to extensive duration of noise impacts. Construction activity will be undertaken only during daytime. There will be some noise generated from the movement of vehicles transporting the materials and equipment but the traffic volumes are expected to be occasional and insignificant.

The workers exposed to the noise produced by the construction equipment should not be exposed for a prolonged period to prevent permanent hearing loss. Because most of these equipment produce high level of noise at close range and exposure to high level of noise may for a prolonged period may cause permanent hearing loss. A rotational work plan is advised for the workers and operators of this equipment. In addition, general measures suggested in TABLE 9.2.7.4 for noise control (e.g., avoiding use of construction equipment producing significant noise during school hours and also at night) should also be followed.

7.8.2.7 Socio-economic Impact

Buffer zone between the school, monastery and construction site should be created to reduce disturbance to normal schooling and to protect school children from health hazard resulting from dust and noise pollution. Scheduling of project activities should be done in such a way that major noise producing activities are not carried out during school hours, especially during exam times. Traffic hazard during construction will increase and need to be carefully managed for the safety of school going children and many industrial laborers of the surrounding area. An alternate route should be used for bringing construction materials and existing public road should be widened.

7.8.3 Operation Phase

7.8.3.1 Overall Operation During Operation Phase

7.8.3.1.1 Overvoltage Protection and Earthing of Tharketa Substation Extension

In order to prevent the infraction to electrical equipment from lightning impulse, one set of zinc oxide surge arrester shall be furnished on each 66kV incoming lines.

In order to prevent the damage from direct lightning, lightning rod shall be installed in the newly-built bays.
The earthing grid of newly-built GIS bays will be copper mesh which will be connected with the existed earthing grid of Tharketa substation not less than 4 points. The cross section of the earthing material will be not less than the existed earth grid.

7.8.3.1.2 Secondary Wiring and Protection System Tharketa Substation

DC power for the Tharketa substation

One set of 230V DC system with 100Ah capacity will be furnished for the protection and control system of the extension Tharketa substation 66kV bays. DC system will be arranged in existed control room in Tharketa substation.

7.8.3.1.3 Supervisory Control System

The 66kV switchgear equipment shall be controlled by micro-based supervisory control system （include RTU function） which is settled in existing control room and engineering workstation is settled in existing engineer desk.

In order to exchange data with dispatching center, RTU data of power plant and Tharketa substation will be sent to MEPE through the supervisory control system. Communication channel is pending.

The configuration of electric energy metering system

The electric metering point will be set up at the side of 66kV lines. Each point should be configured with one digital type meter to measure directional metering information.

7.8.3.1.4 Line Protection

There will be 3 outgoing lines with voltage rate of 66kV. Each line should be configured with 1 set of optical fiber current differential protection of which each main protection contains backup protection function.

7.8.3.1.5 System Corrosion Protection

Because water of the Ngamoeyeik (Pazundaung) River is brackish water, materials for steel gates, brush screen cleaners, trash rakes, valves and other equipments of CW system maybe use 316L material and setting additional anode block locally according to water analysis results. Circulating water pipeline maybe use in the steel with cathodic protection measures and determined according to water analysis results also.

7.8.3.2 Socio-economic

Most of the socio-economic parameters will experience beneficial effects during the operation phase of the power plant project. Efforts should be made to enhance these beneficial impacts, which may include incentives for proper growth of industries in the area.

7.8.3.3 Noise

During the operational phase exceedingly high level of noise is expected to be generated within the confines of the turbine and generator installations. Prolonged exposure to such high level of noise may cause permanent hearing loss. Therefore, proper protective measures should be adopted during the operation and inspection of this equipment. Under no circumstances the operators should be allowed to enter these installations without proper protective gears such as ear muffs. Double-paneled glass doors and windows, along with sound absorbing soft padding on the walls of the turbine and generator room, should be provided for reducing noise exposure to the power plant personnel.

7.8.3.4 Air Quality

Some adverse impact during the operation phase of the plant will come from emission of NOx and particulate matter (PM) from the power plant. The combine cycle power plant uses natural gas or liquid fuel; therefore, it discharges few pollutants (generally no dust and little SO_2 and NOx) and can greatly reduce CO_2 emission if it uses natural gas.

According to analysis on components of fuel gas, there is almost no sulphur content and ash content in natural gas, and the main pollutant in smoke is NOx. The following facts support to mitigate the emission of NOx and others.

(1) Control of sulfur dioxide pollution

In this project, hydrogen sulfide content is relatively low ($2x10^{-5}$mol/mol) and the sulfur dioxide emission generated is in small amount. Therefore, gas desulphurization system may not be set.

(2) Control of smoke pollution

The project utilizes natural gas that flows into gas turbine after purification and does not generate smoke after combustion. Therefore, flue gas dust removal system may not be set.

(3) Control measure of NO_X pollution

The project adopts ultra-low carbon burner and DLE combustion technology, and NOx emission concentration does not exceed 15ppm while combusting natural gas. Therefore, de-NOx system may not be set.

(4) Chimney stack is adopted for emission of air pollutant

Pollutant emission by chimney stack is an important measure to reduce ground pollution; chimney for Project Phase I is temporarily determined as 40m in height and bypass chimney as 25m in height. Chimney for Project Phase II is temporarily determined as 30m in height and bypass chimney as 30m in height. In this way, pollutant concentration can be effectively diluted and expanded.

After adopting the above-mentioned control measures of air pollution, the emission of smoke pollutant in this Project can meet requirements of Emission Standard of Air Pollutants for Thermal Power Plants (GB13223-2011). The Project adopts clean natural gas for combustion, which does not generate ash.

Actual stack height for project phase I is 40 meters.

7.8.3.5 Water Quality Management

For water quality the discharge of water from river or ground water, water storage before pumping has to be equipped and filling into tank should be conducted during the high tide time of the day. For the wastewater, a temporary storage (sedimentation pond) before discharging into river is necessary, to reduce the temperature and to filter out the sediments.

The following Treatment of Domestic Sewage and Industrial Wastewater will be applied.

7.8.3.5.1 Industrial Wastewater Treatment

Drainage from chemical cleaning of set and steam turbine drainage are considered to be discharged to a wastewater pool that is sedimentation pond ($V=100m^3$) (set in Phase I) at plant area. After being pH-adjusted and then being coagulated, settled and filtrated in the sedimentation pond, the wastewater will be discharged into the sedimentation pond which are turned to reuse for cooling tower water. Cooling tower discharged water and strong brine of membrane treatment system do not have other pollutants but high salt content, which are considered to be discharged directly through the discharge pipeline (which was described in Chapter 3) after one month (once a month) or more than one month depending upon the water quality in the sedimentation pond.

System Function

This system can meet the requirement to treat the chemical back wash and cleaning wastewater of the membranes, boiler acid washing, etc. It can make them all reaching the discharge standards.

The designed capacity of the system is 30t/h.

The Main Process of the Wastewater Treatment System

The main process will be as follows:wastewater storage basin >> wastewater pump >> wastewater precipitation tank >> wastewater monitoring basin >> clarified water pump >> self-cleaning filter >> discharge to the reused water pond.

The process of the sludge discharge: sludge from the wastewater precipitation tank >> sludge dehydrator >> transported by truck.

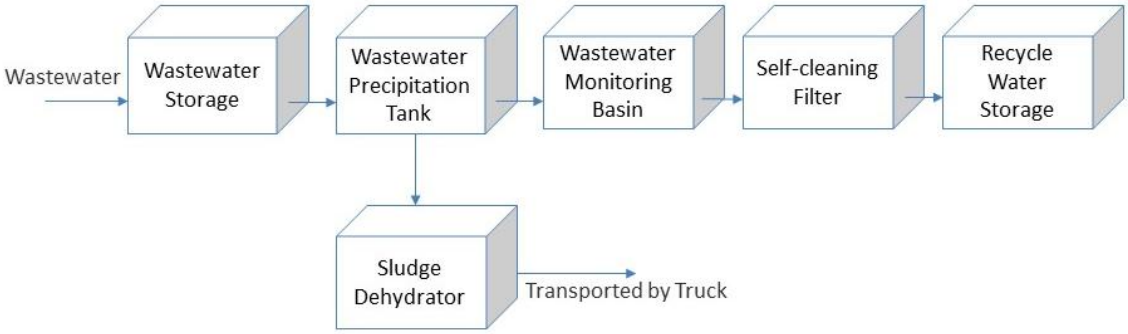


Figure 7.8-1: Main Process of Water Treatment System

Different kind of industry wastewater will be treated according to the characteristic of wastewater. For the water treatment system wastewater, it only needs neutralization. For boiler chemical cleaning wastewater, it will be discharged into unit drainage pit and then sent to the industry wastewater treatment plant by pumps. Through processing of neutralization, aeration, oxidation, condensation and clarification, the harmful substances will be removed and make the water reaching the discharge standards.

This process can ensure final waste drained to river is 3 °C lower than river water.

The Standard Level of Effluent Water

After being treated, the industrial wastewater will reach the following standard:

PH	6-9
Total suspended solids	≤50ppm
Turbidity	≤50NTU

Equipment Layout of the Industrial Wastewater Treatment System

The industrial wastewater system will be laid together with the water treatment plant, the wastewater precipitation tank, self-cleaning filter, discharge pump, clarified water pump, etc. are arranged in outdoor of the plant, Wastewater pumps and roots blowers are above the wastewater basin.

Volume of wastewater discharge

To ensure safe and stable operation of the CW system, circulating water needs to discharge a little regularly. The quantity of circulating water drainage is 117.9 m^3/h, which is discharged to Ngamoeyeik Creek where is near by the pontoon, and diameter of discharged pipe is DN250, steel reinforced HDPE pipe.

The chemical wastewater after treated will be lifted by the pumps and drain outside with CW drainage system.

7.8.3.5.2 Water Treatment Capacity

According to the above table， the normal demineralized water loss of the plant is 8t/h， the capacity of the water treatment equipment is 8t/h.

Potable & service water and Industrial water is 5t/h, according to the required water quality， Potable water comes from product water of primary RO.

The capacity of the water treatment equipment (EDI capacity) is 2×8t/h, Secondary RO Capacity is 2×9t/h, Primary RO Capacity is 2×16t/h, UF Capacity is 2×241t/h, dual media filter 2×30t/h.

Dual Media Filter are connecting in parallel, one running and one stand by.

Self-cleaning filters, UF units, primary RO units, secondary RO units and EDI units are connecting in series, and all of them are two trains 100% with one running or all running simultaneity.

2×150m^3 demineralized water tanks will be provided to satisfy the demineralized water demand in the condition of unit start-up, accident, boiler acid clean, flush and so on.

Operation Mode of The System

(1) DM water treatment system will be monitored and controlled by DCS.DCS operator station will be laid in CCR for monitoring and control of DM water treatment system. One local operator station/engineer station will be laid in water treatment workshop for testing and maintaining the control system.

(2) Operation conditions for dual media filter: value of pressure difference of the filter inlet and outlet or the water volume excess limit.

(3) Operation conditions for UF system: product water rate, recovery rate of system, differential pressure of system, turbidity of product water, SDI etc. are in prescribed limit.

(4) Operation conditions for RO system: product water rate, recovery rate of system, differential pressure of system, salt rejection ration of system, conductivity of product water, removal of silica rate etc. are in prescribed limit.

(5) Operation conditions for EDI: product water rate, recovery rate of system, differential pressure of system, salt rejection ration of system, conductivity of product water, SiO2 of product water etc. are in prescribed limit.

(6) Instrument configuration

Arrangement for Boiler Make-up Water Treatment Equipment

The boiler make-up water treatment plant and chemical laboratory form one building. The building consists of water treatment equipment room, chemical dosing room, water pump room, laboratory, control room, MCC room and so on. Water treatment equipment room is 32m (length)×10m (width)×6m (headroom), in which dual media filter, self-cleaning filters, UF unit, primary RO units, secondary RO units and EDI units are arranged. Against the plant is a penthouse, 32m(length)×6m(width)×4m(headroom), and the penthouse consists of chemical dosing room and water pump room. Neighboring water treatment plant is the chemical laboratory, 38.5m(length)×8m(width)×4m(headroom) and forming a “L” type building with the water treatment plant, which consists of the laboratory rooms for water and oil, control room and MCC room. Water tanks, compressed air tanks, acid & caustic storage tanks are outdoor.

The chemical water treatment system are shown in the Figure 7.8-2.

The main equipment and detailed procedure and chemical list are presented in the Appendix 6 and 7.

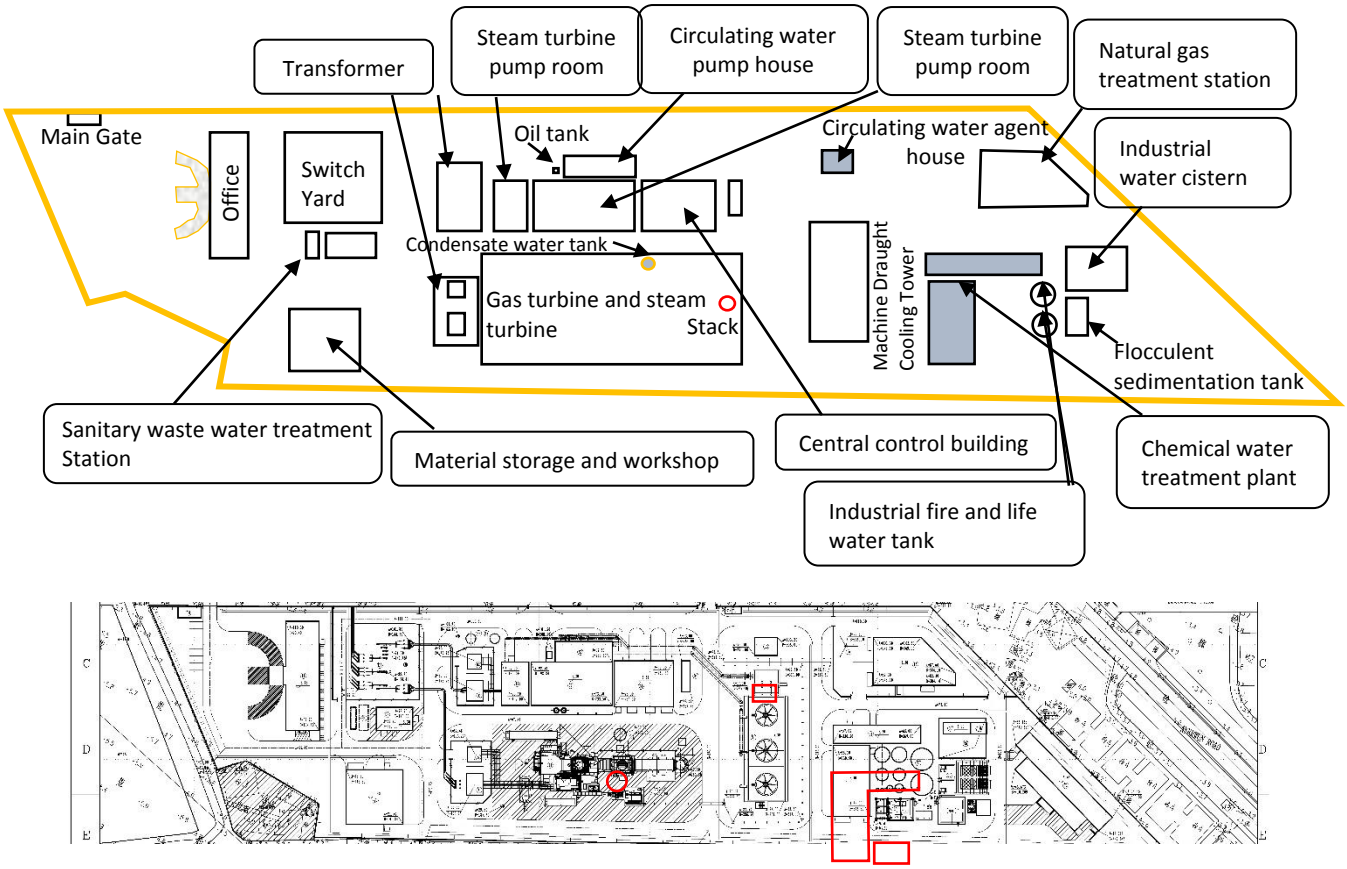


Figure 7.8-2 Chemical Water Treatment System

Chemical Storage Transportation and Wastewater Treatment

Acid and caustic will be transported by transfer vehicle and pumped to the acid and caustic storage tanks by acid and caustic unloading pumps. Acid is 31% Hydrochloric acid (HCl). Caustic is 40% Sodium Hydroxide (NaOH). There is one acid storage tank of 4m^3 and one caustic storage tank of 4m^3 outside the water treatment plant.

The chemical cleaning wastewater of UF system, RO system and EDI system will be discharged to wastewater pit of the neighboring industry wastewater pond for treatment. The backwash effluent from self-cleaning filters and UF units will be drained into the recycle water pond, and then pumped into raw water per-treatment system. The concentrated water from primary RO system will be discharged to concentrated water pond, and then pumped into circulating water drainage system.

Boiler cleaning wastewater will be transported to the wastewater storage basin, discharged or output by truck after been treated.

Compressed Air for the System

The oil-free compressed air from the compressor room in steam turbine hall will be used for the instruments, valves. 2×6m^3 compressed air storage tanks are arranged outside.

Circulating Water Treatment Dosing System

System Description

The total circulating water flow in summer is 9640m^3/h and concentration ratio of 2 is considered.

To control the breeding of micro-organisms and prevent scale formation in the circulating water system and to save water, chlorination (Sodium hypochlorite dosing) and scale inhibitor dosing treatments are designed for circulating cooling water system.

Scale Inhibitor Dosing Equipment

One set of scale inhibitor dosing equipment will be provided, including two (2) tanks and two (2) metering pumps.

Main equipment：

Solution Tank V＝0.5m^3 2 Set

Dosing Pump Q＝30L/h P=1.0MPa 2 Set

C.W Sodium Hypochlorite Dosing System

One set of Sodium Hypochlorite Dosing device will be provided for preventing the microorganism growth in the circulation cooling water.

Main equipment：

Solution Tank V＝4.5m^3 2 Set

Dosing Pump Q＝0-300L/h P=1.0MPa 2 Set

Unloading pump Q＝10m^3/h P=0.2MPa 2 Set

The chemical will be fed periodically at an interval of once of every 8 hours. During chemical injection, the chemical feeding will last for one ~ two hour at 1~3 ppm. The feed point is at circulating water channel.

Arrangement for Circulating Water Treatment Equipment

The equipment of C.W. treatment dosing system is arranged nearby the combination water pump house.

Chemical Dosing System and Water & Steam Sampling System

Condensate water and Closed Cycle Cooling Water Ammonia Dosing Treatment

One (1) ammonia dosing device is set for one (1) combined cycle unit, one (1) dosing device in total. Ammonia will be injected into common header outlet of the condensate water pump and Closed Cycle Cooling Water pump. Condensate water ammonia dosing adopts automatic control mode, and ammonia dosing pumps will be interlocked with signals sent by condensate water specific conductivity and feed water flow meter. Closed Cycle Cooling Water Ammonia dosing adopts manual control mode. Dosing equipment arranged in zero (0) lay of center control room.

Main equipment:

Solution Tanks V＝1.0m^3 2 Sets

Metering Pumps Q＝20L/h P=4MPa 2 Sets

Oxygen Scavenger Dosing System

One (1) Oxygen scavenger dosing device is set for one (1) combined cycle unit, one (1) dosing device in total. Oxygen scavenger will be injected into common header outlet of the condensate water pump. Condensate water

Oxygen scavenger dosing adopts automatic control mode, and Oxygen scavenger dosing pumps will be interlocked with signals sent by feed water flow meter. Dosing equipment arranged in zero (0) layer of Center control room.

Main equipment:

Solution Tanks V＝1.0m^3 2 Sets

Metering Pumps Q＝20L/h P=4MPa 2 Sets

Phosphate Dosing System

One (1) Phosphate dosing device is set for one (1) combined cycle unit， one (1) dosing device in total. Phosphate will be injected into the boiler high pressure drum directly.

Boiler drum phosphate dosing is manual control mode. Dosing equipment arranged in zero (0) layer of center control room.

Main equipment:

Dissolving tank V＝1.0m^3 2 Sets

HP Metering Pumps Q＝10L/h P=12MPa 2 Sets

Water & Steam Sampling System

Water & steam sampling system monitors the chemistry of water and steam in cycle, including feed water, condensate, boiler water, superheated steam and so on in order to control the chemical dosing to the water cycles to ensure correct water and steam quality.

One set of sampling equipment will be provided for one combined cycle unit， one set in total. The sampling equipment shall be arranged into two parts: instrument skid and sampling rack.

The cooling water will come from the closed circle cooling water system.

Sampling Locations and Analysers:

Item	Sample Points	Analyser	Remarks
Condensate	Condensate pump outlet	CC pH O_2 M	
	Condensate pump outlet （After dosing）	SC pH M	
Feed water	Economizer inlet	CC pH M	
Boiler water	HP drum boiler water	SC pH M	
	LP drum boiler water	CC pH O_2 M	
Steam	LP Superheated steam	CC M	
	HP Superheated steam	CC M	
Cooling water	Generator inner cooling water	SC pH M	
	Closed cycle cooling water for GT	SC pH M	
	Closed cycle cooling water for Steam turbine	SC pH M	

Note: CC—Cation Conductivity Meter; O_2—Dissolved Oxygen meter; pH—pH Meter; SC—Specific Conductivity Meter; M—Manual Sampling

The water & steam sampling signal will send to DCS.

The chemical dosing equipment and water & steam sampling equipment are arranged in zero (0) layer of center control room and electric control room.

7.8.3.5.3 Treated Water Volume and Water Quality of Domestic Sewage

Drainage system of domestic sewage mainly covers main powerhouse, central control building, auxiliary buildings, annexes and toilets. Domestic sewage is discharged to domestic sewage treatment plant through sanitary sewer.

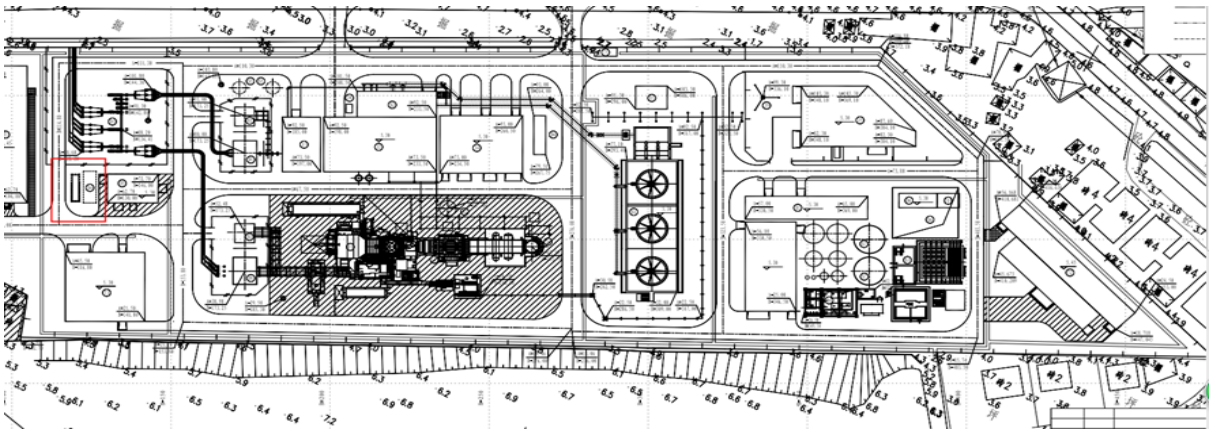


Figure 7.8-3 Location of Sanitary Wastewater Treatment System in Project Layout Plan

Domestic sewage treatment plant is set in Phase I. Domestic sewage treatment equipment consists of regulating reservoir, integrated domestic sewage treatment device and ventilator room. The integrated treatment device consists of anaerobic tank, aerobiotic contact oxidation tank, settling pond, disinfecting tank and sludge tank.

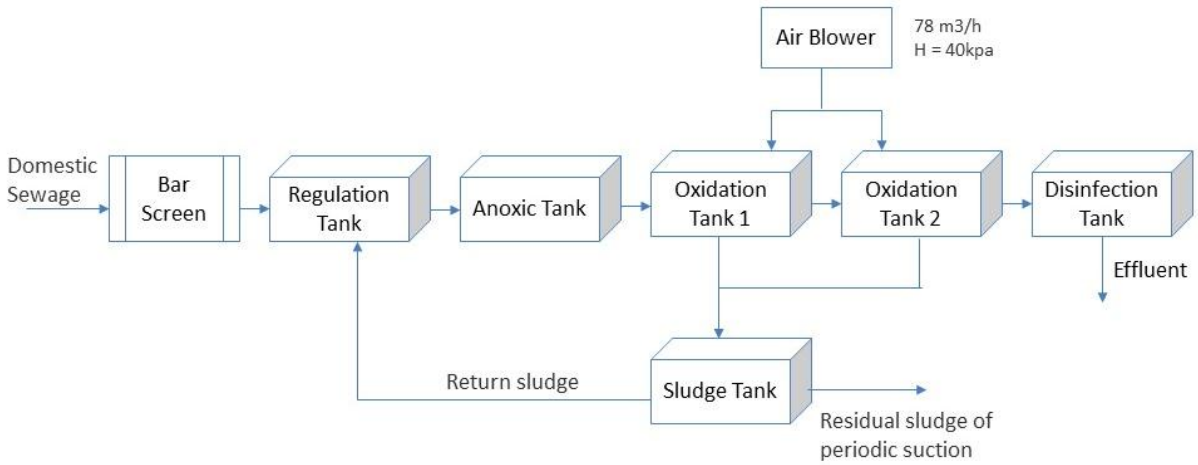


Figure 7.8-4 Sewage Water Treatment System Flow Diagram

Figure 7.8-5 Sanitary Wastewater Treatment System

7.8.3.5.4 Target Effluent Level

The final treated water before discharging out from the project will be in line with the following effluent level of NEQE Guideline.

Parameter	Unit	Guideline Value
Arsenic	mg/l	0.5
Cadmium	mg/l	0.1
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Iron	mg/l	1
Lead	mg/l	0.5
Mercury	mg/l	0.005
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Temperature increase	°C	<3[b]
Total residual chlorine	mg/l	0.2
Total suspended solids	mg/l	50
Total suspended solids	mg/l	1

[a] Standard unit

[b] Temperature increase due to discharge of once-through cooling water

Figure 7.8-6 Location of Effluent Discharge Point and Pipeline

7.8.3.6 Waste

Hazardous, Non-hazardous, Inert and municipal waste such as garbage, refuse, etc. produced during the operation stages shall be disposed in compliance with the local waste management regulations. All hazardous wastes shall be clearly labeled. Scrap, Trash other waste shall be placed in designated containers.

Regular clean-up of scrap material, saw dust, rags, oil, paint, grease, flammable solvents and other residue of operation shall not only remove or reduce the fire hazard, but shall promote general safety at the same time.

Investment Estimation in Environmental Protection of Combined Cycle Power Plant

Item	Cost (USD)
Chimney and flue	Counted in the cost of waste heat boiler
Low NOx combustion technology	included in the cost of gas turbine
Wastewater disposal	985,121
Noise reduction, sound insulation and silencer	322,991
Supplementing noise treatment measures recommended by environmental impact assessment	4,181,110
greening cost	161,495
Cost for instrument and equipment of continuous flue gas monitoring system	387,589
environmental monitor station equipment purchased cost	96897
Cost for environmental protection facility completion acceptance and monitoring	48448
Cost of environmental impact assessment	76,000
Total	6,259,651
Static investment of power generation project	459,054,100
Proportion to total investment (%)	1.36

7.8.3.7 Traffic Safety Rules

Traffic accidents have become one of the most significant causes of injuries and fatalities among members of the public worldwide. Traffic safety should be promoted by all project personnel during displacement to and from the workplace, and during operation of project equipment on private or public roads. Prevention and control of traffic related injuries and fatalities should include the adoption of safety measures that are protective of project workers and of road users, including those who are most vulnerable to road traffic accidents.

Road safety initiatives proportional to the scope and nature of project activities should include:

Adoption of best transport safety practices across all aspects of project operations with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public.

Measures should include:

- Emphasizing safety aspects among drivers
- Improving driving skills and requiring licensing of drivers
- Adopting limits for trip duration and arranging driver rosters to avoid overtiredness
- Avoiding dangerous routes and times of day to reduce the risk of accidents
- Use of speed control devices (governors) on trucks, and remote monitoring of driver actions

Regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.

Where the project may contribute to a significant increase in traffic along existing roads, or where road transport is a significant component of a project, recommended measures include:

- Minimizing pedestrian interaction with construction vehicles
- Collaboration with local communities and responsible authorities to improve signage, visibility and overall safety of roads, particularly along stretches located near schools or other locations where children may be present. Collaborating with local communities on education about traffic and pedestrian safety (e.g. school education campaigns)
- Coordination with emergency responders to ensure that appropriate first aid is provided in the event of accidents
- Using locally sourced materials, whenever possible, to minimize transport distances. Locating associated facilities such as worker camps close to project sites and arranging worker bus transport to minimizing external traffic Employing safe traffic control measures, including road signs and flag persons to warn of dangerous conditions

7.8.3.8 Noise Control Measures

The noise control measures of this project will be designed mainly from the following several aspects.

1） During the type selection of equipment, low noise equipment should be considered first in the similar equipment. Upon signing the equipment supply technology agreement, all the equipment manufacturers will be required to supply the low noise equipment. Noise reduction should be applied if necessary (such as sound-proof shield, muffler, and so on). The SPL (near field noise) of all equipment should meet the noise guarantees in the Table 7.4.5.

2） Gas turbine generating sets, steam turbine generating sets, air compressors, various water pump and other large equipment will adopt independent foundation, damping-optimization design.

3） In order to decrease air power noise, high noise sources such as the accidental release outlet and the air fan exhaust inlet should be installed high efficient muffler.

4） In order to reduce the noise, mechanical vibration and shock should be considered during the design of pipe arrangement and selection of support-hangers.

5） Duty rooms will be set up in the workshop with high noise sources in order to isolate workers. Sound insulation and absorption measures should be considered when necessary in order to protect workers.

6） The general layout drawing will be optimized. Centralized layout should be carefully considered as well as far away from noise sensitive area. Noise reduction will be achieved with full use of space. The average transmission loss of solid wall retaining structure should be more than 50 dB, and the average transmission loss of profiled steel sheet retaining structure should be more than 15 dB.

7） The work of the landscaping will be done according to the plant general layout, pipeline layout, local conditions, etc. Make full use of the noise reduction effect of plant, to reduce the influence of noise to the outside world on the whole.

8） A perimeter/security boundary wall in brick will be provided around the Power Plant. The brick wall will be 2.20m high.

7.9 Residual Impacts

7.9.1 Summary of Residual Impact on Construction Phase

Environmental Attributes	Impact	Proposed Mitigation	Residual Impact	Residual Impact Rating
Air quality	The important sources of emissions would include those from the operations of construction equipment and machineries, vehicles carrying construction materials.	Development of procedures for: ▪ Sprinkling of water on dust generating areas; ▪ Restricting the speed limits of vehicles during movement on unpaved roads; and ▪ Covering of vehicles carrying loose soil/construction material.	Dust propagation will be limited to construction area and will not influence local community. However, workers should be supplied with dust masks especially in dry days.	Low
Noise levels	Noise environment generated by general Site and Plant Construction, Water and Effluent Treatment Plant construction, and Access Road Construction.	▪ Use of noise suppressors and mufflers in heavy equipment ▪ Avoiding, as much as possible, construction equipment producing excessive noise during school hours and also at night ▪ Avoiding prolonged exposure to noise ▪ (produced by equipment) by workers ▪ Creating a buffer zone between the school, residential and construction site to reduce disturbance to elder people and to protect school children from health hazard	Until further details are known, it is not possible to predict whether there may be noise increases at nearby residential properties.	N/A
Wastewater	Wastewater, in the form of human wastes, will be generated mainly in the temporary labor sheds.	▪ Wastewater generated from offices, canteens, and worker accommodation is treated by septic sewage system. ▪ Temporary drainage system will be provided for collecting drain water from construction activity and rain to sediment pond and reuse inside construction area.	Disposal of such wastewater may be carried out by draining them in shallow pits (1 to 1.5 m deep) dug in the ground at appropriate locations and filling them up with sand at the end of the construction phase.	Low
Solid Waste	Construction debris and wastes	Hazardous, Non-hazardous, Inert and municipal waste such as garbage, refuse, etc. produced during the construction stages	Waste for disposal will be disposed of through the municipality (YCDC).	Low

		shall be disposed in compliance with the local waste management regulations.		
Ecological Impacts	Loss of vegetation on site clearance.	Implementation of proper restoration and rehabilitation master plan, the plant and it environment shall be acted as a green growth model.	There are no impacts on Ecology because the proposed power plant site will be built on the disposal site and the surrounding area is occupied by the residential area.	Low

7.9.2 Summary of Residual Impact on Operation Phase

Environmental Attributes	Impact	Proposed Mitigation	Residual Impact	Residual Impact Rating
Air quality	▪ Main risk is considered exposure to the workers and local residents with degradation of ambient air quality.	▪ The project adopts ultra-low carbon burner and DLE combustion technology.	▪ According to analysis on components of fuel gas, there is almost no sulphur content and ash content in natural gas, and the main pollutant in smoke is NOx.	Low
Noise levels	Prolonged exposure to high level of noise may cause significant damage to human hearing organ and may cause neurological damage.	▪ Double-paneled glass doors and windows, along with sound absorbing soft padding on the walls of the turbine and generator room, should be provided for reducing noise exposure to the power plant personnel.	The plant site will be constructed 200 meters far from nearest receptor. Therefore, no negative impact is expected in vicinity of the proposed Project.	Low
Surface Water and Hydrogeology	Operation of the Gas Power Plant would have impact on surface water and ground water principally because of taking water for cooling system in Gas Turbine.	▪ Domestic sewage treatment plant is set in Phase I and Phase II respectively. Domestic sewage treatment equipment consists of regulating reservoir, integrated domestic sewage treatment device and ventilator room. The integrated treatment device consists of anaerobic tank, aerobiotic contact oxidation tank, settling pond, disinfecting tank and sludge tank. The treatment capacity is 3m3/h in Phase I and 5m3/h in Phase II.	After being pH-adjusted and then being coagulated, settled and filtrated by integrated wastewater treatment plant, the wastewater will be discharged.	Low

Solid Waste (process, utility, procurement)	▪ Potential contamination for surface water, groundwater resources and soils. ▪ Negative impacts on ecosystem functioning and also on human health.	▪ Establishment of waste management disposal/recycling techniques. ▪ Hazardous waste disposal techniques to be established.	▪ Increase in recycling/reuse of waste generated. ▪ Waste management will be covered by internal procedures and will be regulated through local regulations.	Low
Ecology	Impacts on river ecology	▪ Appropriate fish-protection systems (i.e., mesh screen, acoustic screen, intense modulated light, bubble curtain and etc.) should be included in the proposed design. ▪ Chemical constituent in wastewater is necessary to be identified. Wastewater has to be treated in a proper treatment system and effluent water quality is required to be monitored.	Domestic sewage reaches discharge standard and the treated water is used as greening water of the plant area.	Low

7.9.3 Summary of Residual Impact on Closure (Decommissioning Phase)

Environmental Attributes	Impact	Proposed Mitigation	Residual Impact	Residual Impact Rating
Air quality	Dust emissions during ground works.	▪ Water spraying roads. ▪ Sheeting vehicles carrying dusty materials. ▪ Speed limits on unmade surfaces. ▪ Dust emission monitoring in selected points.	Dust propagation will be limited to demolition area and will not influence local community. However, workers should be supplied with dust masks especially in dry days.	Low
Noise	Noise from decommissioning of plant.	▪ Good site management; Good choice of machinery; ▪ Methods of working, including sequential blasting; ▪ Hours of working; ▪ Efficient material handling.	Until further details are known, it is not possible to predict whether there may be noise increases at nearby residential properties.	N/A

Water quality	Discharge of silty and contaminated storm water to surface water.	▪ Potentially polluting materials will be stored in dedicated storage areas. ▪ Machines and equipment will be sited on hard surfaces. ▪ All storm water will go via sedimentation ponds and oil separation. ▪ Procedures for finding contaminated material during excavations will be established. ▪ Covering and damping of excavated materials. ▪ Appropriate storage of contaminated material if found.	Ground contamination and storm water contamination will be limited on site by proper handling and storage of materials and equipment. Storm water will be treated in sedimentation ponds, the impacts on overall quality of discharge wastewater will be low.	Low
Solid Waste	Solid waste generation	Segregation and recycling of waste and proper storage in isolation from the ground.	Solid waste will be managed by local waste contractors and disposed according to their permits and in compliance with local regulations.	Low

CHAPTER VIII

ANALYSIS OF ALTERNATIVES

8.1 Introduction

This Section provides an assessment of alternative site and technology options for the proposed 106 MW combined cycle power plant, which is an integral part of environmental impact assessment. For completeness, the scenario under “no project” situation has also been discussed in this Chapter.

8.2 Project Location

The plant site is located in Thaketa Township in eastern part of Yangon City, with about 8.5km straight-line distance from Ngamoyeik River in the north and about 1.1km straight-line distance from Thanlyin River in the south. The northern side of the plant site is close to the highway of Yangon City, and it is separated by a road from the existing natural gas power plant. The southern side of the plant site is adjacent to the railway, south to which locates a residential area. The eastern and western sides of the plant site are distributed with dense residential areas.

The plant site consists of many refuse landfills, some farmland and wasteland, a few trees and crops and a few ponds in some areas. There are about 6 households on the plant site, mainly residing in the eastern and western parts. There are power transmission lines passing through the southwestern part of the plant site.

Figure 8.2-1 Current Land and Environmental Condition of the Project Site (Phase I)

Figure 8.2-2 Current Land and Environmental Condition of the Project Site (Phase II)

The original elevation of the plant site is within 1.30m~8.30m, that of garbage storage area generally within 5.00m~8.30m, that of pond area generally within 1.30m~2.50m and that of other areas on the plant site generally within 3.00m~4.20m.

Located in Yangon City, the plant site is close to the trunk roads, with land routes and water ways extending in all directions. The plant site is about 5km (highway distance) away from the nearest wharf and about 30km (highway distance) away from Yangon International Airport. The transportation here is very convenient.

Figure 8.2-3 Location of Proposed Power Plant Site

One plan shall be adopted for the project which is divided into two phases. Project Phase I shall be planned and arranged in the place which is not a garbage yard as much as possible and be away from residential areas and water

pool. Project Phase II will occupy a relatively large area, and most of the existing garbage yards will be used. The garbage in the planned plant site shall be cleaned out completely.

According to the status quo of plant site and the surrounding situation, the electrical outlet can be directly connected to the booster station of Thaketa Power Plant on the north side of the planned plant. The incoming road shall be connected from the adjacent municipal road. The outlet and transport conditions are good.

The natural gas needed for the power plant shall be connected form the nearby natural gas station. The route of the natural gas pipe shall be the same with the gas supply pipe of Thaketa Power Plant, and the natural gas pipe can be laid based on the corridor of the original pipe.

Water supply of the plant area shall be carried out temporarily according to the municipal water supply system. Chemical water treatment system and circulating cooling water treatment system shall be set in the plant area.

The alternative site study has not yet been conducted however the positive effect of the proposed power project site location is as follows.

8.3 Technology Options

Gas turbine power plants are self-contained, light weight and they do not require bulk water.

They can be quickly installed at a lower cost than other types of power plants. Gas turbine units are high speed, low vibration quick start machines suitable for peaking power plants. These units require less space, have lower installation and maintenance cost and have simple lubrication and ignition system. Specific fuel consumption does not increase with time in gas turbine plants as rapidly as other IC engine-based power plants. Also, poor quality of fuel can be readily used in gas turbines. Their disadvantages are poor part load efficiency, special metal requirements, special cooling methods and short life. Gas turbine power plants are the most suitable plants that can be installed at selected load centers with fewer auxiliaries. Gas turbines can be brought on load quickly and surely.

8.4 Layout Options

Overall Plan of the Plant Site:

The proposed power plant is planned as 118MW (ISO condition) in capacity, an "one on one" combined cycle arrangement of one set of grade 6FA gas turbine generator units plus a steam turbine generator unit is proposed for this project, with full capacity of 108.9MW under the local environmental climatic conditions and the actual output of 95.6MW with the condition of 18mmCFD gas supply.

Overall Plan：

1）Two entrance roads will be built to connect from Ayeyarwin Road outside the north wall of the power plant.

2）Three 66kV circuit outgoing line will be joined into Thaketa power plant substation which is located in the northwest of this project by cable trench.

3）There is a gas pipeline has been installed from Yangon natural gas supply station (Zawtika) to the vicinity of plant site in this project, it can be joined up directly.

4）The water supply system is considered to build intake pump house at the riverside of Ngamoeyeik creek to feed the plant. Secondary circulation cooling system will be adopted in the plant.

General Layout of Plant Area

Principles and Conditions of General Layout of Plant Area

General layout plan must be designed in the boundary wall which was supplied by owner. The land should be saved as much as possible. On the premise of safety and reliability, technological process shall be smooth and fast; function division shall be clear and reasonable; layout shall be compacted; land area and number of auxiliary buildings and

outbuildings shall be reasonably reduced; general layout shall be optimized, buildings and facilities with same or similar functions shall be minimized and merged; land for plant use shall be reduced, and achieve the optimal effects in the aspect of application and perception.

The plan shall be worked out according to the layout requirements of technologies and site conditions.

8.4.1 General Layout Plan of Plant Area (plan I)

The site appears narrow and long shape from northwest to southeast. The length is 450m and width is 110m. The total area in the boundary walls is 3.797ha.

The main functions area contains front area of the plant, the main factory area, auxiliary production facilities area. The front area of the plant includes comprehensive office building, the Gatehouse and parking lots. Auxiliary production facilities area contains some raw water treatment facilities, chemical water workshop, mechanical draft cooling tower, material storage & Complex maintenance house, and gas boost station. The main factory area includes turbine house, gas turbine unit, HRSG, main transformer and 66kV outdoor power distribution unit area.

The front area of the plant is located in the west in order to connect with the Ayeyarwin road. 66kV outdoor power distribution, network control room and Sewage treatment system are laid close to the south and east of the front area. The main factory area is concentrated laid in the eastern part of power distribution. The turbine house, gas turbine unit and HRSG are arranged parallel in the main factory. Material storage & Complex maintenance house and gas boost station are laid in the south of the main factory area. In the east of the main factory area, the raw water treatment facilities, chemical water workshop, mechanical draft cooling tower are arranging concentrated and parallel.

The details are shown in the F2921k-A01-05 General & vertical layout (plan one)

8.4.2 General Layout Plan of Plant Area (plan II)

There are two existing buildings for living at the southwest corner of the plant area. In order to reduce the demolition works and prove more construction area, the secondary plan has been designed to reserve the area which contains the two existing buildings.

The main functions area contains front area of the plant, the main factory area, auxiliary production facilities area. The front area of the plant includes comprehensive office building, the Gatehouse and parking lots. Auxiliary production facilities area contains some raw water treatment facilities, chemical water workshop, mechanical draft cooling tower, material storage & Complex maintenance house, and gas boost station. The main factory area includes turbine house, gas turbine unit, HRSG, main transformer and 66kV outdoor power distribution unit area.

The front area of the plant is same as in Plan I. Material storage & complex maintenance house is located on the south of the front area. The raw water treatment facilities, chemical water workshop and mechanical draft cooling tower are also same as the plan I. The main factory area is concentrated laid on the eastern part of auxiliary production facilities area. The main transformer and 66kV outdoor power distribution unit area is arranged in the north of the main factory area in order to connect to the THAKETA substation which is located to the north of this plant. The gas boost station is laid in the east of the plant.

8.4.3 Conclusion on General Layout Plan

The plan one is more compact, and the pipelines is shorter and smoother. The construction area is more concentrated. The function division is more clearly in plan two and the construction area is bigger. However, the pipelines are not short and reciprocal cross. The repair site of the gas turbine has been limited. So, the recommended order is from plan one to plan two.

8.5 Alternative CCGT Technologies

8.5.1 Principles for Model Selection of Unit

According to the characteristics of fuel proposed to be adopted in this project, from the aspects of electric load

development and characteristics, power source structure, and power generation configuration of Yangon power grid of Myanmar, the installed unit shall be on one hand with a base load and a safe and full generating capacity; on the other hand, the unit shall also be able to startup and shutdown quickly, with relatively strong peak regulation and load varying performance, and be able to take the task of peak regulation.

Accordingly, the principles for model selection of unit for this project are proposed as follows:

(1) A gas-steam combined cycle unit shall be adopted: With the same gas consumption, the generating capacity shall be increased. It's advantage of large capacity and high efficiency can be fully played with a base load; the unit shall also have relatively good peak regulation performance and be able to bear peak regulation load in compliance with the requirements of power grid and the market.

(2) Condensing unit shall be adopted for steam turbine.

(3) The equipment shall be of advanced performance, high reliability, and high availability ratio.

(4) Power shall meet the system requirements, with a large net power of generation, low net heat consumption and high efficiency.

(5) It shall be adaptable to load.

(6) The equipment shall be at reasonable prices.

(7) The equipment shall be of convenient overhaul, operation and commissioning.

(8) Equipment suppliers shall have good actual performance for supply of similar units, high reputation, and good after-sale service.

8.5.2 Unit Selection

From the aspects of power source structure, total installed capacity of power, electric load characteristics, and power generation configuration of Yangon power grid of Myanmar, the construction capacity shall be appropriate to be around 110MW.In accordance with the above principles for unit selection, 110MW combined cycle unit is recommended for installed capacity of the project.

The manufacturers now in the world that design and manufacture gas turbines are mainly GE Company in the US, Siemens Company in Germany, Rolls-Royce Company in the UK. We can take the following scheme s about 110MW combined cycle unit after consulting the information:

(1)Two sets of Siemens's SGT-750 gas turbines "1+1" combined cycle unit, the ISO output is 95.4MW (2×47.7 MW), the net efficiency is 51.7% and the gas consumption is 17.85mmCFD. When only 18mmCFD gas is supplied the output is 90.2MW in the annual average meteorological conditions at site.

(2)Two sets of GE's LM6000PF gas turbines "1+1" combined cycle unit, the ISO output is 111.6MW (2×55.8 MW), the net efficiency is 54.1% and the gas consumption is 19.87mmCFD. When only 18mmCFD gas is supplied the output is 95.4MW in the annual average meteorological conditions at site.

(3) One set of GE' s LM6000PC gas turbines "2+1" combined cycle unit, the ISO output is 109.9MW,the net efficiency is 53.0% and the gas consumption is 20.18mmCFD. When only 18mmCFD gas is supplied the output is 92.6MW in the annual average meteorological conditions at site.

(4) One set of Siemens's AE64.3A gas turbine "1+1" combined cycle unit, the ISO output is 112.0MW, the net efficiency is 53.7% and the gas consumption is 20.15mmCFD. When only 18mmCFD gas is supplied the output is 94.5MW in the annual average meteorological conditions at site.

(5) One set of GE' s PG6111FA gas turbine "1+1" combined cycle unit, the ISO output is 118.4MW, the net efficiency is 55.0% and the gas consumption is 21.0mmCFD. When only 18mmCFD gas is supplied the output is 96.6MW in the annual average meteorological conditions at site.

(6) One set of GE' s PG6581B gas turbines "2+1" combined cycle unit, the ISO output is 130.9MW, the net efficiency is 50.9% and the gas consumption is 25.33mmCFD. When only 18mmCFD gas is supplied the output is 88.0MW in the annual average meteorological conditions at site.

Through Analysis the following main points will be known that:

The gas is overmuch in the scheme (1), it will be failed to make full use of gas, two sets of "1+1" units cover a relatively large area, and the main power building has a large length, the number of units is large and the installation period is long, the number of operating equipment is large and it is difficult for operation, maintenance and overhaul, what's more, it's high cost;

The output is relatively high in the scheme (2), and two sets of "1+1" units cover a relatively large area, the main power building has a large length, the number of units is large and the installation period is long, the number of operating equipment is large and it is difficult for operation, maintenance and overhaul, what's more, it's high cost;

The output is relatively medium when 18mmCFD gas is supplied in the scheme (3), and the number of equipment is large and the installation period is long, the number of operating equipment is large and it is difficult for operation, maintenance and overhaul, what's more, it's high cost;

The output is relatively high when 18mmCFD gas is supplied in the scheme (4), and the number of equipment is small;

The output is relatively high when 18mmCFD gas is supplied in the scheme (5), and the number of equipment is small;

The output is relatively low when 18mmCFD gas is supplied in the scheme (6), and the number of equipment is large and the installation period is long, the number of operating equipment is large and it is difficult for operation, maintenance and overhaul, what's more, it's high cost.

In summary, the scheme (3), (4), (5) is relatively better, so we remove the other schemes, and we get the following conclusions through comparing calculation:

Table 8.5-1: Comparison table of performance parameters of scheme (3), (4), (5)

Scheme	Type	GT Output (MW)	CC Output (MW)	SC Heat Rate (kJ/kWh)	Gas Consumption (mm CFD)	Net Eff (%)
（3）	LM6000PC	36.2	92.6	8778.9	18.0	48.05
(4)	V64.3A	63.3	94.5	10606	18.0	49.02
(5)	PG6111FA	62.6	96.6	10724	18.0	49.55

Through the above comparison, we can know that the output and net efficiency of scheme (5) are the highest when 18mmCFD gas is supplied, and the output and net efficiency of PG6111FA unit are bigger in full load condition, what's more, the operation experience is more in the world. Therefore, PG6111FA gas turbine "1+1" combined cycle unit is recommended in the project.

8.5.3 Model Selection for Supporting the HRSG and Steam Turbine

The HRSG is one of key equipment of the combined-cycle generator. It uses the heat generated by exhaust of gas turbine to produce steam that is provided for the steam turbine. Classified by vapor-water circuit, the HRSG can be single pressure non-reheat type, dual pressure non-reheat type and dual pressure reheat type. The single pressure

non-reheat type and dual pressure non-reheat type are often applied to the medial and small combined-cycle unit. Because this kind of boilers have little gas and water circuits and simple structure, their cost of manufacture is relatively low. However, the single pressure non-reheat type can use little exhaust heat; their efficiency is low as well. Due to additional steam circuit, the dual pressure and triple pressure reheat type HRSG can use more exhaust heat so that enthalpy value of steam is enhanced and thermal efficiency of boilers & the whole plant is further enhanced. Due to additional medium-pressure steam circuit, efficiency of the dual pressure and triple pressure reheat type HRSG is higher, but the corresponding investment is higher as well. The dual pressure and triple pressure reheat type HRSG is the advanced type used by current combined-cycle unit, which is often applied to gas and steam combined-cycle unit with large capacity and high parameter. In consideration of load characteristics and low unit capacity of this project, dual-pressure non-reheat type HRSG is recommended.

Classified by cycle pattern of gas and water of the HRSG, it has two cycle types, including natural circulation and forced circulation. The forced circulation is often applied to the vertical HRSG and the natural circulation is often applied to the horizontal HRSG. Both of two types of the HRSG have their own advantages. The horizontal natural circulation HRSG has advantages of easy operation, strong self-adaption balance capacity for exhaust fluctuation, high available rate and homogeneous scale formation for vertical pipe bundle; however, its structure is less compact than the vertical boiler and it occupies more space. The vertical forced circulation HRSG has advantages of high rate of heat exchange, compact structure, small occupied area and fast start-up; however, it needs additional boiler water recycle pump that often restricts the available rate of the vertical forced circulation HRSG. According to current generator unit configuration of the Grade F gas turbine, the typical configuration is horizontal HRSG. Hence, the horizontal HRSG shall be considered in this stage.

According to pressure grades of the HRSG, the supporting steam turbine has three types, including single pressure, dual pressure and triple pressure. And the corresponding structures are single cylinder, dual cylinders, triple cylinders and dual pressure combined cylinder. Dual-pressure single-cylinder condensing steam turbine is adopted in this project.

Unit Selection for Phase II

Different natural gas turbine has a different demand about inlet pressure, in this project the natural gas is from the YWA MA MAIN CONTROL. STN Control Center, the gas pipeline is installed to 1 m outside the plant by the Myanmar Ministry of Electric Power, the gas pressure at the interface is 1.5MPa, but range from 2.46 MPa to 2.81MPa is required by the gas turbine, so it has to set natural gas compressor before natural gas turbine inlet to adjust natural gas pressure.

Currently natural gas compressor is mainly separate by three types: first is centrifugal compressor 、 second is screw compressor、 third is reciprocating compressor. Above types advantages and disadvantages as below:

	Centrifugal type	**Screw type**	**Reciprocating type**
Advantage	**1**.compact and small size(much small than reciprocating type with same flow) **2**.high operational reliability **3**.large flow **4**.small media pulsation **5**.media don't contact with lubricating system oil	**1**.compression stationary process, the smallest media pulsation **2**.small leaks 3.low noise **4**.high efficiency **5**.simple structure, small size	**1**.high pressure scope (up to 20MPa) **2**.maximum efficiency **3**.traffic applicability, a wide range of changes **4**.cheap single price, less total investment

Disadvantage	**1**.not suit for small flow rate and high pressure situation **2**.efficiency is below than reciprocating type with same parameters **3**.regional narrow stable condition	1.low pressure, maximum pressure only can reach 5.0 MPa	**1**.big dimensions and large weight, complex structure **2**.many easily damaged parts **3**.media pulsation, operate with vibration

According above contrast, it can be considered three type compressors all suit for this project. According the information supply by compressor manufacturer, and combining the actural condition of the gas pressure and flow, as centrifugal compressor satisfy with pressure and flow, it is high reliability; screw compressor lack of operating experience in China, exist high risk; as reciprocating compressor suit for pressure and flow demand, it is less reliability and high cost of maintenance, so on this project it is recommend to use centrifugal compressor.

8.6 Plant Cooling Options

General introduction of two types of cooling systems.

Cooling geothermal power plants is necessary in order to condense the vapour feeding the turbine, lower the heat rejection temperature, raise power output and increase heat to power conversion efficiency. Three main cooling options are used: a) surface water (once-through systems), b) wet type cooling towers, and c) dry type cooling towers. Cooling with surface water yields the lowest condensing pressure and temperature and the highest conversion efficiency, followed by wet cooling towers, and then by dry cooling towers. Regarding the need for cold water supply, the order is reversed. Typical values are 970 t/h, 30 t/h and zero t/h respectively per MWe of installed power. In terms of costs, once through cooling may require both high capital costs and electricity consumption for transporting water. Dry cooling is the most expensive option due to the much higher heat capacity and heat transfer coefficient of water compared with ambient air. A dry cooling tower for a binary power plant of high conversion efficiency may cost 10 times more than its wet counterpart, which may result in raising overall power plant costs by 50%. In flash plants, where there is plenty of steam condensate to use as make up water, the standard technology adopted almost exclusively is cost effective direct contact condensers coupled with wet cooling towers. In binary plants, where the more expensive shelland-tube or plate heat exchangers are used as surface condensers, the selection of the cooling system type is governed by water availability, local water use regulations and economics.

Based on the analysis U Energy divide geothermal power plants into the following main types:

Back pressure flash plants where the steam is discharged from the turbine at 1 bar(a) pressure or 100°C.

Condensing flash plants which use a condenser in order to condense the steam at the turbine discharge at lower pressure and temperature.

Binary plants, which use the geothermal hot water or steam to boil a closed loop of a secondary working fluid, which drives a turbine and is condensed at the turbine discharge, and then is conveyed by a pump to the geothermal source and follows the same cycle again and again.

Present technology for cooling the power plant condensers may use either or both water or air and includes:

Cooling with surface water in once through systems

Cooling with water evaporation in air draft by wet type cooling towers

Cooling with air by dry type cooling towers

94% of the total generated power globally is derived by steam flash plants, the majority of which use condensing turbines, which in practice yield twice as much power output than the atmospheric exhaust ones. Due to the thermodynamics involved, all geothermal binary plants, which correspond to 6% of global geothermal power output,

use working fluid condensing turbines.

In nature, available cooling fluids are either water (from sea, lakes, rivers, or subsurface) or air. In terms of heat transfer, water has more favorable properties than air. Water has over 4 times higher specific heat than ambient air. Water is 830 times denser than air. Water has volumetric heat capacity approximately 3450 times the one of ambient air. This implies that in order to have the same heat transfer effect, 3450 more volume of air has to be moved than in the case of water, resulting in the need for bulky and expensive equipment for air-handling, plus higher electricity consumption for the air fans than the water pumps.

In condensers water yields typical heat transfer coefficient 58 times higher than the one of air. This implies that the surface of the condenser and the corresponding costs will be accordingly higher if air is used as cooling fluid rather than water.

The heat exchange surface has a direct impact on the weight and size of the condenser, which are the most important economic variables defining the corresponding costs.

In this category the cooling fluid is water, which is transported to the power plant through pipes from a river, a lake or the sea. The temperature of the cooling water in this case varies in proportion to season's temperature. It can be 5°C -25°C. This is why surface water yields the lowest condensing pressure and temperature in compare to the other two types. A typical value of water supply is 970 t per h and per MWe of installed power for approximately 10°C temperature gain of the cooling water across the condenser. As far as it concerns the plant's cost, electricity consumption for transporting water (pipes, pumps etc.) may not be at all negligible, depending on the location and distance of the water source.

In cases where sea, lakes or rivers are located close to the power plant, and in cases where local regulations for water use allow it, cooling with surface water should be considered as one of the available options. Its main advantage is that it can yield the lowest possible condensing temperature, and hence the maximum conversion efficiency as:

Surface waters tend to have lower temperature than ambient air during the summer period; for example in South Europe sea water has temperature of ~25°C during the summer, while ambient temperatures around 35°C are common.

In most European countries surface waters do not froze when ambient temperature drops below 0°C.

No cooling towers of either wet or dry type are necessary.

The heat delivered to the cooling water can be utilized for downstream heating applications, resulting in a geothermal heat and power cogeneration plant and further increasing overall energy efficiency.

Main drawbacks include:

Need for large water quantity.

Fooling or corrosion in the condenser in cases of adverse chemistry, or organisms present in the cooling water.

High capital costs for piping and pumping stations or electricity consumption in case the water has to be transported from large distances.

8.6.1 Wet Type Cooling Towers

The cooling water that is used in the condenser is conveyed to the cooling tower in order to reduce its temperature so that it will be recycled and looped through the system. An important reduction of its temperature is accomplished in the tower. In small or medium size plants, such as geothermal power plants, cooling towers usually use mechanical ventilation (fan) for the advection of the air stream. In these plants cooling towers that are mostly used are cross-flow and traverse-flow. The typical temperature difference between the inlet and outlet cooling water is 10°C. As far as it concerns the temperature of the cooling water that comes out of the cooling tower, it reaches at least 25°C, resulting

in condensing temperatures around 40°C, depending on the ambient temperature.

Wet cooling towers combine the use of water as a cooling media to the condenser and benefit from its favourable heat capacity and heat transfer properties compared with air, while they do not need the large volumes of surface water needed in once through cooling systems. Instead, they evaporate water at a cooling tower, and need a much smaller quantity of makeup water to compensate the evaporation losses plus the water blowdown necessary to maintain water quality. Typical needs for makeup water of a geothermal binary plant have been estimated as 30 t/h per MWe of installed power capacity.

In geothermal flash plants, there are usually enough water quantities available for the makeup water of the cooling towers, as the much less make up water needed per MWe of delivered power, corresponds to a fraction only of the available steam condensate. There, wet cooling towers are usually coupled with direct contact condensers, where the cooling water is sprayed and mixed with the steam condensate, and which are simpler in design and much more cost effective than surface condensers used in binary plants. For this reason, direct contact condensers and wet type cooling towers are the standard technology in geothermal flash plants. Exceptions are encountered in cases where large quantities of surface water are available locally, and in extremely cold climates in order to avoid frosting water droplets precipitating in the plant neighborhood.

8.6.2 Dry Type Cooling Towers

In dry type cooling towers, the temperature of the air that comes out of the tower in order to cool the fluid in the condenser is higher than 25°C. Typical values are 2530°C resulting in condensing temperatures around 40-50°C. In a dry type cooling tower no water supply is necessary. Regarding auxiliary power consumption, they usually consume twice as much electricity than wet cooling towers.

Due to the need for many times higher heat exchange surface and the large volume of air that has to be moved through them, dry type cooling towers are the most expensive option. A dry type cooling tower costs 5-10 times as much as a wet type one depending on the condensing temperature of the turbine. If low condensing temperatures are considered, an air source geothermal binary plant may have 50% higher capital costs than one with a wet type cooling tower of the same efficiency. In practice, air source geothermal binary plants are designed with considerably less conversion efficiency and costs 10-20% higher.

However, in cases of lack of water, strict local water use regulations, extremely low ambient temperatures during winter which cause water droplets from wet type cooling towers to freeze onto nearby vegetation, dry type cooling towers may be the only available option.

8.6.3 Conclusion on Cooling Towers

Cooling geothermal power plants is necessary in order to improve conversion efficiency. Water cooling leads to higher conversion efficiencies and lower plant capital and operation costs than air cooling, as has been proved by analyzing heat transfer properties of water and air, as well as by optimizing the corresponding Rankine cycle. So Union Resources & Engineering Company Limited (UREC) proposed to use water cooling system for the Thaketa Plant.

8.7 Water Supply and Cooling Facilities

The project site is located in downtown Yangon, Thaketa Township 10 km east of north about 0.8 km away from the NGAMOYELK River. Possible use for this project of water supply has three, respectively is in downtown Rangoon municipal tap water, the power plant surrounding groundwater and NGAMOYELK river water.

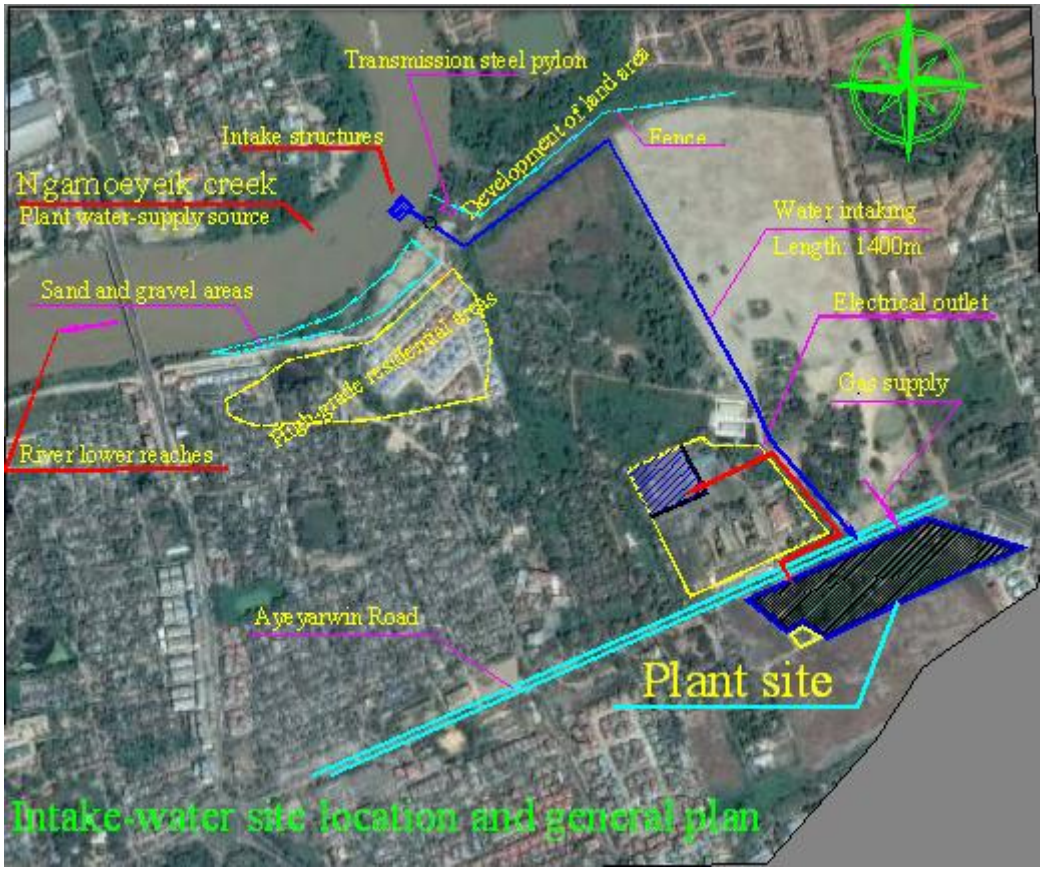


Figure 8.7-1 General Layout Plan for Water Supply System

The project site north is an old gas turbine power plant, the old power plant capacity of 50MW. Due to insufficient Rangoon municipal water supply, the power plant combustion system of industrial water uses municipal water, turbine parts of the industrial water use of ground water. Groundwater sources to Rangoon municipal corporation for the power plant construction of 6 Wells, deep Wells of well depth of about 400-500 feet, stand-up well 1 h water yield of about 5000 gallons (22.7 m^3).

Ngamoyeik River (tidal river), the river downstream and Rangoon are interlinked, this project proposes to adopt for NGAMOYELK River as water supply source for the plant.

8.7.1 The Ngamoyeik River Characteristics

NGAMOYEIK water level influenced by tides (high tide, low tide each once a day) greatly influenced obviously salt water intrusion phenomenon at high tide, the water flow from downstream to upstream, at low tide, the river flow downstream Yangon River, and then to exit. Through site visits, width of the River at high tide around 120m wide 80m River at low tide, high tide and low tide the water level about 7m, dredges the river passage, steep on one side near the power plant riverbed.

Table 8.7-1 Ngamoyelk River Water Quality Data

NAME	UNIT	Q'TY	NAME	UNIT	Q'TY
Na+	mg/L	779	Cl-	mg/L	1277．26
Ca2+	mg/L	50.7	HCO_3	mg/L	139.12

Mg2+	mg/L	79.58	Carbonate hardness	mg/L	2.28
Suspended solids	mg/L	205.40	Conductivity (25 °)	US/cm	7690
PH(24°)	mg/L	7.26	dissolved solids	mg/L	2370.40

8.7.2 The Reliability of Water Supply

This project life water, water and circulating cooling water are proposed NGAMOYELK river water, industrial cooling water adopted the closed cooling water system.

When drawing water from natural river, it should consider the flow with 97% assurance rate minus the plan water consumption for industry and agriculture that upstream of intake. The water intake structure should be designed by low water level that with 97% assurance rate. Besides, it should be check with low water level that with 99% assurance rate.

The field investigation, power plant cooling water system using secondary circulating water supply scheme, the largest water supply about 344 m after/h, the present condition of water can meet the requirements of factory's largest water supply. Due to the project at this stage, it is detailed the river hydrological data cannot be obtained, so next stage the project owner should supply detailed hydrological data of the NGAMOYELK river, so as to further determine the reliability of water supply source.

8.7.3 Secondary Circulating Water Supply

Secondary circulating water supply system's largest circulation of water is about 10460 m^3/h.

Due to the high tide and the tide when the water level difference about 7 m, plans to set up a set of floating dock near the river water, floating dock size for liu xiaobo = 8.5 x6m, is equipped with two water pumps, water pumps for the WFB - 200 BD, Q = 345 m 3/h, h = 28 m, N = 55 kw, the pump is made of stainless steel.the shore with distribution and office.

An intake pipeline, diameter DN300, adopts a steel skeleton plastic composite pipe, length of about 1380m.

The plant set up 2 sets circulating pump, 3 sets of mechanical ventilation counterflow cooling tower.

Circulating water pump is in the open air to decorate, the pump parameters: DFSS700-25, Q = 5230 m^3/h, h = 0.20 MPa, N = 400 kw. V = 11000 V. Circulating water pump is made of stainless steel.

A single cooling tower water treatment is 3500 m^3/h, fan distribution power of 160 kw.

To improve the circulating water system and the reliability of water supply of water, the factory is equipped with a 2200m^3 industrial pool.

The plant set up a set of flocculation tank, water processing of about 350 m^3/h, after settling basin treatment of water supply chemical water workshop and circulating water system, tank water turbidity < 5 mg/L.

8.7.4 Comparison of two Kinds of Circulating Water Supply System

The circulating water pump, the water facilities and circulating water pipe trench are set outside the plant in the once-through circulating water supply system. Big water intake, large ship size of water intake and shipping conflict should be authorized by relevant departments with hard coordination work. If the shore type of pump house intakes water,

the underwater construction difficulty is very hard because of large difference of water level.

The diameter of circulating water supply pipe is DN1400, and the section size of circular drainage ditch is BXH=1.3x1.2m. The big size of trench causes the big excavation volume along the trench and hard coordination. The upstream shore of water intake area is development land and cannot arrange circulating water pipe trench, so the downstream shore is chosen.

The shore is piled with sand and gravel along the downstream 400m within the water intake area. The sand and gravel area is opposite to the high-scale residential area. The road between them, 2m width, is as the main entrance and exit of residential areas and not damage. The circulating water pipe trench should only be arranged along the sand and gravel, and it affects the sand excavation and increases the coordination work of sand excavation department.

Due to the ebb and flow increases the uncertainty in the direction of flow, setting circulating drainage point adds a certain difficulty. Because of no detailed river hydrological material, whether the amount of water intake can guarantee 9900 m^3/h during the ebb is not yet clear, the detailed river hydrological material is provided by.

Secondary circulating water system outside the factory pipes are smaller, water intake facilities and supplies supply pipe diameter 12, using the steel framed hdpe pipe pipe is light, convenient transportation and installation, do not need to corrosion, small the excavation earthwork quanlity.

According to the in-situ observation, take water in the river when the ebb tide basic can guarantee after 350 m^3/h, the follow-up to provide specific details need to be owner river hydrological data, further confirm the reliability of water supply. Secondary circulating water system with a total investment of than Once-through circulating water supply system to save more than4.5 million (not statistical circulating water pipe trench costs of land requisition and relocation along the way.)

Once-through circulating water supply plan and secondary circulating water supply scheme comparison table.

Project	Once-Through Circulating System	Secondary Circulating System	Note
Intake Water Way	Pump boat way，LxB=25x15m， 2 set C.W.pump，Quantity of intake water 9900 m³/h， Piers complex on the shore.	Floating dock way，LxB=8.5x6m,2set intake water pump，Quantity of intake water 344 m³/h， Piers simple on the shore.	
Supply Water Pipe	Steel pipe，DN1400 L=1.4km	Steel skeleton plastic composite pipe，DN300 L=1.4km	
Anti-Corrosion Way	To strengthen the level of corrosion and cathodic protection	No anti-corrosion	
C． W. Drainage Ditch	Reinforced concrete BXH=1.3x1.2m L=1.7km	No	
Installation of Quantities	Trench size is large, large amount of excavation, construction process, more time consuming.	Small diameter, excavated volume is small, light pipe, without anti-corrosion technology, construction progress fast.	

Coordinate Work	Circulating water pipe ditch along the land acquisition area, sand	Intake pipe along the land area is small, small amount of coordination

8.7.5 Conclusion on Circulating Water Supply System

In summary, Once-through circulating water supply system outside the plant engineering capacity, coordination of large engineering quantity, high investment, water supply reliability is poor, the two circulating water system of outside plant engineering quantity is small, the coordination of small engineering quantity, quantity of water is guaranteed, a total investment of more than Once-through circulating water system for small, therefore the project recommend using secondary circulating water supply system.

8.8 Water Affairs Management and Water Balance of the Whole Plant

8.8.1 General

The goals of water balance of the whole plant are to choose water source and ascertain water supply system reasonably according to the water consumption and water quality requirements of various process systems besides the condition of water source, to make sure each drainage systems and water treatment schemes based on the flow and quality of different drainage points as well as the regulation regulations and to integrate the design of water supply, drainage and water treatment systems, so that the use of water will be reasonable and economical， water contamination will be reduced.

Water recirculation rate

The project of circulating water system uses two times of circulating water supply system, gas turbine and steam turbine auxiliary water, industrial water system adopts closed cycle cooling water system. This project is a 6FA gas turbine unit with a 40MW turbine, the capacity of the turbine condition of pure condensate is 123t/h. Warm season cooling rate m=75, cool season cooling rate m=55, the circulating water system is according to the design and calculation of circulating water, see the following table: ***Circulating water volume (unit: m³/h)***

No.	Item	Hot Season	Cold Season
1	the condenser cooling water	9225	6765
2	auxiliary engine cooling water and industrial water	1235	1235
	(1) gas turbine lubirating oilccooler cooling system		
	(2) gas turbine generator air-cooler cooling water		
	(3) steam turbine lubircating oil cooler cooling water		
	(4) steam turbine generator air-cooler cooling water		
	(5) industrial water		
3	Total	10460	8000

8.8.2 Make-up Water Demand

The demand of the maximum makeup water is 344m³/h, the demand of the minimum makeup water is 247m³/h and the average makeup water is 295m³/h. The water consumption of millions' units is about 0.0038m/s.GW.

No.	Item	Water Demand	Recycling Water	Actual Water Consumption	Note

1	Evaporation loss of cooling tower	150	0	150	
2	Windage loss of cooling tower	10	0	10	
3	Sewage loss of circulating water	140	3	137	Flushing water
4	Boiler makeup water	20	0	20	
5	Pretreatment of sewage	17	0	17	
6	Domestic water	3	0	3	
7	Unforeseen water	4	0	4	

The minimum water demand and makeup water demand (unit: m^3/h):

No.	Item	Water Demand	Recycling Water	Actual Water Consumption	
1	Evaporation loss of cooling tower	104	0	104	
2	Windage loss of cooling tower	8	0	8	
3	Sewage loss of circulating water	96	3	93	Flushing water
4	Boiler makeup water	20	0	20	
5	Pretreatment of sewage	12	0	12	
6	Domestic water	3	0	3	
7	Unforeseen water	4		4	
8	Total	247	3	244	

8.8.3 Main Water-Saving Measures

(1) When installing water removing device for mechanical ventilation cooling tower, the loss of the cooling tower wind is reduced to 0.1%.

(2) Effluent of circulating water system is used as road ground and plant main workshop.

8.8.3.1 The Selection and Layout of Circulating Cooling System

Circulating cooling system

This phase of the project consists of a 40MW steam turbine unit with a group which composed of 3 single cooling for the 3500m^3 counter flow mechanical ventilation cooling tower and 2 circulating water pumps. Circulating pump is arranged opened between the cooling tower and steam room.

Setting in a pool of water circulating pump booster cooling tower after a diameter near DN1400 in circulating water pipe and sent to the main plant, respectively by the two root diameter circular pipe DN900 is sent to the main plant for steam turbine steam condenser, cooling equipment and industrial water use. The condenser heat water respectively by two root diameter circulating pipe DN900 is connected to the main plant near DN1400 back to the water pipe, from the parent tube to cooling by cooling tower, using recycled after cooling. Auxiliary equipment of thermal discharge and industrial water return directly to the cooling tower sump cycle use. The total length of circulating water pipes of this phase of the DN1400 project is about 230m.

Cooling tower

This phase of the project of a 40MW steam turbine unit consists of a group from 3 sets of cooling water for 3500m^3 fand type counter flow mechanical ventilation cooling tower consists of tower group. Single cooling tower with dimensions is length x width =15.6m * 15.6m, sump dimensions is length x width x depth of =49m * 17.6m * 3.80m, on the ground. Cooling tower adopts the concrete frame structure, glass steel enclosure. The total amount of cooling water for 10500m3/h, every cooling tower's diameter is 8.53m, and the fan motor power is 160kW.

Water circulating pump

This phase of the project uses the circulating water pump of horizontal centrifugal pump. The main technical parameters of circulating water pump and motor specifications are as follows:

Water circulating pump: Q=5250m³/h ,H=0.2MPa

Matching motor: N=400Kw .V=11000V, IP55

Water circulating pump will be installed outside.

The content of CL^- in the river is 1227mg/L, the concentration rate of circulating cooling water is 2, the content of CL- circulating water system is more than 2400mg/L, so the circulating pump is made of stainless steel material.

Circulating pipe

This phase of the project of circulating water inlet and a water pipe parent a root, welded steel pipe is adopted, the pipe diameter is DN1400, the total of then are about 230m.

The CL^- content of the circulating water system is more than 2400mg/L, the circulating water pipe uses epoxy coal asphalt anticorrosive cathodic for protection.

Makeup water system Water supply source for the project adopts Moyer-river.

This phase of the project is the largest supply water for the 344m/h river fand, with a floating dock water facilities, the size is LxB=8.5x6m, equipped with 2 sets of water intake pump, the pump type is 200WFB-BD, Q=350 m/h, H=28m, N=55KW, fand, V=380V, the water pump is made of stainless steel. The shore has the distribution and the duty room, the size is LxBxH=7x6x3m.

A pipeline, diameter is DN300, adopts a steel skeleton plastic composite pipe, the length of it is about 1450m.

In order to improve the reliability of water supply, the factory sets a 2200m fand industrial pool for the water supply and water workshop for circulating water system.

Water supply and drainage system for production and living

Production and domestic water supply system

Water suspended substance 205mg/L, which is required for processing, the factory set a flocculation pool, the processing capacity is about 350m^3/h. Turbidity of treated water is less than 5mg/L. After the treated water entering the 2200m fand industrial pond, the water plant gives water circulating water system through a water booster pump.

8.9 Fuel Supply

8.9.1 Overview of Natural Gas in Myanmar

Myanmar is known as the Asia's largest natural gas exporter for rich resources. The data from the Ministry of Energy shows domestic natural gas supply of Myanmar predominantly relies on Yadana Gas Field， Yedagon Gas Field， Shwe Gas Field and Zawtika Gas Field. From the collected data, we can know that the output of Yadana Gas Field is approximately 650mmCFD (767000Nm^3/h), of which nearly 525mmCFD (619500Nm^3/h) are for export and

125mmCFD (147500Nm^3/h) are for self using respectively; the output of Yedagon Gas Field is approximately 460mmCFD (542800Nm^3/h) for the main purpose of export; the output of Shwe Gas Field is approximately 500mmCFD (590000Nm^3/h), of which nearly 400mmCFD (472000Nm^3/h) are for export to China and 100mmCFD (118000Nm^3/h) are for self using respectively; the output of Zawtika Gas Field is approximately 300 mmCFD (354000Nm^3/h), of which nearly for export to China and 60mmCFD (70800Nm^3/h) for self using respectively.

8.9.2 Fuel Source and Analysis

The feed of natural gas to Yangon, Myanmar is comprehensively dispatched by the YWA MA MAIN CONTROL.STN Control Center. The Myanmar Ministry of Electric Power has promised that the composition of natural gas in this project is provided by Zawtika Gas Field. Low heating value (LHV) of natural gas is 849 BTU/SCF (43666 kJ/ kg). For detailed analysis, see Table 8.9-1.

Table 8.9-1: Analysis of Natural Gas Composition

Composition	Volume%	Composition	Volume%
CH4（%Vol）	91.804722	C6	0.006002
C2H6（%Vol）	0.401160	C7+	0.005002
C3H8（%Vol）	0.111044	CO2（%Vol）	0.240096
iC4H10（%Vol）	0.035014	N2（%Vol）	7.358944
nC4H10（%Vol）	0.021008	H20(lbs/MMscf)	0.0000
iC5H12（%Vol）	0.010004	H2S（ppm, wt）	0.0000
nC5H12（%Vol）	0.007003	Total	100%

8.9.3 Fuel Transmission

The flow rate required by the project is 19.85mmCFD. Now the Myanmar Ministry of Electric Power has promised they could provide 18mmCFD, and after calculation by GE we know it could satisfy the consumption of 87.1% load of gas turbine. Because we are lack of the accurate parameters, and the owner said it is nearly 1.5MPa, then we assume that the gas pressure is 1.5MPa at the plant site, so it necessitates installation of natural gas booster in the plant.

8.10 Conclusion and Recommendations

Despite unavailability of some data, such as total reserves of natural gas in Myanmar, resources of Yadana and Yedagon Gas Fields, residual gas supply capacity of Yangon Gas Supply Master Station and natural gas production and export plans of Myanmar, the following conclusions can be made from available information:

18mmCFD natural gas which has been promised to provide by the Myanmar Ministry of Electric Power couldn't satisfy the maximum consumption of the project, however it could satisfy 87.1% load capacity of the project. So it is required that the Myanmar Ministry of Electric Power coordinates with the gas supply department to obtain more gas in order to make the gas turbine running at full capacity, improve the efficiency of power plants.

8.11 No Project Scenario

Myanmar is facing a major electrical power shortage for the last one decade. The shortfall aggravated during the last three years and the total power scenario is very complex one. The supply demand situation in this sector will drastically hamper the development in all sectors of life including those in agricultural, industrial, commercial and domestic sectors. There is no alternative than to add more power generating units to the existing power system of the country within a shortest possible time frame. This is due not only to the increase in demand, but also due to aging of the existing power generating units most of which will near their life cycle very shortly. Both, base load and peaking plants are necessary to be added to the system, so that the whole system can run economically and efficiently. Technically a combined cycle gas turbine plants are necessary to have more energy efficient power generation systems with higher output.

The Main advantages of combined cycle power plant are as follows:

1) Its power supply efficiency is much higher than that of coal-fired steam turbine power plant;
2) Its construction period is short, and it can be constructed by phases, leading to the highest efficiency of fund utilization;
3) It uses less water and land;
4) Its operation is highly automated, and it can be started and stopped every day;
5) Its availability rate is up to 85%~95%;
6) It can be quickly started without external power supply;
7) It uses natural gas or liquid fuel; therefore, it discharges few pollutants (generally no dust and little SO_2 and NOx) and can greatly reduce CO_2 emission if it uses natural gas.

Considering the nature of the peaking demand the proposed combined cycle gas turbine power plant seems to be the most suitable option.

CHAPTER IX

ENVIRONMENTAL MANAGEMENT PLAN AND MONITORING

9.1 Scope of EMP

The primary objective of the environmental management and monitoring is to record environmental impacts resulting from the project activities and to ensure implementation of the "mitigation measures" identified earlier in order to reduce adverse impacts and enhance positive impacts from specific project activities. Besides, it would also address any unexpected or unforeseen environmental impacts that may arise during construction and operation phases of the project.

The EMP should clearly layout:

(a) the measures to be taken during both construction and operation phases of the project to eliminate or offset adverse environmental impacts, or reduce them to acceptable levels;

(b) the actions needed to implement these measures; and

(c) a monitoring plan to assess the effectiveness of the mitigation measures employed.

Environmental management and monitoring activities for the proposed power plant project could be divided into management and monitoring:

(a) during construction phase, and

(b) during operation phase.

9.2 Construction Phase

The environmental management program should be carried out as an integrated part of the project planning and execution. It must not be seen merely as an activity limited to monitoring and regulating activities against a pre-determined checklist of required actions.

Rather it must interact dynamically as project implementation proceeds, dealing flexibly with environmental impacts, both expected and unexpected.

For this purpose, it is recommended that the U Energy Thaketa Power Co., Ltd. should take the overall responsibility of environmental management and monitoring. U Energy shall form Health, Safety and Environment (HSE) section with required manpower and expertise to ensure proper environmental monitoring, as specified in Section 9.4, and to take appropriate measures to mitigate any adverse impact and to enhance beneficial impacts, resulting from the project activities. U Energy will make sure that the Contractor undertake and implement appropriate measures as stipulated in the contract document, or as directed by the responsible person to ensure proper environmental management of the project activities. It should be emphasized that local communities should be involved in the management of activities that have potential impacts on them (e.g., traffic congestion in the surrounding areas). They should be properly consulted before taking any management decision that may affect them. Environmental management is likely to be most successful if such decisions are taken in consultation with the local community. The environmental management during the construction phase should primarily be focused on addressing the possible negative impacts arising from:

a) Generation and disposal of sewage, solid waste and construction waste

b) Increased traffic

c) Generation of dust (particulate matter)

d) Generation of noise

e) Deterioration of water quality

9.2.1 Project Policy Statement

The final goal of U Energy 'S HSE philosophy is to ensure the health and safety of personnel, to eliminate property damage and to provide a safe and comfortable working and living environment, during the entire construction period.

U Energy 'S will maintain its own safety philosophy as described below.

- Safety is a paramount consideration in the project.
- All accidents are preventable.
- All tasks shall be planned and performed with concern for HSE.
- HSE is a line management responsibility.
- Identify and eliminate or minimize inherent hazard in the work.
- Closely monitor each steps of the work to detect and promptly eliminate hazards and unsafe practices.
- Provide clear and concise written instruction, rules and plans for the work to be performed.
- Use trained and qualified workers and supervisors.
- Recognize and reward outstanding performance.
- Provide personnel protective equipment.
- Provide mechanically correct tools and equipment.
- Maintain fire prevention and protection program.
- Provide first aid and medical facility.

9.2.2 Project HSE Goal

Project safety is a primary responsibility of all management and supervision on the project. The Project has a NO ACCIDENT goal. Project Manager has overall responsibility for safety at each respective location.

Specific HSE goals for the project are as follows:

Zero Incident and Accidents achieved through a HSE plan and HSE procedures that are aimed at modifying the behavior of all employees on the project to become safety conscious to prevent.

Provision of medical and first aid facilities to provide immediate treatment and proper management of injuries to prevent it from developing into more serious type of injuries.

No site damage incidents.

Avoidance of off-site damage incidents where the control of Project Management is limited.

Optimization of the site working conditions, leading to the prevention of physical and mental complaints, prevention of occupational sickness disability leave, and prevention of the occupational illnesses of all workers.

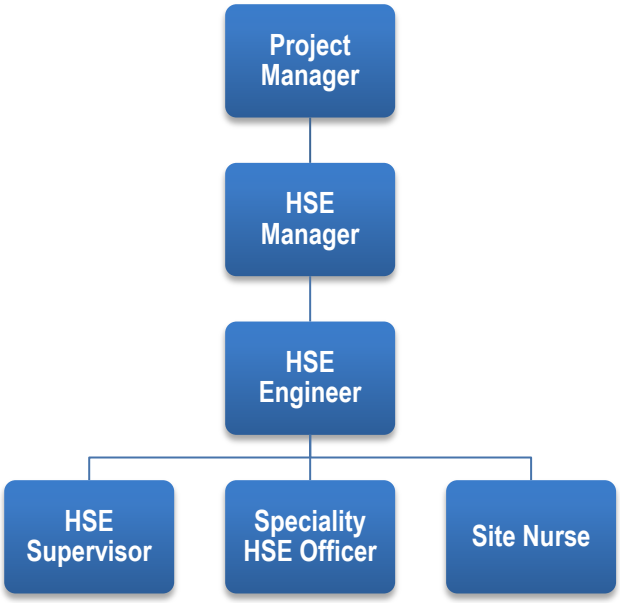
Minimum of nuisance (e.g. Noise, light, traffic, odors) to the surrounding community, potentially caused by construction activities.

Maintaining safe working areas and good housekeeping.

Strictly control waste management to avoid environmental impacts.

9.2.3 Project HSE Organization

The typical HSE organization of the PROJECT construction phase is shown as below:



9.2.4 Responsibilities

HSE in the workplace is everybody's responsibility; however, certain individuals will be required to accept additional responsibilities based on job assignment. These will include the following:

Project manager	- Have the overall accountability for HSE. - Be accountable for achieving HSE goals. - Set up HSE and Security Plan and be responsible for their implementation before starting site activities. - Plan and maintain housekeeping to high standards. - Inform the management of U Energy, also COMPANY Representative(s) of any accidents, incidents, and mishaps with the potential of injury and illness consequences immediately. - Provide HSE training opportunity to all employees. - Perform corrective actions for any identified unsafe conditions. - Be responsible for setting up appropriate training including refresher training, as needed, to enable managers and workers to assess hazards, and to familiarize themselves with the relevant requirements (legislation, regulation and company standards). - Check working methods and precautions for high risk activities with HSE Manager before work starts in accordance with the HSE policy.
Site HSE manager	- Assist the Project Manager in the management and execution of health and safety plan. - Conduct regular SITE inspections and prepare reports for Project Manager for corrective actions. Check and advice on each work plan or procedures for HSE prior to work commencement. - Provide advice, guidance such as may be needed in accident prevention. - Coordinate with Government Authorities on matters pertaining to legal HSE requirements. Establish and maintain an adequate HSE administrative system. - Investigate all near misses, incidents and accidents and submit reports

	complete with remedial actions to HSE team of U Energy head office through Project Manager for corrective action. - Ensure that Safety supervisors conduct their safety activities in a professional manner. - If HSE violations are determined high risk then stop the work as necessary to co-ordinate and monitor implementation of the requirements of COMPANY HSE manual and arrange continuous and formal daily safety monitoring to ensure compliance and effectiveness.
HSE engineer	- Provide timely communications on significant issues or developments. - Site inspection of safety facilities. - Carry out special inspection at least two times per week - Make monthly plan and summary of safety work - Take part in monthly inspection of HSE work - Carry out safety training plan
Safety supervisor/officer	- Assist HSE Manager and perform the safety activities under the direction of HSE Manager - Advise the supervisory personnel of each function for HSE activities - Report immediately to the HSE manager any near miss incidents also any safety violations that may require work to be stopped. - To report any incident/accident, unsafe acts/conditions and near misses to their HSE officer. - To ensure work places are kept clean during and at the end of the work.
Nurse	- Be on duty at job site during working hours (except when on emergency calls). - Care for an injured or sick person and keep the record. - Plan and execute the hygiene activity program for all workers at work-site. - Reports to be available at all times to U Energy HSE manager.
Specialty HSE officer	- Assist safety supervisor in checking each work procedure from the view of safety point and report to HSE manager - To report any incident/accident, unsafe practice/condition - To identify HSE problem in their work area and take necessary action - To identify any safety violation which need work to be stopped immediately - To ensure their work areas are kept clean throughout the duration of the work - Participate in HSE meeting regularly - Conduct HSE training for their new personnel
Employee (Worker)	- Comply with HSE rules and regulations. - Work safely and shall not do anything that can cause injury to him (her) or others. - Ensure work-tools, apparatus, appliances, materials, and/or equipment including Personal Protective Equipment (PPE) are used correctly and maintained in good serviceable conditions. - Report any unusual occurrences and all defects of plant and equipment

	to supervisor. - Attend all Tool Box Meetings, other meetings and/or training relating to HSE. Observe all written and verbal HSE instructions issued from time to time by HSE Manager and/or HSE Supervisor. - Observe and obey all HSE signs/notices. Keep work place clean and tidy. - Seek medical assistance for all injuries - Report to the medical center if feeling unwell.

9.2.5 HSE Meetings

U Energy HSE Manager shall establish a regular schedule for HSE meetings and maintain records of personnel attendance to manage and communicate on HSE effectively. The Project Manager shall also have a responsibility to manage and monitor HSE activities by taking action and providing resources to support their objectives and work activities.

Kick-off Meeting	The U Energy should ensure that all related persons are aware of the site hazards of the operation detailed in the scope of work and are familiar with HSE working procedures, regulations and emergency communications.
Monthly HSE meeting	Site HSE Manager shall hold monthly meeting with HSE Committee that consist of Project Manager to discuss HSE activities during the construction and operation stage.
Weekly HSE meeting	HSE Manager shall hold Weekly HSE Meeting with Project Manager, Discipline Superintendents and Subcontractors Construction Manager and HSE Manager to discuss HSE matters.
Tool box meeting (TBM)	The topics for the TBM shall include, but not limited to: - Highlight identified hazards and deviation during inspection. - Countermeasures for prevention of recurrence. - HSE reminders to constantly remind workers of HSE rules and regulations. - Highlight specific job hazardous activities for today's work. - Check work's health condition and if any person who are ill and or effected by alcohol or drugs are found, they shall not be allowed to work.

9.2.6 HSE Training

HSE training is essential for executing work safely during the entire construction, operation and decommissioning of the project. The Project Manager and the HSE Manager shall establish an On-site HSE Training Program before commencing the work. On site HSE Training Program with the following six categories:

i. HSE Induction Training for New Personnel

ii. HSE Training for Specific Hazardous Job

iii. Emergency and Evacuation Training

iv. HSE Training Refresher course

v. HSE Tool box talks

vi. HSE training for Visitors

U Energy would have additional trainings as the following safety training course, but not limited to, and adopt required trainings.

- Safety Procedure Competence Test
- Gas testing

9.2.7 Environmental Management Plan during Pre-construction and Construction Phase

During construction phase, the contractor shall plan, organize, and control work to construct the Works in a safe and orderly manner. The scope shall include, but not be limited to, licensing, labour, supplies, materials, equipment, tools, transportation, and anything else required to perform the construction, erection, and installation services necessary for the completion of the Works. The Contractor shall submit its Site Management Plan comprising mobilisation, organisation, logistics, personnel planning, transport and storage prior to the commencement of the Works on Site.

9.2.7.1 Site Cleanliness and Waste Disposal

Throughout the period of construction of the Works, the Contractor shall maintain the whole area of his operations in a clean, tidy and safe condition and shall arrange his materials in an orderly manner, all to the satisfaction of the Employer. The Contractor shall be responsible for waste collection and transfer to a suitable disposal Site. The Contractor shall clearly state, in the appropriate schedule, what provision is being made for disposal of waste materials both on and off-Site.

All rubbish shall be systematically cleared from the working areas and, if not removed directly from the Site, shall be deposited at general collecting points provided by the Contractor and agreed with the Employer, pending removal from the Site.

Where practicable, screening shall be provided to prevent the ingress of dust and dirt to any part of the Works.

The Contractor shall not cause pollution of the Site land drainage system or any water course by dumping rubbish, fill materials or waste products from any source whatsoever.

In the event of an incident whereby the pollution is attributable to any act or omission on the part of the Contractor, then the Contractor shall clear the pollution as soon as possible and make early plans to remedy the cause. The Contractor shall prohibit the committing of nuisance by his employees within the Site or upon either the Employer's land or others, and any employee found violating this provision shall be immediately discharged and not be employed again on this Contract.

In addition to its obligations as stated in the Conditions of Contract and the Technical Specification, the Contractor shall make himself familiar with all requirements relating to the discharge of effluent from the Plant and shall take all steps to ensure that these are not contravened by the disposal of effluent from the Site.

No dangerous or noxious waste products, chemicals or materials shall be disposed of, on or off the Site without the Employer's approval.

The Contractor shall take all necessary measures to ensure the safe collection and disposal of waste oils pertaining to the Works for which he has responsibility and to ensure the prohibition of:

(i) Any discharge of waste oils into surface waters, ground waters or drainage systems of any kind.

(ii) Any deposit and/or discharge of waste oils on to the ground or floors of buildings and any uncontrolled discharge of residues resulting from the processing of waste oils or the cleaning of oil contaminated surfaces with solvents.

In order to ensure compliance with this requirement, the Contractor shall provide suitable vessels for the collection of all waste oils. Where large quantities of waste oils need to be stored prior to being disposed of in bulk, suitable storage tanks shall be provided by the Contractor for this purpose.

(iii) Any processing of waste oils causing air pollution which exceeds the level prescribed by existing statutory provisions. The burning of all waste oils should only be carried out following written permission being granted by the Employer.

9.2.7.1.1 Damage to Public or Existing Site Roads

The Contractor shall make good practice to prevent damage to roads, footways, paved areas, boundary walls and fences etc. and clean all fouled roads paving etc. whether public or existing at the Site, caused by or in any way attributable to the handling/transport of Plant or materials by the Contractor or any Subcontractor and indemnify the Employer against loss, damage or claims by the local authority or others for damage to or fouling of roads paving etc., by reason of unusual traffic or other causes.

9.2.7.1.2 Cleanliness of Site Access Roads

The Contractor shall at all times ensure the public roads, giving access to Site, are kept clean of any materials deposited by traffic from the Contractor or his Subcontractors. The Contractor shall for this purpose provide wheel washing facilities at the Site entrance which will be used as required.

Table 9.2-1 summarizes the potentially significant environmental impacts during pre-construction phase, the measures needed to eliminate or offset adverse impacts and enhance positive impacts.

Table 9.2-1 Potential significant environmental impact during pre-construction phase and mitigation measures

Activity/Issues	Potentially Significant Impacts	Proposed Mitigation Measures	Responsible Parties
Site Clearance	Generation of dust	- Sprinkling of water on dust generating areas; - Restricting the speed limits of vehicles during movement on unpaved roads; and - Covering of vehicles carrying loose soil/construction material.	Contractor (Monitoring by HSE section and/or third party)
	Generation of noise from site clearance activities	- Site clearance activity will be undertaken only during daytime.	
	Excavated material (e.g. rock, sand, vegetation) waste	- The wastes will be transported to dispose in municipal land fill area.	
	Ecological Impacts	- The proposed power plant site will be built on the disposal site and the surrounding area is occupied by the residential area.	

9.2.7.2 Environmental Management Plan for Physical Parameters

9.2.7.2.1 Ambient Air Quality Management Plan

Objectives	This EMP relates principally to the control of emissions from plant, equipment, vehicles and dust. Potential impacts associated with gaseous emissions include health impacts to the community and on-site personnel, and community perception.
Legal Requirements	National Environmental Quality (Emission) Guidelines, 2015
Implementation Schedule	Construction phase of the project
Management Action	▪ Not using equipment such as stone crushers at site, which produce significant amount of particulate matter ▪ Keeping construction equipment and generators in good operating condition ▪ Keeping vehicles under good condition, with regular checking of vehicle condition to ensure compliance with national standards ▪ Using equipment, especially generators with high levels of emission control ▪ Immediate use of construction spoils as filling materials ▪ Immediate disposal/sale of excavated Materials ▪ Watering unpaved/dusty roads (at least twice a day) ▪ Sprinkling and covering stockpiles ▪ Covering top of trucks carrying materials to the site and carrying construction debris away from the site ▪ Use of alternate material (may require Client's approval) ▪ Installation of pollution preventive measures ▪ Use of alternate design or technology (if economically feasible) ▪ Control of construction schedule and plan ▪ Control through monitoring and inspection ▪ Dust Conditions basically shall be kept at a minimum level by periodic watering. In addition, U Energy shall consider the followings during the construction phase. Sandblasting shall not be permitted except as otherwise specified elsewhere. Only wet cutting of concrete block, concrete, and asphalt will be permitted. Dirt, soil, and rubble likely to be dislodged during transit shall be removed from the trucks and other vehicles prior to leaving site. ▪ U Energy shall ensure that equipment transporting materials, to and from the site that may become airborne is covered.
Responsibilities	Contractor (Monitoring by HSE section and/or third party)

9.2.7.2.2 Drainage and Erosion Management Plan

Objectives	To control erosion and sediment during construction phase
Legal Requirements	Environmental Conservation Law
Implementation Schedule	Construction Phase of the Project
Management Action	Erosion and sediment control during construction at the site should be to: ▪ protect the land surface from erosion with following approaches; - disturb minimal area when excavating

	- where possible, divert upslope storm water around the work site and other disturbed areas - vehicle access will ensure to enter from one entry point where possible. Gravelling the access point will allow all weather access and minimise erosion. - connect a temporary pipeline to a storm water system before laying the roof - place all stockpiles under the roof on the construction site. - Landscaping all bare areas as soon as possible after construction is completed. ▪ Intercept and safely direct run-on water from undisturbed upslope areas through the site without allowing it to cause erosion within the site or become contaminated with sediment ▪ provision and maintenance of permanent and the temporary surface and foul water drainage systems shall all be separately installed
Responsibilities	Contractor (Monitoring by HSE section and/or third party)

9.2.7.2.3 Traffic Safety Management Plan

Objectives	This Traffic Safety Plan relates principally to the road transport of materials and supplies to the Project site.
Legal Requirements	Yangon City Development Committee Law, 2018
Implementation Schedule	Construction Phase
Management Action	▪ Scheduling of deliveries during non-school hours and after regular working hours ▪ Protecting school going children from traffic hazard during construction phase, with installation of proper traffic sign and warnings ▪ Speed reduction to 10 km per hour within the school zones ▪ Schedule of heavy equipment, materials to enter and leave the site ▪ Park all vehicles in their authorized spaces only-do not park in front of firefighting equipment. Vehicles and pedestrian traffic shall enter and exit through designated route ▪ Off-hour admittance (Friday or Holiday) must be approved by U Energy in advance of arrival ▪ Observe specific speed limits ▪ Alternate traffic at intersection is expected Yield to pedestrians ▪ Site parking area for construction personnel shall be designated by U Energy ▪ Loading and unloading area shall be designated by U Energy ▪ U Energy shall provide, by the installation of detours and/or traffic control devices and by the use of flagmen, for the safe uninterrupted flow of vehicular and pedestrian traffic through contract sites unless otherwise provided for in the contract documents, or unless otherwise approved or directed by the Client
Responsibilities	Contractor (Monitoring by HSE section and/or third party)

9.2.7.2.4 Noise & Vibration Management Plan

Objectives	Activities have minimal adverse noise and vibration effects on surrounding environment and project site.
Legal Requirements	National Environmental Quality (Emission) Guidelines, 2015
Implementation Schedule	Construction phase of the project
Management Action	▪ Identify all persons likely to be exposed. ▪ Provide enough information to enable appropriate action to be taken. ▪ The exposure of persons to noise must be reduced, as far as is reasonably practical, without the use of hearing protection. As with any item of personnel protective equipment, the use of it should be the last resort. ▪ Determined efforts should be made to 'engineer out' the noise. The following noise pressure levels shall be complied with (per RCER (2004)): at site boundary max. 75 dB (A); at 1 meter away from open air installations: max. 85dB (A). ▪ The sound levels shall be measured according to ISO standards. ▪ Specific internal noise pressure level limits will be specified in the technical disciplines' bases of design and in document No. R214.00/M.02a/0004 - Noise Control Philosophy. ▪ Scheduling of deliveries during non-school hours and after regular working hours ▪ Use of noise suppressors and mufflers in heavy equipment ▪ Avoiding, as much as possible, construction equipment producing excessive noise during school hours and also at night ▪ Avoiding prolonged exposure to noise (produced by equipment) by workers
Responsibilities	Contractor (Monitoring by HSE section and/or third party)

9.2.7.2.5 Waste Management Plan (hazardous and non – hazardous wastes)

Objectives	This EMP relates to the management hazardous and non-hazardous waste material at the Project site.
Legal Requirements	Yangon City Development Committee Law, 2018
Implementation Schedule	Construction Phase
Management Action	- Hazardous, Non-hazardous, Inert and municipal wasted such as garbage, refuse, etc. produced during the construction, pre-commissioning and commissioning stages shall be disposed in compliance with the local waste management regulations. - All hazardous wastes shall be clearly labeled. Scrap, Trash other waste shall be placed in designated containers. - Work areas shall be kept clean and orderly. Cords and hoses routed across walkway shall be protected, so they shall not present a tripping hazard. - Materials, tools and equipment shall be stored in a stable position (Tied, Stacked, or chocked) to prevent rolling or falling. - A safety access way to all work areas shall be maintained. - Regular clean-up of scrap material, saw dust, rags, oil, paint, grease, flammable solvents and other residue of construction operation shall not only

	remove or reduce the fire hazard, but shall promote general safety at the same time. - U Energy will arrange to obtain at each of work areas adequate waste disposal and toilet facilities, potable water for use of its employees. In addition, U Energy shall comply with all laws, standards, codes and regulations relating to sanitation at the Work-site, including COMAPNY'S requirements as to waste disposal and toilet facilities and Potable Water. <u>Hazardous Wastes</u> ▪ Minimize risk of explosion or unplanned releases ▪ Keep incompatible wastes separate ▪ Not < 15m from site boundary (where possible) ▪ Away from foot & vehicular traffic ▪ Impermeable base material ▪ Protection from climate ▪ Good ventilation ▪ Limit height of stacked containers ▪ Provide drainage system or elevate ▪ Adsorbent material for spills ▪ Comply with regulations <u>Non-hazardous Wastes</u> ▪ Construction of sanitary latrine and septic tank system ▪ Erecting “no litter” sign, provision of waste bins/cans where appropriate ▪ Waste minimization, restricted use, recycle and reuse ▪ Proper disposal of solid waste (in designated waste bins)
Responsibilities	Contractor (Monitoring by HSE section and/or third party)

9.2.7.2.6 Wastewater Management Plan (Sanitary Water)

Objectives	This EMP relates to the management of wastewater at the Project site
Legal Requirements	Yangon City Development Committee Law, 2018
Implementation Schedule	Construction Phase
Management Action	▪ The Contractor shall be responsible for the foul drainage and the disposal of all sewage from the Site during the construction period ▪ sewage treatment plant of the requisite capacity to meet the permanent requirements for the Site shall be installed by the Contractor ▪ This must be capable of producing an effluent to comply with the stricter of the regulations of the country in which the Site is located and World Bank Guidelines as stated in the Technical Requirements ▪ The contractor shall provide its employees with all necessary instruction based on site sanitation plan as to the use of sanitation facilities at the site, and shall take all other steps, which may be necessary or appropriate in order that its employees utilize such facilities ▪ Toilet Facilities: Number, Type, Location, and ratio-to-user of toilets and h

	and washing facilities ▪ Cleaning procedures for toilets and washing facilities ▪ Remove all wastewater from the work site on a daily basis or at less frequent periods if requested by Client and approved by Client ▪ All debris shall be transported in an enclosed truck to the sanitary landfill
Responsibilities	Contractor (Monitoring by HSE section and/or third party)

9.2.7.2.7 Oil and Chemical Spill Contingency Management Plan

Objectives	Oil and Chemical Spill Contingency Planning ensures that the appropriate emergency response is made in the event of an oil and chemical spill.
Legal Requirements	The Prevention of Hazard from Chemical and Related Substances Law, 2013
Implementation Schedule	Construction Phase
Management Action	▪ Good house keeping ▪ Proper handling of lubricating oil and fuel ▪ Collection, proper treatment, and disposal of spills ▪ To ensure against contamination and disruption to the surrounding environment and work site, with a target to achieve zero chemical or oil spills, zero dust complaints from adjacent plants, zero property damage incidents, a zero discharge steel complex and to increase environmental awareness through HSE training
Responsibilities	Contractor (Monitoring by HSE section and/or third party)

9.2.7.2.8 Flora and Fauna Management Plan

During the construction period, loss of vegetation and habitat are expected in power plant construction area due to the site clearance and removal activities. In order to minimize the disturbance to local flora and fauna species, following management plans are provided to take necessary actions.

- Ensure all native flora and fauna is not intentionally harmed as a result of construction works.
- Night work activity shall be avoided as possible as it can in working site.
- Project site boundaries shall be regularly checked ensuring unnecessary habitat and vegetation do not happen in the project area.
- Relocate the native fauna specie to the area where same habitat system is provided for those.
- Instruction given to all drivers and workers to take care from causing incidents of fauna fatalities by the movement of construction vehicles and machine.
- Hunting and catching the local wildlife is strictly prohibited.
- Where technically feasible and practicable, new plants are to be grown as early as possible during the construction phase of project. New vegetation in the project area should use native species and the use of exotic species should not be allowed.
- Works areas in temporarily affected areas shall be reinstated with tree/shrub/ grass upon completion of the works.

9.2.7.3 Emergency Response Plan (including Community Emergency Response)

9.2.7.3.1 Role and Responsibility

Emergency Response Chief	Emergency Response Chief (U Energy HSE Manager) shall have prime responsibility for the development of an Emergency Response Plan, auditing of the effectiveness of the plan and the preparedness of members of the Emergency Response Team (ERT). He shall have the responsibility for the declaration and execution of an emergency response.
Emergency response team leader (ERT)	The HSE and Security Officers will be assigned to act as the Leaders of ERT and the HSE and Security Officers shall: - Direct control of ERT members at all times - Access the situation in plant on daily basis and keep the Emergency solved. - Ensure the preparedness of the ERT members to respond to any emergency. - Coordinate the ERT'S Classroom Training and Drills. - Ensure the operational status of emergency equipment. - Cooperate with police in the case of civil protest.
Members of the emergency response team	Shall consist of the assigned HSE and security officer and safety wardens who are working in an area at any given time.
Nurses and response team	Upon notification of any medical emergencies/injuries, U Energy Nurse shall immediately respond to the scene with the emergency vehicle. His/her primary responsibility is to treat and stabilize injured or ill persons safely, during any emergency incident within the project, security personnel roles and responsibilities are to control traffic and access to the site or to the affected area or building.

9.2.7.3.2 Communication system

A communication system shall be established between each ERT Leader, the Emergency Response Chief (U Energy HSE Manager), and the First Aid Room so that a contact can be made at any time.

Handset radio/mobile phone	Emergency Response Chief (HSE Manager) and ERT Leaders shall maintain handset radios or mobile phones to ensure availability at all times for response.
Emergency telephone numbers	Emergency Telephone Numbers shall be posted at all Assembly Points, in phone location points available to ERT at all times and other persons who may need to telephone for emergency services.
Assembly point location	At least one designated “Assembly Point” shall be established in a safe location for each of the Emergency Response areas. Assembly point will be clearly sign posted and all persons instructed to the location.

9.2.7.3.3 Emergency Response

On hearing the emergency fire or gas alarm in the area of work, the following steps must be carried out by all personnel:

- Stop the assigned job, turn off the equipment and proceed to Emergency Assembly Area. Walk across wind direction to the designated Emergency Assembly Area in case of a gas alarm.
- If you are driving a vehicle, stop, stop engine, and vacate the vehicle (leaving the key in the ignition if the vehicle was parked at undesignated parking area) and walk towards the Assembly Area.
- Do not return to work until emergency is declared over by notification from immediate supervisor.

9.2.7.3.4 Community Emergency Response

As the magnitude of an emergency increases, so will the need for multi-agency support from within the community. Upon notification of an imminent or actual emergency, the emergency response team will initiate the notification of key personnel and agencies. Based on the type and seriousness of the event, appropriate personnel are notified of the current or imminent situation.

The public in the community will be warned by:

- First responders advising those at risk in the immediate proximity of the emergency;
- Emergency Coordinator;
- Local radio station;
- Television, and or radio media;
- Vehicle mounted PA systems of the Fire Department; or
- Sounding of the community siren.

There are three operational levels to identify the level of emergency management function an activity:

- Normal Operations – routine daily operations;
- Monitoring – heightened surveillance of potential or developing hazards; or
- Activation – multi agency coordinated response.

9.2.7.3.5 Fire Emergency Response Plan

Fire is a hazard in any part of the premises. Its consequences include the threat to the lives or health and safety of relevant persons, damage to or loss of property and severe interruption to normal business activities or opportunities. Managing the risk of fire safety precautions based on a combination of appropriate prevention and protection measures depending upon building use and occupancy, the inherent fire risks. This fire emergency plan requirements extend to all persons at those premises including staff, visitors and contractors whether permanently or temporarily engaged.

Response Plan

a. The facility information describes key elements of the facility that is useful for new employees and response agencies, such as local fire departments.

b. Employees must know how to report an emergency. This may include the activation of pull alarms or notifying the facility security center. Consideration must be given to methods of notifying local agencies such as the fire department.

c. Alarms and signals to alert employees must be identified; this may include audio alarms, highly visible lights, and/or a public address system. Management and employees must know what actions to take when an emergency alarm is activated.

d. All emergency phone numbers should be identified, listed in the emergency preparedness plan, and posted. Emergency phone numbers should include any facility numbers, local agencies, and any emergency-facility personnel. Consideration should also be given to recovery of operations.

e. All responsibilities should be clearly defined for management and employees. Management must determine its strategy for responding to fire emergencies.

f. A chain of command should be established to minimize any confusion. Personnel must be identified to coordinate the emergency-response actions.

g. Detection and alarm systems should be identified and described. Testing and preventative maintenance procedures should be included.

h. Diagrams should be developed for critical information. Evacuation routes, exit doors, fire extinguishers, and other critical elements should be visually displayed for all employees. If the fire sprinkler system or standpipe system is used, all critical controls/valves should be clearly identified.

i. Assembly areas should be established for all employees. Accounting for employees can be performed at assembly areas. All assembly areas should be established at safe distances from fire hazards and clear of emergency vehicle traffic and activities.

j. Search and rescue procedures must be established. Only trained and authorized personnel should attempt search and rescue.

k. Procedures for shutting down equipment during emergencies should be established. Equipment operators must know the proper actions to take during an emergency.

l. Recovery strategy should include plans to restore the operations. This should include a list of contractors who can provide equipment and services for operations. Additional consideration should be given to temporary contractors who can provide manufacturing services.

Employees must know the emergency routes in their work areas and be familiar with the plant layout. All employees must receive a guided tour of evacuation routes and emergency exits during orientation.

Operators must know their specific procedures when an emergency arises. Safe shutdown procedures for equipment should be established to prevent equipment damage and additional hazards. Evacuating employees to a safe location is a top priority.

The alarm system to notify employees of emergencies and evacuations must be clearly recognizable during emergency conditions. Horns, sirens, public announcement system and other alarm devices must alert employees of an emergency. All alarm systems and fire protection systems must be maintained and tested on a regular basis.

Emergency routes and exit doors should be clearly posted on a wall diagram to show employees the primary and secondary emergency routes for evacuating the building. The diagram should show the employee's current position and emergency routes. Each department should display this diagram in a highly visible area.

Emergency evacuation drills must be conducted to ensure employees are knowledgeable and trained on emergency plans.

9.2.7.3.6 Training

The purpose of training is to establish and verify the organization's ability to prevent fires and to effectively respond to fire emergencies. Training considerations should include the following:

- Action to take in the event of a fire
- Portable fire extinguishers
- Familiarity with plant
- Operations and maintenance of equipment
- Alarms
- Hot work permits
- Handling of flammable liquids
- As a minimum, all employees should receive training in the following areas:

1. **Actions to take in the event of a fire:** When to evacuate, when to attempt to extinguish a fire, whom to notify, what equipment to shut down.
2. **Portable fire extinguishers:** The correct extinguisher and its proper operation on a particular type of fire (e.g., metals, electrical, chemical, wood, or paper). The training should be "hands-on" to give employees experience in extinguishment techniques.
3. **Familiarity with plant:** A tour of the entire facility, with emphasis on the location of exits, fire extinguishers, hazardous operations, and restricted areas.
4. **Care and maintenance of equipment or machinery they will be operating:** To reduce fire loss potential by helping to keep equipment from malfunctioning or breaking down.
5. **Alarms:** The meaning of various alarms and the actions to take when they are sounded.
6. **Hot-Work Permits:** How to protect against fire hazards caused from welding/cutting/brazing and other hot work.
7. **Flammable Liquids:** How to safely handle, use, and store flammable liquids.

Drills

Planning for fire emergencies requires drilling. The prevention of personal injury and loss of life are the prime objectives of emergency planning. Fire drills must be conducted to test the organization's abilities and readiness to handle a fire emergency. Employees should evacuate the building immediately at the proper alarm/signal.

All employees should recognize the evacuation signal and know the exit route they are to follow. This point generally will be located outside of the building. Primary and alternate routes should be established and all employees should be trained to use either route.

When employees are assembled, the line manager of each area should account for all personnel under his/her supervision. If any employees are missing, immediately report their names to the plant Safety Coordinator so that search and rescue efforts can be initiated. Only trained search and rescue personnel with adequate protective equipment should be permitted to re-enter an evacuated area.

After each drill, a meeting of the responsible managers should be held to evaluate its success and to discuss any problems that may have occurred.

9.2.7.4 Emergency Response Plan for Explosion

Explosions at site could occur from combustion of dusts, increased pressures of compressed gases, or ignition of accelerants. During an explosion, the following emergency response procedures should be followed:

- Employees will protect themselves by taking shelter against a sturdy object, i.e., desk or table.

- If inside, exit the building/structure as soon as possible and be aware of additional hazards such as fires, falling debris, etc.
- If there is a fire, use a wet cloth to cover the nose and mouth and crawl underneath the heavy smoke.
- Once out of a building, never return to a burning building.
- If outside during an explosion, find an area to stay that is clear of debris.

If personnel become trapped in or under debris, trapped personnel should take the following actions if possible:

- Cover nose and mouth with one's shirt or piece of material and try to breathe through it;
- Avoid sudden or unnecessary movements to reduce stir up of harmful dusts;
- Use a flashlight or whistle to signal to rescue workers of location. Or tap/bang on a pipe or wall to make noise for rescuers; and
- Shout only as a last resort, to avoid inhalation of dangerous dust or smoke particles.

U Energy shall take appropriate measures with a view to preventing the explosion, including such measures to

a. ensure the safe production, processing, use, storage, handling, treatment, movement and other dealings with flammable and explosive substances;
b. prevent the uncontrolled release of flammable or explosive substances;
c. prevent the unwanted or unnecessary accumulation of combustible, flammable or explosive substances and atmospheres; and
d. prevent the ignition of such substances and atmospheres.

9.2.7.5 Emergency Response Plan for Leak and Spill of Hazardous Materials

Exit the area: immediately after a hazardous chemical is spilled employee must exit the area. If the spill occurred in a laboratory and access to the fume hood is not blocked by the spill and/or hazardous vapors are not present in the area, then raise the sash on the fume hood and increase the airflow.

Shut the doors and secure the area: shut the doors to the area where the spill is located and secure the area if possible.

Call emergency contacts from a safe location and give the following information:

- Building name
- Room number or location
- Type of incident
- Name of chemical spilled or description of odor if unsure of the chemical
- Estimate of the volume of chemical spilled

Assess the situation: determine if the spill is Immediately Dangerous to Life or Health (IDLH). IDLH incidents are those that pose a significant and immediate threat to building occupants due to extreme toxicity, imminent explosion, or other life threatening scenario. These types of incidents are rare. If the spill does not pose a threat to the building occupants then remain outside the entrance to the laboratory until the response team arrives. If the situation is Immediately Dangerous to Life or Health, then proceed to the next step.

Pull the fire alarm: after determining that the spill poses an immediate danger to the building occupants, pull the fire alarm. Activating the fire alarm will evacuate the building occupants and will also notify the local fire department.

Exit the building: once the fire alarm has been activated exit the building. Remain at a safe distance from the main entrance of the building. Give the information to the emergency response teams that will be arriving.

9.2.7.6 Emergency Response Plan for Structure or Equipment Failures

Bridges, towers, and scaffolding are common structures at construction sites. Accidents involving these structures can be serious and often life threatening. All structures should be listed, and the emergency action plan should be developed for each structure.

Response plan

- Where there is the possibility of a total or partially collapse structures must be checked
- Persons should be immediately evacuated or kept away from the structures with potential for collapse
- The area surrounding the building should be cordoned off at a sufficient distance that persons cannot be exposed to falling debris
- Consider alternative shelter for displaced occupants
- Where there is no risk of structure collapse, but persons should be evacuated or kept away where there is the possibility of objects falling from the structures (e.g. roof cladding, window failure):
- Immediately cordon off the area below, to prevent persons from being injured by falling debris

9.2.7.7 Emergency Response Plan for Injuries and Illnesses

Employees should report minor illnesses and injuries that require medical care to the HSE Supervisor. Employees may go to their private physician but they must let the physician know if the injury or illness is work-related. Supervisors must ensure that they or a co-worker accompany the injured or ill person to the medical care facility.

Response plan for severe bleeding and wounds

- Apply direct pressure on wound.
- Use clean cloth or hand.
- Elevate body part.
- Apply pressure to blood vessel if necessary. Add more cloth if blood soaks through. Never remove bandage once applied.
- Keep pressure on wound until help arrives.
- Use tourniquet ONLY as a last resort.

Response plan for Fainting, Unconsciousness and Shock

- Have victim lie down and rest.
- Keep victim comfortable, not hot or cold.
- Place victim on side if unconscious.
- Ask or look for emergency medical I.D.
- Treat other injuries as necessary.

Response plan for Burns, Thermal & Chemical

- Immerse burned area in cold water.
- Flood chemical burn with cool water for 15 minutes.
- Cover burn with dry bandage.
- Keep victim quiet and comfortable.

Response plan for Fractures and Sprains

- Keep the victim still.
- Keep injured area immobile.

- Choking and Airway Obstruction
- If victim is coughing, or able to speak, stand by and allow victim to cough object up.

9.2.7.8 Emergency Response Plan for Natural Disasters

9.2.7.8.1 Response plan for Earthquake

(a) If employees are inside during an earthquake:

- Immediately take cover under a table or desk, or stand in a doorway. In areas where cover is not available, kneel at the base of an interior wall, facing the wall and with head down and covered by arms.
- Turn your body away from windows and mirrors.
- Be alert for falling objects and stay away from overhead fixtures, filing cabinets, bookcases, and electrical equipment.

(b) If employees are outside during an earthquake:

- Move to an open area away from buildings, trees, and power lines.
- If unable to move to an open area, watch for falling objects.

(c) After an earthquake:

- Be aware of the possibility of aftershocks.
- If possible and it is safe to do so, evacuate the building as soon as the shaking has ceased.
- Do not move injured persons unless they are in obvious immediate danger (from fire, building collapse, etc.)
- Open doors carefully. Watch for falling objects.
- Do not use elevators.
- Do not use matches or lighters.
- Limit use of telephone to calls for emergency services.

9.2.7.8.2 Response plan for Severe Thunderstorm

(a) A thunderstorm warning means that weather conditions are favorable for the formation of a thunderstorm. If a thunderstorm warning has been issued and employees are inside:

- Stay inside.
- Stay away from outside walls, windows, mirrors, glass, overhead fixtures, and unsecured objects such as filing cabinets or bookcases.
- If possible, move to a below-ground-level floor, interior corridor, or room or office without windows and crouch low with your hands covering the back of your head and neck.
- Do not use elevators.
- If requested, assist persons with disabilities to the safest area on the same floor.
- Do not leave the shelter area until after the storm is over.
- Continue to monitor the weather via radio or television until the tornado warning has been lifted for your area.

(b) If a thunderstorm warning has been issued and employees are outside:

- If employees are in their car, get out of it. Never try to outrun a thunderstorm.
- Look for a nearby safe structure in which to take shelter.
- If there is no shelter, lie down flat in a low area such as a ditch away from trees with your hands covering the back of your head and neck.

9.2.7.9 Stakeholder Engagement Plan

U Energy will create a website with the main Projects' information and events of interest for the various stakeholders. The documents and information that will be disclosed in the website include, but are not limited to, the following:

- the SEP, that will be disclosed in English and Burmese;
- ESIA executive summary;
- information on the operation schedule and services disruption;
- stakeholders consultations time, venues and minutes;
- grievance procedure;
- community development activities; and
- SEP Manager contact.

Considering the low percentages of internet users in the affected area, the Project disclosure through U Energy website will be mainly targeted, but not limited to, specific stakeholders (NGOs, national or regional stakeholders, authorities, Lenders, etc.).

In addition, given the particular setting of Project operational areas, possible methods to reach the target audience include, but are not limited, to:

- open meetings with residents of the affected communities (e.g., at schools, public/ religious or associations premises);
- separate meetings with land owners/land users, vulnerable groups, farmers associations and local NGOs, as needed and appropriate;
- brochures, posters, informative leaflets at key communities' centres, and radio announcements, in particular to inform about the construction schedule, grievance mechanism and forthcoming community meetings. Written information material should take in duly consideration the fact that there is a relevant number of illiterate people in the area; and
- social media: this method can be useful to keep ongoing communication with NGOs and other interested stakeholders.

U Energy will provide and publicise well in advance a schedule of the dates and locations of any planned consultation activities, including follow up and disclosure activities.

All meetings will be carefully documented and logged, minutes taken, and follow up activities recorded.

9.2.7.9.1 Disclosure Plan

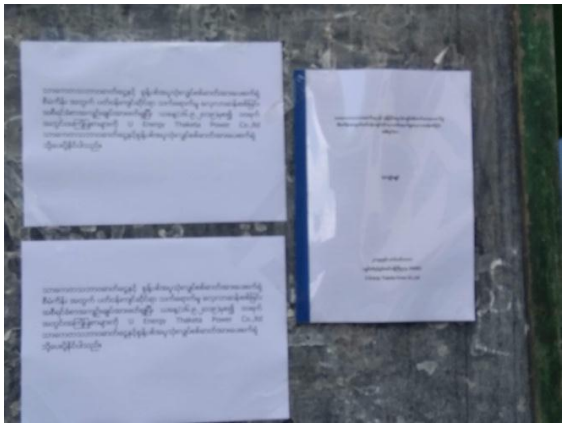
During the Project construction and operation phases U Energy will disclose information regarding ongoing Project activities or relevant changes in the Project through the following main methods:

- detailed publications in local newspapers or other media, which allow to easily reach also illiterate people: this method is aimed at informing all Project stakeholders on the ongoing activities and future development plans, including the impacts and mitigation measures foreseen;
- notice boards in the main public spaces of the affected areas: this method addresses in particular all Project affected communities (residents) and land owners and users on the ongoing activities, including the impacts and mitigation measures foreseen, methods to present complains and comments;

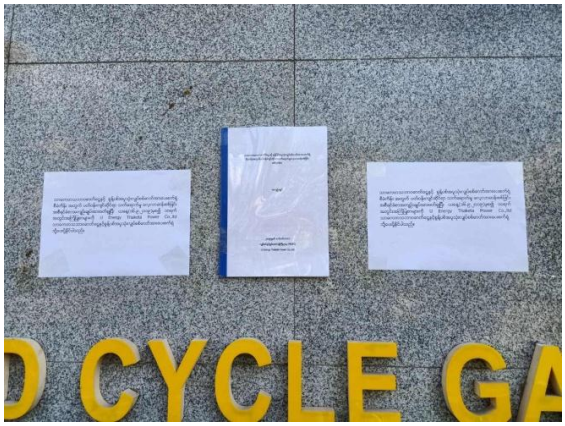
- meetings and events (with open or restricted participation), which allow to reach local and national authorities, residents of affected communities, NGOs and civil society associations to present Project activities, including the impacts and mitigation measures foreseen, grievance mechanism, and discussion on relevant topics such as labour issues, environmental impacts, communities health and safety, etc.;
- U energy webpage and SEP Manager contact, which will allow the distribution of information on Project impacts and mitigation measures, schedule of activities and plans, as well as the collection of grievances. Furthermore, it will represent a good channel to collect stakeholders' suggestions and concerns.

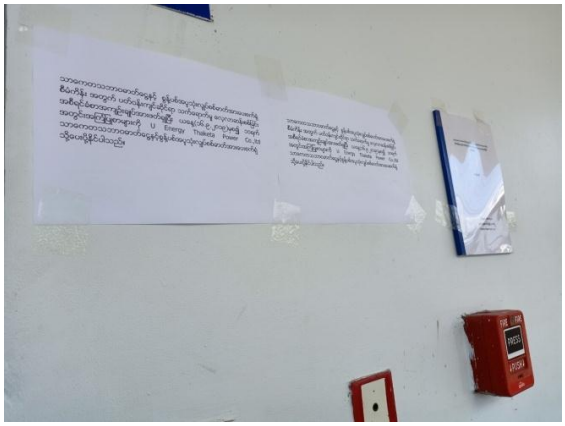
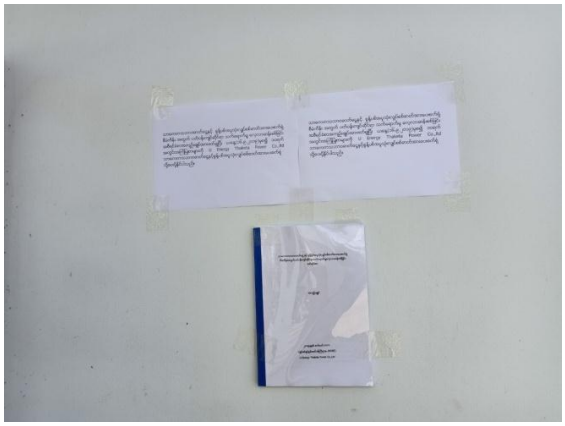
An internal and external grievance mechanism will be in place during all the Project phases. The photos described in below show the photos of public disclosure by U Energy.

At Ward 10 (North) Office

At U ENERGY Office



9.2.7.9.2 Grievance Mechanism Procedure

The purpose of this document is to formalize the management of grievances from stakeholders to minimize the social risks to the business. The grievance process, outlined in the document, provides an avenue for stakeholders to voice their concerns and gives transparency on how grievances will be managed internally, which aims to reduce conflict and strengthen relationships between external stakeholders.

Scope

The grievance mechanism procedure applies to all external stakeholders of our operations and activities. This procedure does not cover grievances raised by internal stakeholders, such as employees, who are to refer to U Energy Thaketa Power Co., Ltd.'s internal grievance standard located on U Energy Thaketa Power Co., Ltd.'s intranet.

Specific and localized grievance mechanisms may need to be put in place for future development projects, which take into account local language and customs.

Definition

Term	Definition
Grievance	An issue, concern, problem, or claim (perceived or actual) that an individual or community group wants addressed by the company in a formal manner.
Grievance Mechanism	A formalized way to accept, assess, and resolve community complaints concerning the performance or behavior of the company, its contractors, or employees. This includes adverse economic, environmental and social impacts.
Internal Stakeholders	Groups or individuals within a business who work directly within the business, such as employees and contractors.

External Stakeholders	Groups or individuals outside a business who are not directly employed or contracted by the business but are affected in some way from the decisions of the business, such as customers, suppliers, community, NGOs and the government.

9.2.7.9.3 Grievance Reporting Channels

U Energy Thaketa Power Co., Ltd. will communicate this procedure to its external stakeholders to raise awareness and offer transparency of how stakeholders can voice their grievances. Various channels for external stakeholders to vocalize their grievances formally include:

Telephone: Stakeholders can call U Energy Thaketa Power Co., Ltd.'s head office on 095018038 and request to speak to a stakeholder contact officer.

Email: Grievances can be sent to dongfan@urecei.com

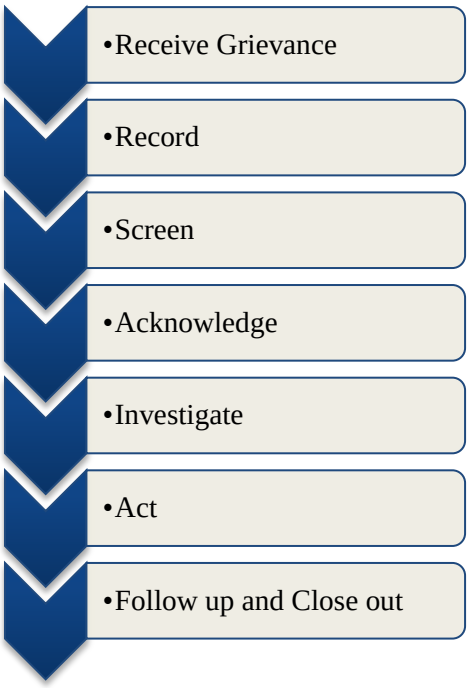
Face to face: Stakeholders can voice their grievance to any U Energy Tharketa Power employee who will then escalate using the correct process.

Roles and Responsibilities

Role/ Position Title	Responsibility
Grievance Owner	▪ Employee investigating the grievance and liaising with the external stakeholder/s. ▪ Developing resolutions and actions to rectify any issues. ▪ Follow up and track progress of grievance. ▪ Document any interactions with external stakeholders.
Stakeholder Contact Officer	▪ Receive grievances and assign a grievance owner. ▪ Makes sure the grievance mechanism procedure is being adhered to and followed correctly. ▪ Maintains grievance register and monitor any correspondence. ▪ Monitor grievances/trends over time and report findings. ▪ Raise internal awareness of the grievance mechanism among employees and contractors.
Employees	▪ Receive grievances in person. ▪ Report grievance to the Stakeholder Contact Officer by lodging the Grievance Lodgement Form. ▪ May provide information and assistance in developing a response and close out of a grievance.

9.2.7.9.4 Grievance Mechanism Process

The figure below describes the process that will be used to resolve any grievances:



Receive Grievance

In Person/ over the phone

If a grievance is received face to face or over the phone and the stakeholder wishes to address the grievance formally, it is the responsibility of the employee who receives the grievance to complete a Grievance Lodgement Form (see Form I). Once the form is completed the employee will then pass the form on to the stakeholder contact officer for processing.

Electronic

The stakeholder contact officer receives all grievances that come through via email. The stakeholder contact officer will review the grievance form and process the grievance in accordance to this procedure.

Record

All formal grievances will be logged in the External Grievance Register (see Form II) and Grievance Lodgement Forms will be saved in U Energy Thaketa Power Co., Ltd.'s intranet for record of correspondence.

Screen

The stakeholder contact officer is responsible for assigning a grievance owner to liaise with the external stakeholder/s and work on a resolution. Grievances will be screened depending the level of severity in order to determine who the grievance owner will be and how the grievance is approached. See below table categorizing the different levels:

Category	Description	Grievance Owner
Level 1	When an answer can be provided immediately and/or U Energy Thaketa Power Co., Ltd. are already working on a resolution. (Only formal grievances to be lodged in the External Grievance Register)	Stakeholder Contact Officer

Level 2	One off grievances that will not affect the reputation of U Energy Thaketa Power Co., Ltd.	Supervisor level or above
Level 3	Repeated, extensive and high-profile grievances that may jeopardize the reputation of U Energy Thaketa Power Co., Ltd.	Executive level

Acknowledge

A grievance will be acknowledged, by the grievance owner, within two working days of a grievance being submitted. Communication will be made either verbally or in written form (stakeholders will outline their preferred method of contact on the Grievance Lodgement Form, see Form I).

The acknowledgement of a grievance should include a summary of the grievance, method that will be taken to resolve the grievance and an estimated timeframe in which the grievance will be resolved. If required, the acknowledgment provides an opportunity to ask for any additional information or to clarify any issues.

Investigate

The grievance owner is responsible for investigating the grievance. The investigation may require the grievance owner to make site visits, consult employees, contact external stakeholders and complete other activities. Records of meetings, discussions and activities all need to be recorded during the investigation. Information gathered during the investigation will be analyzed and will assist in determining how the grievance is handled and what steps need to be taken in order to resolve the grievance.

Act

Following the investigation, the grievance owner will use the findings to create an action plan outlining steps to be taken in order to resolve the grievance. The grievance owner is responsible for assigning actions, monitoring actions undertaken and making sure deadlines are adhered to. Once all actions have been completed and the grievance owner feels the grievance has been resolved, they will then formally advise the external stakeholder via their preferred method of contact.

Follow up and close out

The grievance owner will make contact with the external stakeholder/s three weeks after the grievance is resolved. When contacting the external stakeholder, the grievance owner will verify that the outcome was satisfied and also gather any feedback on the grievance process. Minutes of the meeting will be recorded and saved in U Energy Thakeyta Power Co., Ltd.'s intranet.

If required the grievance owner may need to follow up with the external stakeholder on numerous occasions to confirm all parties are satisfied.

9.2.7.9.5 Appeal

If the external stakeholder is unhappy with the resolution and/or does not agree with the proposed actions, then the grievance owner needs to escalate the matter to the executive management team. The executive team will review the grievance and all documentation gathered throughout the investigation and determines whether further actions are required to resolve the grievance. U Energy Thaketa Power Co., Ltd. are fully committed to resolving an external stakeholder's grievance so if U Energy Thaketa Power Co., Ltd. are unable to resolve a complaint or a stakeholder is unhappy with the outcome, U Energy Thaketa Power Co., Ltd. may seek advice from other independent parties.

9.2.7.9.6 Reporting

Information outlining the number of grievances, time to resolution and outcomes of grievances will be communicated. U Energy Thaketa Power Co., Ltd. will evaluate and update the Grievance Mechanism procedure every two years (or when required) to continually improve its stakeholder engagement.

9.2.7.9.7 Storing of Grievances

All records, including grievance forms, investigation notes, interviews and minutes of meetings will be securely filed in U Energy Thaketa Power Co., Ltd.'s intranet to ensure privacy and confidentiality is maintained for all parties involved.

Grievance Lodgment Form

Name:		☐ Please do not use my name when talking about this concern in public.	
Company: (if applicable)			
Date:		Time:	
Preferred Contact Method:	☐ Telephone ☐ Email ☐ Mail		
	Please provide contact detail:		
Supporting Documents Attached?	☐ Yes ☐ No		
Please provide details of your grievance			
What outcome are you seeking?			
Additional Information			
Claimant Signature:		Date:	
U Energy Thaketa Power Co., Ltd. Signature:		Date:	

Office Use only

Stakeholder Reference:	☐ NGO	☐ Government
	☐ Neighbor	☐ Contractor
	☐ Indigenous	☐ Consultant
	☐ Other	
	Comment:	

9.2.7.9.8 Monitoring and Evaluation

The SEP will be endorsed by the U Energy, who will have the responsibility for its implementation.

The Company SEP will be regularly updated, presenting changes in Project activities, stakeholders, as well as advice and inputs received, lessons learned and any change to the consultation process. As a minimum, the SEP will be updated before the start of the operation phase.

The Company will develop a programme to monitor the Project stakeholder engagement activities and public perception of the Project. The monitoring programme will detail key elements of the monitoring, such as monitoring parameters, modality and frequency. The Company will also describe how and when the results will be reported.

Stakeholder, consultation and grievance registers, recording relevant information in a tabular form, shall be updated on an on-going basis. Progress reports will be prepared on a quarterly basis during the construction period and on a biannual basis during the operation phase to include updates on the grievance process, with the number of grievances received and addressed/closed, most frequent types of grievances, and any recommendation or action taken to decrease the number of grievances.

As long as there will be open grievances, the SEP Manager will make a selection of a random sample of grievances biannually, and follow up with the complainants to ensure that appropriate corrective actions have been taken and that the outcomes are satisfactory.

The reporting mechanism and responsibilities for stakeholder engagement are outlined in Table 9.2-1.

Table 9.2-1 SEP Reporting Mechanisms and Responsibilities

SEP Reporting Mechanism	Timing	Responsibility
Consultation Form	For each consultation or stakeholder contacted	SEP Manager
Stakeholder Identification and Consultation Register	Continued	SEP Manager
Grievance Register	Continued	SEP Manager
Grievance Monitoring	Quarterly during construction Biannual during the operation	SEP Manager
SEP Progress Reports	Quarterly during construction Biannual during the operation	
SEP Annual Report	Annually	

9.2.7.9.9 Resources and Responsibilities for Management Functions

The implementation of this SEP is responsibility of U energy during all over Project phases. U Energy will appoint one SEP Manager in charge of all SEP activities (from the available staff or an external figure, for example from a local NGO or university, in both cases with appropriate professional background on stakeholder engagement in the local context).

U Energy staff involved in the Project will be briefed in order to be aware of the commitments taken by the Project and the Project approach in dealing with stakeholders. The SEP Manager will coordinate the implementation of the SEP activities and keeping ongoing contacts with the construction manager.

The SEP Manager has a general control function of the grievance mechanism process and collects, records and deals with grievances.

9.2.7.9.10 Budget

The budget for the SEP implementation will consider the following items throughout the Project construction and operation phase:

- cost of human resources: the remuneration of the SEP Manager, if not identified within the internal U Energy staff, and of a short-term experts to carry out specific tasks, if necessary;
- training of the SEP Manager;
- specific consultation activities as outlined in the SEP;
- consultation materials and tools; and
- monitoring of the effectiveness of the SEP.

9.2.7.10 Occupational Health and Safety Management Plan

Occupational health and safety means preventing accidents and work-related ill health. Improved health and safety management can bring significant benefits to the business. It reduces individual and human costs of accidents and ill health, direct and indirect cost to the business, improves customer perception and company profile and workers' morale.

Under occupational health hazards, one can group several categories of working conditions impairing the health conditions of workers, though this impairment is slow. Safety relates more to health hazards that results from accidents and can cause instantaneous impairment of the workers' health.

There is various occupational health and safety risks are likely to happen during the construction and operation period. In order to avoid the harms caused by project activities to employees and local people, occupation health and safety management system shall be developed based on the Client own Occupational Health and Safety Management System for the proposed power plant.

The Environmental Management and the Emergency Response Plan must ensure that all staffs working within the Power Plant Project are oriented, through orientation programs, about the dos and don'ts during emergencies as well as overall environmental aspects and issues related to power plant operations.

9.2.7.10.1 Medical First Aid

Prior to start of work, U Energy shall arrange for medical facilities, emergency transport and medical personnel to be available for prompt attention to the injured and consultation on occupational health.

Medical clinic	U Energy shall provide and employ suitably qualified personnel to operate a medical service. The room should only be used for first aid treatment and always ready for immediate use. Notices displayed providing information on emergency contact numbers.
First aid kits	U Energy shall provide the first aid and medical facility as per the requirements of the Occupational Safety and Health.

9.2.7.10.2 Personal Protective Equipment (PPE)

The U Energy shall provide the standard PPE e.g. safety helmet, eye protection, long sleeve shirts and pants, gloves, safety footwear. All employees shall wear appropriate personal attire and wear approved types Personal Protection Equipment.

Head protection:	Safety helmets conforming to EN 397 (or equivalent)
Foot protection:	Safety boots (not trainers) to EN 345 (or equivalent) with toe, mid-sole and ankle protection, plus over protection.
Fall protection:	Safety harness must be used when working at high elevation positions
Eye and face protection:	Safety glasses (wrap around or with rigid side shields) conforming to EN 166 (or equivalent)
Hand and skin protection:	Work gloves appropriate for the hazard and shirts with sleeves and long trousers (or coveralls)
Hearing protection:	Hearing protection conforming to EN 352 (or equivalent) exceed 85 decibels (dB) or when normal speech cannot be heard at a distance of two meters.
Respiratory protection:	Respiratory protection must be worn where possibilities of dust, fumes or toxic gases exist.

9.2.7.10.3 Heat Stress Prevention

Heat stress is one of the most common and potentially serious illnesses that workers confront where high temperatures are normally encountered. Its results can be mild resulting in fatigue, irritability, anxiety, decreased concentrations and movement however, these conditions can lead to death. U Energy will train all persons via HSE induction and toolbox talks in recognizing symptoms of heat stress. Add to the water rehydration minerals (electrolyte powder) or make it available for individuals use. Rotate workers duties to avoid continual working in extreme hot/hazardous areas e.g. confined spaces, working at height, welding, etc.

9.2.7.10.4 Entering Confined Spaces

No one may enter any vessel or manhole without specific approval, training and a current permit to work. Prior to entering any confined space, the proper safety equipment and instruments are required these consist of but not limited to:

- Gas detector (suitable for H2S) during live sewer connections
- Approved mechanical air blower and power supply
- Emergency breathing apparatus
- Atmosphere monitoring device capable of monitoring oxygen levels and levels of toxic and flammable gas
- Washing facilities as necessary (live sewer connections)
- Lighting (explosion proof as necessary).

A barricade shall be in place around the opening Calibrate analyzer and test for oxygen concentration (19.5% minimum) before entering. Forcing ventilation shall be provided when needed. When test shows conditions beyond safe limits that cannot be overcome by cleaning and ventilating, suitable and approved respiratory equipment must be used.

A flammable gas test shall be made before entering, whenever toxic vapors or gases may be present. Their concentrations must be determined. No entry shall be made until tests prove the air safe. All electric items used inside must be connected through earthing/grounding cable.

Sufficient manpower shall be available outside confined space in the event rescue is necessary. All personnel assigned to the job shall be trained to use the mechanical lift, analyzer, air mask, audible signals and fire extinguisher Gas cylinders and welding machines must be left outside the confined space. Gas hoses must be tight and be removed from the vessel or manhole when not in use. Stand-by man should be trained.

9.2.7.10.5 Hazardous Material Work

MSDS (Material Safety Data Sheets) must be provided by the suppliers of hazardous materials and the MSDS sheets used to carry out an assessment for the safe use of such substances. Appropriate control measures may include; isolation, substitution, changes of process, ventilation, PPE, housekeeping, training and education etc.

9.2.7.10.6 Respiratory Protection

All respiratory protection selection, use, storage, cleaning, maintenance, and worker training will comply with the requirement of the respiratory protection program All respiratory equipment used on the construction site shall meet the international standard. Breathing air supplied by respiratory equipment must meet the following requirement

Oxygen Content % vol.	20 to 23
Condensed Hydrocarbons max.	0.5 mg/m3
Carbon Dioxide	500 ppm (maximum)
Carbon Monoxide	5 ppm (maximum)

Workers are to be healthy and regular medical checkups are to be arranged, to be conducted by professionals sufficiently trained and competent in the use of respiratory protective equipment.

9.2.7.10.7 Housekeeping and Clean-Up

Regular clean-up of scrap material, saw dust, rags, oil, paint, grease, flammable solvents and other residue of operations will not only remove or reduce the fire hazard, but will promote general safety at the same time.

All area and storage yards shall be cleared of combustible materials. All rubbish shall be cleared from buildings at least daily and work areas shall be maintained free of accumulation of debris.

All rags waste etc., soiled by combustible or flammable materials shall be placed in tightly closed metal containers for daily disposal.

9.2.7.10.8 Fire/Explosion Prevention

To prevent fire from occurring in site any spark shall be mentioned at all time. Smoking is permitted only in designated smoking areas. U Energy shall not permit unauthorized fires within or adjacent to the limits of the Work-site. U Energy shall instruct its personnel in work location on the use of fire extinguishers already installed at site. All flammable materials and store in a manner consistent with proper fire prevention measures. U Energy shall instruct its personnel in their location on the use of fire extinguishers already installed at work sites.

9.2.7.10.9 Electrical Work

All electrical work shall be done under the supervision of certified electrical personnel in accordance with International standard. As a general rule, hand tools will be of 240 volts. Where 240 volts are used, they will be grounded or double insulated. Equipment casing will be intact with no loose fittings or exposed cables. Plug fitting will be of an approved industrial type. Condition will be good and the tool will be subject to preventative maintenance schedules. For confined space work 24 volt supply with protection shall be provided. All temporary lighting (intrinsically safe) and

powered equipment shall be protected by the use of a ground fault circuit interrupter (GFCI) and portable electrical equipment should: be connected, individually or collectively, to an earth-free, extra-low voltage (24 V) supply from an isolating transformer(s), with the transformer(s) being located outside the confined space. Be protected through a residual current device, with the device being located outside the confined space. Additionally, the equipment should be fitted with a flexible supply cable not inferior to a heavy-duty type. The cables should be located, suspended or guarded to minimize accidental damage. It is recommended that double-insulated electrical tools be used.

9.2.7.11 Community Health Management Plan (Construction and Operation)

9.2.7.11.1 Organizational Management

UREC at all levels shall establish the prevention and control management network for infectious diseases, formulate and strictly comply with the provisions of the Regulations for Prevention and Control of Infectious Diseases, improve the report system for infectious diseases, provide necessary fund, transport and communication equipment, and make decisions according to intervention measures. HSE management personnel have the right to supervise and manage construction companies and propose relevant intervention measures to project department.

9.2.7.11.2 Health Publicity and Education

Medical service personnel at all levels are responsible for the health education about prevention of infectious diseases, and organize forces to eliminate the threats of rats, insects carrying diseases and other animals transmitting infectious diseases.

9.2.7.11.3 Epidemic Report

Medical staff of Construction Company is responsible to report infectious diseases. When discovering any patient, suspected patient and carrier of infectious diseases, they shall report it to the superior authority within the specified period, and to health administration of Myanmar. Also, they should go to treat patients at the site and conduct the preliminary investigation.

9.2.7.11.4 Patient Administration

The infectious disease patients, pathogen carriers and suspected infectious disease patients shall before they are cured or cleared of suspicion, be barred from jobs which national health administration prohibits them from doing because of the likelihood of causing the spread of infectious diseases. UREC shall collect the information of its employees, including age, gender and occupation, etc., the arrangement of its sanitary resources, the availability of local medical services, its food health, environmental hygiene and water source health etc.

9.2.7.11.5 Drinking Water Source

UREC is responsible for purification and disinfection of drinking water source and professional doctor is responsible to monitor water resource, provide technical guidance, purchase and distribute disinfectant.

9.2.7.11.6 Infectious Diseases

During outbreak and prevalence of infectious diseases, the company at all levels should immediately organize forces for prevention & control, and cut off the transmission channel of infectious diseases. If necessary, emergency response measures may be taken, such as stopping construction, enclosing public drinking water source, restricting gatherings or other group activities, etc.

9.2.7.11.7 Malaria Control

Train and educate all workers (including contractors' workers) about malaria prevention; further reduce the incidence of malaria (and eliminate the germ carriers of other waterborne diseases); provide sufficient drainage facilities at construction areas to reduce the area of stagnant; provide culverts on the new road to keep smooth natural drainage; and provide the mosquito nets processed with mosquito repellent for dormitories of construction workers.

9.2.7.12 Community Development Plan

Objectives	To describe the project's commitments in managing and mitigating social impacts raise from the existence of project in defined location and in enhancing identified benefits to communities and stakeholders.
Legal Requirements	Social Security Law (2012)
Implementation Schedule	Throughout the project life
Management Action	**<u>Community Engagement</u>** Community management committee shall be organized to establish an effect channel and appropriate mechanism in communicating local residents and gain the feedback of project related community issues. Any complaints of communities concerning unacceptable behavior conducted by project workforce shall be seriously taken into consideration attention in with local residents. Use grievance mechanism to ease the concerns of local residents by tracking, assessing and managing the performance of project workforces. Community management committee shall engage with local community through ongoing disclosure of the project information and consultation on matters that directly affect them. **<u>Community Development</u>** ***Employment:*** U Energy will hire a certain number of local staff according to the staffing requirements of the unit's operation, and shall carry out the safety and technical and other trainings for the local employed staff, so that they can master the various knowledge and skills of the power plant operation and maintenance, and to gradually realize the localization management. In order to better implement the power plant operation and maintenance, it is need to develop the training plans at the production preparation phase, organize the production staff training in time, and executes the trainings by stage, per the plan and based on the discipline. ***Education:*** U Energy will explore ways of supporting the education and it will also seek to support schools in the neighborhood by addressing needy areas such as infrastructure development and the company create a foundation for offering a limited number of scholarships (education prizes) for exceptionally performing students/pupils as an incentive for hard work, sponsoring orphans and pupils from vulnerable families etc. ***Economic Development:*** U Energy will as a matter of policy gives priority to local contractors and suppliers of goods and services provided they meet the quality requirements at a cost not exceeding comparative advantage. This will be done with a view to supporting local economic development. Information on how to conduct business with U Energy will equally be publicized to help would be local contractors and suppliers. ***Health and Welfare:*** The company will participate in health campaigns with local communities targeting infectious diseases and malaria as an integral part of its social responsibility plan. To promote the local health, the company was upgrading two clinics which are located in No. 9 and No. 10 Wards of Thaketa

	Township. Specific activities would include but not be limited to awareness campaigns; counseling services, distribution of insecticide treated nets (ITNs), spraying in offices and homes and in areas with stagnant water etc. ***Physical Infrastructure:*** For the development of physical infrastructure, U Energy was upgrading Roadside Drainage and canal between Railroad and Project Site (2 kilometer for capital, and regular maintenance). U Energy also donated and was upgrading the monasteries which closed to the project area or any entity with a viable proposal for providing social services for the wellbeing and development of local communities.
Responsibilities	Monitoring by HSE section and/or third party

9.2.7.13 Workers' Accommodation Management Plan

Objectives	To provide accommodation for workers that will remain clean, safe and will meet, at a minimum, the basic needs of workers.
Legal Requirements	The Labour Organization Law, 2011
Implementation Schedule	Throughout the project life
Management Action	- Waste-water treatment and discharge must meet Local standards - Rooms or Dormitories should be single sex occupancy - Sleeping accommodation should have a minimum ceiling height of 2.1m - Separate sanitation, toilet and shower facilities will be developed for male and female workers - All toilets, shower/bath area and washing facilities should be designed to be easily cleanable with non-slip wipe clean flooring. - Site canteens should provide - Medical Care Standards - Food Hygiene Standards - Visitor policy - Entrance and exit policy and protocols - Alcohol and drug policy - Security - Fire and Evacuation
Responsibilities	Monitoring team (HSE section and/or Third party)

9.2.7.14 Cultural Heritage Chance Find Procedure

The proposed power plant site will be built on the disposal site and the surrounding area is occupied by the residential area.

9.2.7.15 Security Plan

Site Security Plan in compliance with all security rules and regulations is to limit and control access to the Site of authorized personnel and vehicles and to provide secure conditions for materials and equipment to prevent theft or damage. Site will be totally enclosed with a perimeter security fence and controlled access gates for personnel, vehicles/equipment and materials under control. It is not permitted to bring in or be in possession of alcoholics,

narcotics, drugs or weapons. U Energy shall develop site security system for implementing and maintaining 24 hours.

9.2.7.15.1 Control Measures

The Site will have gates for the entrance and exit for all Site personnel and materials/equipment working and required on the specific project. Entry and exit of all persons into the Site district will be controlled through these entrances. Vehicular traffic through personnel entrances will be tightly restricted. Deliveries of materials/equipment will be directed to the storage areas.

Issuance of visitor's badges will be done only at one gate. Visitors will be required to be signed in by a responsible security representative and visitors entering construction area must have personal protection equipment. Vendor engineers and other long-term visitors will receive induction safety training.

U Energy storage and warehouse areas are to be considered as "RESTRICTED" areas. Collection or removal of materials from those areas is subject to U Energy approval of a material issue (withdrawal) requisition and the attendance of a U Energy's representative.

On Site communication will generally be handled by use of two-way radios. Cellular phones and radios (VHF/UHF) approved by Client and U Energy. Cell phones may not be strictly used within the existing facility areas and the areas restricted by Client.

9.2.7.15.2 Identification Control

The pass and identification system will be used in identifying and controlling all persons entering the Site. The U Energy shall provide identification to all U Energy personnel authorized to enter the work site, showing:

- Personal photograph.
- Name of the individual and assigned number.
- Name of Employer.
- Maintain a current list of personnel.

9.2.7.15.3 Material Control

All bags, packages, supplies, materials and equipment brought in or out of the Site will be subject to inspection by the security guards.

9.2.7.15.4 Vehicle Control

Vehicles entering the main construction gates will have permit either temporary (issued by the security main gate guards) or the ones issued by U Energy to be displayed in the windshields.

All motor vehicles entering or leaving the Site or other parking areas will be subject to random search by the security guard on duty.

9.2.7.16 Contractor Management Plan

9.2.7.16.1 Purpose and Scope

This CMP is intended to outline the relationship between the Project Owner and the Contractors, and to describe how the overall contract will be managed (i.e. describe the Contractor management processes that will be implemented by the Project).

9.2.7.16.2 Role and Responsibilities

Project Owner is responsible, for project management, for control and monitoring activities regarding constructors' actions and has overall responsibility for environmental, social, health and safety, and cultural heritage aspects of the project.

The Contractor will be responsible for the Health and Safety Plan and Measures, regarding their own employees and sites conditions, as well workers' accommodation, in accordance with legal provisions, advised by U Energy.

9.2.7.16.3 Organizational Design/Human Resources

Contractors are also responsible for developing organizational and human resource elements of the solution recommended by the Project.

9.2.7.16.4 Technical Monitoring/Quality Assurance/Communication

Contractor is responsible for technical execution, quality of engineering solutions, communications and training of its employees in order to respect all contractual conditions and recommendations of U Energy. The purpose of this level of communication is to keep stakeholders and interested parties informed about progress and any other daily problem. Contractor is also required to comply with all relevant national regulatory requirements. Contactor must also ensure that relevant requirements of the various construction-related permits for the Project issued by national (and local) regulators are addressed.

9.2.7.16.5 Environmental and Social and Health and Safety Reporting

The Contractor will prepare and deliver to the U Energy progress reports on environmental, social and health and safety performance. The report will identify:

- incidents within the period and investigation findings
- planned activities
- a textual description of progress,
- a brief description of any problems encountered

The weekly Reports will be review by Contractor and the U Energy.

9.3 Operation Phase

Most of the environmental parameters will experience beneficial effects during the operation phase of the power plant project. Efforts should be made to enhance these beneficial impacts, which may include incentives for proper growth of industries in the area. U Energy will be responsible for the operation and maintenance of this power plant.

The operation and maintenance organization structure of the power plant is composed of five departments including Leader Group, Operation Department, Maintenance Department, Safety Production Department, Procurement Department and Administrative Department, with 90 employees, including 76 Chinese employees and 14 local employees.

The following tables show the organization structure and key personnel.

Department	Total Number of Staff	Chinese Staff	Local Staff
Total	90	76	14
Leader Group	3	3	0
Operation Department	40	34	6
Maintenance Department	18	18	0
Safety Production Department	6	8	1
Procurement Department	4	3	1
Administration Department	16	10	6

Key Personnel

S/N	Role	Name	Position	Campany	Influence
1	Owner	Zhao Jin	chairman	U Energy	VVIP
2		Dong Fan	General Manager	U Energy	VVIP
3		Yang Bing	Project Manager	U Energy	VVIP
4	Sepco Ⅲ	Wang Lujun	General Manager	SEPCO Ⅲ	VVIP
5		Zhang Lianqing	Deputy GM	SEPCO Ⅲ	VVIP
6		Zhang Huanxiang	Chief Engineer	SEPCO Ⅲ	VVIP
7	Huafeng	Ni Jiawei	General Manager	HUAFENGWEIYE	KEY ROLE
8	Weiye	Peng Hong	Deputy GM	HUAFENGWEIYE	VIP
9		Shi Huaiwei	Deputy GM	HUAFENGWEIYE	VIP
10		Li Shanggang	Deputy GM	HUAFENGWEIYE	VIP
11		Lyu Tao	Deputy GM	HUAFENGWEIYE	VIP
12		Chen Ting	Project Department Director	HUAFENGWEIYE	VIP
13	O&M Team	Wang Jian	O&M Manager	HUAFENGWEIYE	VIP

9.3.1 Environmental Protection Management Organization

Set up a Leading group for environmental protection management which shall be subject to lead of company as well as supervision and inspection of the Owner, identify the responsibilities and formulate effective and feasible measures based on characteristics of the project, strictly implement various systems and realize set goals for environmental protection.

9.3.2 Environmental Protection Measure

Organize all staffs to learn the Environmental Protection Act and relevant laws and rule as well as regulation made by the Owner, strengthen environmental protection education and training for operators, strengthen environmental protection awareness and improve Work-Environment-Friendly Management awareness.

According to ISO 9001:2008: Quality Management Systems, combining with the characteristics of the plant and requirements of the owner, SEPCOIII will establish document, maintain and implement a quality management system and continually improves its effectiveness.

9.3.3 Overview of Quality System and Management

U Energy will enact the quality management system what must be in accordance with the objective. In order to ensure the quality of maintenance, the company will strictly according to the quality management system standard, ensure to complete the tenderer's contract requirements.

9.3.4 Implement Quality Management System

According to the SEPCOIII's "quality control handbook", combining with the project and the owner's requirements to implement and control the production of the quality system documents. And shall be continuous improvement in the maintenance project.

- Identify the quality activities in the process of the maintenance project.
- Clear control method, cross sequence and interface relations of maintenance process. Manage the maintenance process through the identification, determination, supervision, inspection and analysis, etc.

- The purpose of managing these processes is to accomplish the project quality goals according to the quality management system and company quality principle.
- Process Control

  In order to achieve planned results, and shall be continuous improvement by supervision and inspection, test and analysis and adopt improvement measures, This system is to ensure the quality of the project under control, and meet the requirements of the owner's quality and expectations.

- Planning and Resource

  U Energy will establish systems for planning of maintenance activities and the allocation of sufficient and adequate resources. Verification activities shall be included on all plans and programme. The programme will be updated in response to unplanned breakdown and operating defects, faults or malfunctions.

- Identification and traceability

  U Energy will generate maintenance schedule, which shall comply with equipment manufacture's recommendation frequency and type of maintenance.

- U Energy will make sure of that all the working process of the project department is always under control and leave the corresponding records by implementing company quality management manual, program files and project planning book, etc.
- Training

  Training procedures will ensure all personnel are competent, effective and efficient execution of their defined responsibilities.

- Documentation and Software

  Maintenance information system will ensure the availability and appropriate distribution of all pertinent documentation of the facility. Including codes, standards, legislation and technical publications.

(1) Document control

a) Soft version: quality manual and program document; program support document; three-level documents (like technical management system document); regulated record form;

b) Hard version: documents of outside source (drawings, project mail and regulation and rules), record;

c) It is required to take soft version except the special required hard version by tenderer;

d) The documents made by project shall fully base on quality management system and confirm writer, verifier and date, or receive approval from owner side; it is required to fully consider and pay attention to the reconciliation of environment, safety and measurement management.

(2) Record control:

a) Record form includes soft version and hard version.

b) It is required to have clear writing and the record shall be complete, timely and correct; there shall be signature of in-charge staff, there shall be data and serial number; the record shall be kept in special document cabinet.

c) There shall be specially arranged staff to manage these records to prevent damage and lost.

d) Project video record shall be included into record management, and it shall be managed according to special requirements.

e) Set up holding period limit and handling requirements according to importance degree.

- Audits: Provide a recorded internal audit plan.

Improvement and corrective action

- Achieve the purpose of continuous improvement and keep the company's quality management system continuous adaptability, adequacy and effectiveness through the unqualified things prevention, control and correct and the internal audit and management review.

9.3.5 Maintenance Quality Management

1) Maintenance quality management must be systematical, hierarchical, procedural, and responsible. Shall achieve the following 4 points: have reference for checking, have institution for following, have personnel for responsiblility, and have personnel for supervision. Strengthen whole process management. All level maintenance technical management personnel must participate in quality management, strengthen technical training for maintenance personnel, improve their quality awareness and prevent from occurring quality problem.

2) During equipment maintenance, once found important defects, shall timely report, analyze reasons, and establish treatment scheme. Quality of spare parts and material is very important for quality management during maintenance. Strictly control quality before entering to the storehouse as per drawing and technical agreement. It is forbidden to use unqualified spare parts and material into the equipment.

3) Maintenance technique can directly influence maintenance quality and check the technical level of maintenance personnel. Shall strictly follow maintenance regulation and quality criteria. Strengthen all level check and acceptance work according to the institute. All level maintenance technical management personnel shall enter to the site, supervise and solve quality problem during maintenance. Project Director and field engineers shall strengthen process supervision of maintenance technique, timely rectify incorrect maintenance technique and discipline violation phenomenon. For those maintenance quality problems, due to careless criteria execution or inexactitude acceptance, the relevant personnel must be timely notified and given relevant punishment.

9.3.6 Management System Establishment

9.3.6.1 ISO 9001, ISO 14001 and OHSAS18001

U Energy has passed the ISO 9001, ISO 14001 and OHSAS18001 management system authentication which serves as the basis for standard management of our company for daily work of headquarter and operation and maintenance work of each project. We established scientific, regular and orderly integrated project management system and incorporated advanced international management mode in it, which contributes to enhancing management level and enterprise' sustainable development. We have very rich experience in project management. All in all, our company is very experienced and competent in establishing an integral management system and applying it for this project.

9.3.6.2 Implementation Method:

1) Decide the standard to be adopted.

2) Establish the team and formulate the strategy.

3) Training (including seminar)

4) Select consultant.

5) Select authentication company (considering the factors: experience, geographical scope, price and service level)

6) Present state investigation and analysis.

7) Arrange organization structure and allocate resource.

8) Organize and draft the plan.

9) Prepare manuals.

10) Prepare constructive documentation (for supporting manual preparation)

11) Try to operate the management system (the key point is to communicate and train. All executors should make a record during implementation period.)

12) Review service (generally, it starts 6 weeks after the management system is carried out.)

13) Get authentication

14) Maintain and improve it continuously follow-up verification (the authentication agency will check the standard execution situation periodically. The system needs to be appraised again after it expires. If it passes the appraisal, the certificate will be replaced.)

9.3.7 Environmental Management Plan

The environmental management during the operation phase should primarily be focused on addressing the following issues:

(a) Emission from the power plant

(b) Generation of noise

(c) Waste generation at the plant

The monitoring plan and monitoring schedule has been presented in Section 9.12. Most of the mitigation and enhancement measures identified for operation phase, e.g., use of tall stack, using low NOx burners, selective catalytic converters, using silencers for generators and turbines, have already been addressed during the design phase and resources required will be within the estimated cost of the plant construction.

The environmental management plans during operation phase are described below.

9.3.7.1 Air Quality Management Plan

Objectives	To control gaseous emissions from power plant
Legal Requirements	National Environmental Quality (Emission) Guidelines, 2015
Implementation Schedule	During operation phase
Management Action	▪ Using low nitrogen oxide burners, as specified in the bid document ▪ Installation of stack emission monitoring equipment for major pollutants. An in-house Continuous Air Monitoring Station (CAMS) shall be established ▪ In stack design due consideration should be given to proper insulation ▪ Planting of trees around the project site, especially along the boundary of the school and residential areas located close to the project site ▪ Restrictions may also be imposed on installation of industries in the area that emit significant amount of particulate matter
Monitoring	CO, NOx, PM10, PM2.5 and temperature
Responsibilities	Monitoring team (Safety Production Department and/or Third party)

9.3.7.2 Noise Emission Management Plan

Objectives	Activities have minimal adverse noise and vibration effects on surrounding environment and project site.
Legal Requirements	National Environmental Quality (Emission) Guidelines, 2015
Implementation Schedule	Operation Phase
Management Action	▪ Provision of silencers for generators and turbines ▪ Planting of trees around the project site ▪ Regular plant maintenance ▪ Regular noise monitoring, especially at the school and residential quarters located ▪ Use of ear-muffs and ear-plugs by plant personnel working in the generator and turbine facilities of the plant
Monitoring	Ambient noise level (dB (A))
Responsibilities	Monitoring team (Safety Production Department and/or Third party)

In order to reduce the influence of noise, noise barriers at the top of wall (total height 4m) will be used and the lengths of three sections are 123m, 78m, 78m. It can be considered that the project will use noise wall system to reduce the influence of noise. This type of noise barrier includes barriers constructed of fabricated brick or masonry block units. Typically, these types of systems are constructed by laying the brick or masonry block in a conventional fashion using a continuous spread footing as a base. However, in certain instances, such barriers may be constructed on a base beam supported at the ends by the posts or by the top of the concrete caissons for the posts.

9.3.7.3 Waste Management Plan (hazardous and non – hazardous wastes)

Objectives	To initially limit the amount of generated waste
Legal Requirements	Yangon City Development Committee Law, 2018
Implementation Schedule	Operation Phase
Management Action	▪ Wastes, scraps, materials, equipment and instruments shall be put in an orderly and clean manner according to the Owners requirements without being throwing about ▪ Wastes shall be recycled as much as possible so as to minimize quantity of unrecyclable waste ▪ Toxic and hazardous wastes shall be sealed and separately stored and dangerous and general wastes shall be separately stored and managed to prevent secondary pollution; combustible and explosive goods shall be placed away from each other; dangerous wastes of difference categories are forbidden to be put in one place ▪ Impact on the surrounding environments shall be taken into consideration for storing waste, especially dangerous waste which shall be safely stored in suitable containers to prevent accident leakage or spillage ▪ Dangerous wastes shall not be arbitrarily disposed or directly discharged into wastewater pipe network, but be handled by organization with qualification on dangerous waste handling ▪ Sprinkling and leakage preventative measures for wastes shall be

	completed before transportation Hazardous Wastes ▪ Handling and storage are part of an integrated system - need to: ▪ Choose/design storage site carefully ▪ Ensure waste compatibility ▪ Consider storage duration and types of storage ▪ Select appropriate packaging materials and containers ▪ Ensure proper marking and labeling ▪ Keep accurate records and make regular Non-hazardous Wastes ▪ Good housekeeping ▪ Ensuring proper storage, treatment, and disposal of all solid waste
Responsibilities	Monitoring team (Safety Production Department and/or Third party)

9.3.7.4 Wastewater Management Plan

Objectives	To be responsible for the wastewater and to carry out, monitor, supervise, maintain, manage and control wastewater.
Legal Requirements	National Environmental Quality (Emission) Guidelines, 2015
Implementation Schedule	Operation Phase
Management Action	▪ Proper construction and maintenance of wastewater disposal system for the plant premises ▪ Monitoring of effluent quality from treatment plant (monitoring requirement and cost estimate ▪ provided) ▪ Monitoring of river water quality (monitoring requirement and cost estimate provided) ▪ waste oil and other waste liquor shall be soundly collected and recycled ▪ treatment of Domestic Sewage and Industrial Wastewater will be implemented ▪ Construct settling pond for muddy water in the Ngamoeyeik Creek and within the power plant compound before pumping to the power plant
Responsibilities	Monitoring team (Safety Production Department and/or Third party)

9.3.8 Occupational Health and Safety Management Conducting Plan

9.3.8.1 Management Policy

Resolutely implement the policy of "safety first, prevention first, Administration management", establish the thinking of "protection of personnel, power grid and equipment", strengthen management and implement the measures to protect the personal and equipment safety, health, environmental protection, and reduce the pollution and continuously improve the working level of safety, health and environment management and culture management. Achieve the "legalization of safety management, standardization of safety facilities, fixed stacking of equipment and materials,

methodization of production site, family-like team building" in order to guarantee the achievement of the requirements of the owner.

9.3.8.2 Management Objectives

9.3.8.2.1 Safety Management Objectives

"Five Ensure": Ensure that there is no extra serious and major equipment accidents, personal injuries and death accidents, malignant misoperation accidents, major fire accidents, major pollution causing the environmental events with adverse social impact all the year round.

"Four Control": Control the personal serious injuries at 0 times, Class 1 fault at no more than 1 time/year, Class 2 fault at no more than 2 times/year.

9.3.8.2.2 Work-Environment-Friendly Management Objectives of the Site

Implement modular management to achieve "standardization of operation, normalization of behavior, ordering of operation and cleanliness of environment", and establish the company's brand image project of safety and Work-Environment-Friendly Management.

9.3.8.2.3 Environmental Protection Objectives

Strictly implement the requirements related to the environmental protection, establish the concept of "green operation" to realize "construction site is cleaned and the residual material is disposed when the construction is completed", and keep the site clean, maintain the original ecology; do not affect the surrounding environment and discharge the excessive pollutants, the waste disposal shall comply with the regulations and there should be no environmental pollution accidents.

9.3.8.3 Assurance System and Organization of Safety and Work-Environment-Friendly Management

9.3.8.3.1 Assurance System of Safety and Work-Environment-Friendly Management

To ensure the continuous, effective and safe operation work, the Project Director is authorized to establish the appropriate safety management organization to implement the safety management in the operation and maintenance process. Establish the safety management organization which is fully responsible by the Project Director and deputy Project Director, and supervised by the HSE department and production & technical department in the whole process, and consists of Project Director, administration department and operation department and maintenance department, set up three-level safety management system and safety supervision system, and accept the supervision and inspection of the owner and the relevant departments on its safety management work.

9.3.8.3.2 General Requirements of Safety and Work-Environment-Friendly Management

Performing the standardized management in line with the requirements of the owner, and achieving the standardization of office facilities, team building and safety facilities at the site.

Visual image

1) Implementing the responsibility division management in the principle the person responsible for the area shall be responsible for the management. Ensure that the identification on site is clear, the safety warning is high-lighted, and the site area is standardized and orderly.
2) The operation personnel at the site shall wear uniforms which are clearly marked, and shall ware and use the standardized and unified safety helmets. Wearing of seriously oil-stained uniforms and dirty safety helmets is prohibited regardless of any operation.
3) The machinery and equipment, industrial equipment, tool room, scaffold tubes entering the site shall be repaired, painted and identified in the same color to ensure that they are intact and clean.

4) Toolbox, container and others shall be placed and arranged in the unified manner, and identified with unified color.

Regional management

Project department office and living areas shall implement the regional enclosure and closed management.

1) Section management shall be performed according to responsibility areas to ensure that the whole road and drainage channel are smooth and unblocked.
2) Each production vehicle shall be kept clean and driven as required as well as subject itself to uniform command and management.
3) Layout of smoking room and drinking water point.
4) According to site actuality, smoking room and drinking water point shall be placed in terms of uniform standard and kept clean under the management of specific personnel.

Equipment and materials pile-up Management

Field equipment and materials shall be piled up by area for fixed location management. What to achieve is that various materials shall be in neat and orderly form with clear marks for safety and reliability.

9.3.8.4 Guarantee Basis and Measures for Safety Production

9.3.8.4.1 Management Standards and Implementation Basis for Safety Production

U Energy has passed the certification of OHSAS18001:2007 Occupational Health and Safety Management System and has perfect occupational health and safety system architecture and management documents. The Project Department will establish management implementation measures and safety management account under the management system of the company according to practical situation.

9.3.8.4.2 Concrete Safety Guarantee Measures for Personnel Trainings

1) Arrange technical experts above foreman in advance for special training, arrive at the site in advance to understand in-depth equipment condition, and meanwhile develop pointed study of equipment operation and maintenance and maintenance specifications, and make spare parts plan.
2) Ensure the effectiveness of training work, update in time training content according to equipment operation situation and equipment upgrade and transformation situation, continuously improve the Administration quality of operating personnel and deepen the understanding and knowledge of the machine set.
3) Carry out Administration assessment when training completed to ensure that the members of operation maintenance team have met the requirements of three familiars and three capabilities. Three familiars: be familiar with system and equipment on structure and performance; be familiar with equipment on its assembly technology, working procedure and quality standard, and; be familiar with safety operation rules. Three capabilities: be capable of any one other craftsmanship closely relevant to their own profession; be capable of understanding drawings, and; be capable of making drawings.
4) Arrange technical experts above foreman in advance for special training, arrive at the site in advance to understand in-depth equipment condition, and meanwhile develop pointed study of equipment operation and maintenance and maintenance specifications, and make spare parts plan.
5) Ensure the effectiveness of training work, update in time training content according to equipment operation situation and equipment upgrade and transformation situation, continuously improve the Administration quality of operating personnel and deepen the understanding and knowledge of the machine set.

6) Carry out Administration assessment when training completed to ensure that the members of operation maintenance team have met the requirements of three familiars and three capabilities. Three familiars: be familiar with system and equipment on structure and performance; be familiar with equipment on its assembly technology, working procedure and quality standard, and; be familiar with safety operation rules. Three capabilities: be capable of any one other craftsmanship closely relevant to their own profession; be capable of understanding drawings, and; be capable of making drawings.

9.3.8.4.3 Fire Safety Management Measures

1) Implement by-level responsibility system of fire control, arrange in place by-level fire control safety responsibilities and post fire-control safety responsibilities, and establish complete fire control inspection system.

2) Strengthen fire control safety education for team members to ensure all of them to master the characteristics of flammable and explosive materials and basic firefighting knowledge and to clearly know about fire risk. Reaching THREE UNDERSTANDs, THREE CANs. (THREE UNDERSTANDs: understand the fire risk of the post of their own; understand the fire control measures of the post of their own, and; understand the firefighting methods for the post of their own. THREE CANs: can give an alarm; can use fire extinguisher of the post, and; can fight fire at initial stage).

3) Establish accounts for the firefighting equipment in the scope of management and regularly carry out and finish maintenance of them.

4) According to relevant content in the fire inspection table, organize regular fire safety inspection to eliminate in time any fire hazard found, and before any fire hazard eliminated, implement corresponding prevention measures to ensure the safety during fire hazard rectification period. Any unqualified firefighting equipment shall be replaced and replenished timely according to relevant requirements.

5) Strictly prohibit piling up materials, equipment and other barriers that may influence evacuation at emergency exit or evacuation exit.

6) Set up by specification guide marks on fire safety evacuation and emergency lighting equipment conforming to the state regulations.

7) Organize regular inspection, maintenance and service against fireproof doors, guide marks of fire safety evacuation, emergency lighting equipment and fire accident alarms in the scope of management to ensure them to use reliably at any time.

8) Strictly enforce the approval system of hot work permit, eliminate any flammable and explosive hazardous substance near hot point as required before hot work starting or carry out proper safety isolation, and deploy ready-to-use firefighting equipment of proper types and quantity. If no approval procedure is performed, it is strictly forbidden to carry out any hot work without authorization.

9.3.8.4.4 Disciplines and Regulations on Safe and Work-Environment-Friendly Management

1) When entering the field, it is necessary to pay attention to any safety signboard and to obey the requirements on the board and the field rules voluntarily.

2) Any personnel entering the field must wear in correct way safety helmet and fasten hatband. It is strictly prohibited to sit on safety helmet (The color code and mark of safety helmet shall be determined uniformly).

3) Field personnel shall wear uniform work clothes that conform to safety requirements.

4) Any personnel engaged in toxic dust operation or special operation shall wear special protective clothing.

5) Every high-rise operator must wear a safety belt.

6) Any personnel on the field shall not wear any tie, ring or bracelet.

7) The personnel on the field is not allowed to let her back hair down, but long hair or pigtail shall be bundled into safety helmet.

8) Do wear safety goggle when using grinding machine, or performing abrading and correcting, fire welding and cutting, or touching hazardous chemicals.

9) It is strictly forbidden to enter the field after drinking.

10) It is strictly forbidden to smoke at any place out of the smoking room.

11) It is strictly forbidden to enter dangerous operation area without authorization.

12) It is strictly forbidden to scatter litter or stack items at will on the field.

13) The vehicles on the site shall be kept clean-up and in good condition and driven at limited speed along the signboards.

14) Any vehicle entering the field (including non-automatic vehicles) must be driven along the designated path and stopped in the designated area.

9.3.9 Emergency Guarantee Measures

9.3.9.1 Emergency Plan and Measure for Emergent Events

Special Emergency Plan for the Project is hereby established to effectively operate the machine set, to do well crisis prevention and control works, to establish crisis management thinking, to improve the ability to deal with emergencies, to standardize the management of the emergency plan for safety production accidents, and to establish a crisis emergency mechanism of perfect organization, quick response and clearly-determined responsibility that tallies with practical project situation.

9.3.9.2 Emergency Organization Structure for Sudden Accidents

An emergency command center should be established, with the Project Director as commander-in-chief. The emergency command center is composed of persons in charge of the teams and related departments, including HSE department, Tech support department, maintenance department, operational department, general management department, etc. The center should hold regular meetings, carry out trainings, set up normative systems and procedures, etc.

9.3.9.2.1 Duty of the Emergency Command Center

Release the order for starting and terminating the emergency plan; Organize and command the rescue crew to carry out rescue operations; Be responsible for reporting to the company and the owner to seek help; Organize accident investigation and summarize emergency experience and lessons learned from the accident; Be responsible for formulating and revising the pre-plan; After the emergency rescue team being set up, organize drills and urge the personnel to prepare corresponding measures for major accident and all kinds of necessary preparations for emergency rescue(The emergency center should be set up in the HSE department).

9.3.9.2.2 Duty of the Commander-in-Chief

Take overall control of the emergency rescue for this project.

9.3.9.2.3 Office of the Emergency Command Center

As a daily administrative body(the HSE department should take care of the office of emergency command center), its duties include: implement the guidelines and policies about the emergency operation of sudden accident given by the superior officers, and carry out the emergency plan for sudden accidents; be responsible for the receiving, examining, processing, delivering, notification and reporting of emergency information about sudden accidents; coordinate with,

supervise and urge all the team members in the emergency command center of sudden accidents to prepare for emergency rescue; organize emergency rescue training and drills regarding sudden accidents in accordance with the company's arrangement and deployment. During emergency response, collect information and come up with report and suggestions timely; Deliver and execute all the decisions and orders from both the leaders and emergency command center, then examine the executive condition and report; carry out any other related decisions made by the emergency command center after the emergency state being terminated. The emergency command center should carry out works by complying with the principle of dividing works according to the project and taking respective responsibilities. The person in charge should assure each person of their respective duties and obligations. Taking the crisis management principle as standard, the person in charge should reinforce management and treat all types of work in a serious and responsible way by adhering to the related management responsibilities.

9.3.10 Precaution and Early Warning

9.3.10.1 Monitoring of Dangerous Points

Staff of the emergency command center should keep their phones open 24 hours a day and ensure smooth communication; field management should be strengthened by operating in strict accordance with the safety management regulations and implementing the precautionary measures so as to reduce violations and avoid accidents. Field monitoring should also be strengthened. Besides the full-time safety guards, each of the operation and, maintenance team should also arrange some part-time safety guards to take overall control during the productive process; implement the regulations about patrol inspection, regular inspection and maintenance on the productive machines and safety tools so as to ensure safe operation and completely wipe out the unsafe factors of production.

9.3.10.2 Precautionary Actions

Hold regular meetings monthly to conclude and analyze the safety operation and come up with instructions and requirements for the safety work of the next month. Report the related information collected recently to both the company and the owner. Inspect carefully to find out hidden danger and assure the processing rate of related problems. Discuss about how to deal with critical incidents.

9.3.10.3 Emergency Response

The first person who finds out or receives the information about a sudden accident should inform the emergency command center office or the commander-in-chief as soon as possible. After being informed, the office or the chief commander then should start the emergency measures. While organizing the early-stage processing, the person should inform the related departments immediately and find out details of the events. As for serious accidents, the emergency command center can decide to make an emergency call for help.

9.3.10.4 Submission of Information

At the beginning of the accident, self-rescue emergency measure is recommended to prevent the accident from getting worse. Meanwhile, the emergency command center should report the situation to the owner. Content of the report should include: basic information about the accident, including related equipment or name of the facilities; time, location, scale, brief course, persons involved, damage degree, casualties and measures taken etc.; cause analysis, judgment of the nature, assessment of the effect degree and so on.

9.3.10.5 Information Passing

The emergency command center office will coordinate with other related departments to transfer the information about the sudden accident through phone call, fax, network and so on so as to pass the information to the emergency center of related departments.

9.3.10.6 Response Program

After receiving the alarm message, the emergency command center should start the emergency plan for production safety accident immediately. All the members in the emergency command center should get to the accident site without any delay and perform their own duties. At the early stage of the accident, self-rescue measures should be taken to prevent the accident from getting worse. According to the situation, the emergency command center decides whether to make the emergency call for social help and report to the group company as well as other related departments. Content of the report: general situation about the unit; time, location, situation on the site, brief course, casualties and measures taken, etc.

9.3.10.7 Rescue Activities

The emergency rescuing and maintaining staff should cut off the power supply and clear away other flammable and combustible things on the accident site so as to prevent the accident from spreading. While rescuing the wounded and the property, attention should be paid to protect the site of accident. If the accident site has to be changed because of rescuing the wounded and property, preventing the accident from spreading or evacuating the staff, etc., mark the site and take pictures. Keep the physical evidence from the accident site in good state. The emergency command center should make all efforts to organize rescuing work. And the rescuing workers should act by complying with the orders and keep calm during the rescuing process.

9.3.10.8 Measures for Emergency Support

Staff of the emergency command center should keep their phone open 24 hours a day to ensure the smooth communication and information. The emergency rescuing team should study further and enhance related trainings so as to improve their self-rescuing and mutual-helping abilities. Necessary expenditure should be set aside as guarantee for emergency supplies so as to assure the fund requirement for emergency rescue.

9.3.11 Training and Drill

9.3.11.1 Training

Train the staff about laws and regulations regarding the emergency rescue of sudden accidents through face-to-face instruction, notice and so on. The training should cover prevention of accident and disasters, avoiding risk and disaster, common sense about self-rescue and mutual-help; besides, the training should also include knowledge about basic treatment to equipment and facilities. In this way, safety awareness and awareness of public responsibility of all the staff will be heightened; and the staff's capability of emergency rescuing, risk avoiding as well as self-rescuing will also be largely improved.

9.3.11.2 Drill

According to the regulations, an emergency rescue drill with all staff involved should be organized once every year. Keep record of the drill and conclude about it. A written summary report should be formed.

9.3.12 Operation Management Conducting Plan

9.3.12.1 O&M Daily Management

Daily Production Meeting: the tech support department will hold the meeting attended by the project manager and relevant personnel from various departments; the production of the previous day will be reported in the meeting and the production arrangements of this day will be made; production problems will be dealt with under the cooperation of different departments.

Monthly Production Meeting: the vice project manager will hold the meeting monthly to analyze the production of the previous month including production indexes, equipment reliability, unit abnormity, defects and problems and arrange the production of next month.

Annual Production Plan: in August the project department is responsible for compiling annual production plan for the next year; at the beginning of every year, annual production index, safety control index and expense quota shall be given to every department and shift; at the end of the year every department and engineer shall summit Annual Department Report and Major Department Report to the project department and the project department shall summit Annual Report to the Owner according to the contract.

Safety Inspection: periodic safety inspections and anti-accident measure inspections shall be conducted every year; pertinent safety inspections shall be conducted to make sure the safe and stable production of the units according to the safety production conditions and the requirements of the Owner.

9.3.12.2 Operation Management

U Energy will make sure the safe and stable operation of the units by operation plan management, panel monitoring management, equipment patrol inspection management, equipment regular test rotation management, operation record management, equipment fault management etc.

Build the production and maintenance indicator management system, construct energy saving inspection system, enhance benchmarking management, take benchmarking management as the method, find out the problem and the gap, make sure the measures, and build firm foundation for unit economic operation.

Manage the equipment and improve the equipment's health level. so the operators of the equipment should carefully find out the defect and hidden danger of the equipment, kill the defect, do the best on equipment maintenance with plan, implement the equipment managing principles of 'repair what should be repaired and get it repaired, and improve the equipment's health level.

Pay attention to abnormities analysis, analyze the abnormities in unit operation, find out the reasons with the raw data, parameters change and abnormities, try to solve the problem in primary period, and improve the economic efficiency of the unit.

Enhance the technical management, carry out the technical inspecting work, make the annual technical inspection plan as per professional inspection rules and regulations in order, and insure both safety production and economic operation.

Find out the hidden danger, make anti-accident measures, and kill the hidden danger in primary period.

Pay attention to adjustment, adjust the equipment carefully and frequently, master the operation characteristics, and improve the economic efficiency of the unit gradually.

Enhance the training, do more on-site practice for emergency, and improve the practical operating level and emergency treating ability of the operators. Make targeted training plan for new unit and new technology, and use the methods including technology lecture, questioning and on-site practice to improve the skill level of the staff.

9.3.12.3 Maintenance Management

Maintenance divided into schedule maintenance and routine daily maintenance. Maintenance plan include equipment minor repair, intermediate maintenance and major overhaul; Routine daily maintenance must be conduct properly and correctly, ensuring unit safety and stable operation.

9.3.12.4 Equipment Periodic Maintenance Management

Equipment periodic maintenance is an effective measure for improving the equipment working condition, making equipment to be in a good working state and standby state, eliminating the environmental factors that can influence the safe operation of equipment, making passive eliminating defect to become active maintenance, decrease the happening probability of equipment defect, preventing accident, lowering shutdown time of unit, lengthening working life of equipment, improving work efficiency of equipment, reducing maintenance cost and insuring safety production.

The equipment master management system should be used for equipment maintenance. The master of equipment should do the tour and inspection at least once to the equipment every day and find out the problem.

When doing the maintenance for equipment, workers should strictly follow equipment oil-feeding management including the part, period and method of oil-feeding, oil type and standard. The following table is an example of standard form for equipment oil-feeding.

Equipment Name			Model Number	Date Code		Y-Year M-Month W-Week D-Day		
No.	Part Requires Lubrication	Type and Brand of Lub. Oil	Lubricating Mode	Oil Change Standard		Standard of Topping Up Oil		Responsible Department
				Capacity of Oil	Oil Change Period	Capacity of Topping Up Oil	Oil Top Up Period	
1								
2								
3								

Make periodic maintenance manual for each equipment. The maintenance manual should cover the item, content, measure, period and standard of maintenance. The maintenance worker should do the periodic maintenance as per the manual. The following table is an example of periodic maintenance log sheet.

Equipment (Device) Name		Spot Check Mark	○— Spot Check in Operation △— Spot Check in Stop	Stop Check Period Mark	D–Day W–Week M–Month Y–Year	
Standard Number	Version Number	Maker	Date	Check	Permit	
No.	Spot Check Position and Item	Spot Check Content	Standard	Spot Check Period	Spot Check Method	Spot Check State
1						
2						

9.3.12.5 No Leakage Management

No leakage management is for water, gas, air, and oil leakage of equipment, pipe system, and inside leakage of valve. Solve the leakage problem can effectively improve the economic efficiency and cleaning situation of the unit.

The operation department and maintenance department should count the seal point of unit, make no leakage management regulation including counting regulation for seal point, checking standard for leakage point, calculating method for leakage point, and examining method for leakage point.

The operation department should organize a no leakage check every month for promoting the no leakage work.

9.3.12.6 Social Responsibility of Enterprises

SEPCOIII is enthusiastically involved in nurturing the local educational, cultural and developmental resources at its global construction locations and has been taking great efforts to integrate itself with local communities. These humanitarian activities have won praise from SPECOIII stakeholders at every level in many countries.

SPECOIII's underlying operating philosophy for international projects is based on utilizing the best local resources available and providing thousands of new jobs and technical training for the indigenous residents. SPECOIII's primary contribution of efficient power generation thereby has two very direct and secondary benefits on local human welfare: an indelible positive impact on the community's vocational human resources and, accordingly, brighter prospects for its residents for future economic prosperity.

The CSR activities and principal of U Energy are shown in Appendix-11.

9.3.12.7 Recruitment of Local Staff

U Energy will hire a certain number of local staff according to the staffing requirements of the unit's operation, and shall carry out the safety and technical and other trainings for the local employed staff, so that they can master the various knowledge and skills of the power plant operation and maintenance, and to gradually realize the localization management. The recruitment process is as follows:

Responsible department	Flow chart	Implementation step	Working standard
Employment department	Talent Demand Plan	The staffing department fills in the "staff demand application form"	Should be practical, Administration and getting ready
Plant Manager	Review	Leader's approval	Does the Company's leader approval meet the requirements
Admin. Department, employment department	Prepare the recruitment implementation plan	Prepare the recruitment implementation plan	HR department communicates with the employment department to determine the recruitment needs and related requirements.
HR supervisor	Information delivery and collection of resumes	Publish job information, collect resume and shortlist it	Recruitment channels must be matched with the nature of the post; the posted information conforms to national laws and regulations; screen the resumes in strict accordance with the job requirements.
Admin. Department, employment department	Written examination and interview	Written examination and interview	Candidate registration form is unified, conduct the unified interview, and set the principle of avoidance
Recruitment team members	Interview assessment	Interview evaluation	Determine the results of the interview evaluation; inform the personnel (the Company decides to hire) of the medical inspection notice, and issue the notice of employment.
Admin.	Employment	Hiring	Issue the notice of employment in three working days; sign the personnel

Department			supplementary agreement
Admin. Department	Physical examination and registration of new employees	Staff physical inspection and registration	Determine the physical examination items per the needs of the project, and implement physical examination; the qualified personnel after physical examination shall complete the registration procedures and attend the pre-job training.
Admin. Department	Probation	Staff probation assessment	The probation period will be three months and decide to keep or not as per the assessment results.

9.3.12.8 New Employee Training

In order to better implement the power plant operation and maintenance, it is need to develop the training plans at the production preparation phase, organize the production staff training in time, and execute the trainings by stage, per the plan and based on the discipline.

9.3.12.9 On-job Training

1) Only after the on-site training staff pass the training assessment, can they be assigned to the project site. The staff must attend the safety training, job theory training, on-site follow-up study, pre-job examinations, and internal examination organized by the project department; after passing the exams, the staff can ultimately obtain the formal qualification for post. During the execution of the operation and maintenance contract, the project department shall implement the regular training and examination system and continuously improve the technical level of the operation and maintenance team.

2) The fixed-post staff must pass the exams and obtain the qualifications before they can operate; the post operating shall follow the principle of gradual and orderly procedure. Strictly implement the post management system. The operation staff shall follow the trial post responsibility of tour operator, vice shift engineer and the main shift engineer, and complete the operating process from the site equipment inspection, meter reading, fill in records, assisting the operating, and independent operating, etc. The maintenance staff shall follow the trial post responsibility of the maintenance worker, technician and team leader, and complete the process of the on-site inspection, repair and maintenance, etc., for the site equipment. The site probation post period is three months, and then the staff shall attend the theory plus practice exams for fixed-post; according to the examination results, it is to determine the formal post, or degrade the post or continue to learn.

3) According to the actual situation of the project site, led by the project department, the operation and maintenance department shall implement the specific daily training. The department shall prepare the detailed training plans and training programs, and determine the teacher and teaching methods one week in advance; the instructor prepares the training in advance according to the course; the trainees prepare and exchange the training in advance, so that the trainees attend the training with questions in mind, so as to improve the quality of training.

Item	Training requirements	Training content
Safety Training	Once a month	Safety regulations, operation regulations, and twenty-five countermeasures
Technical examination and	Operation and maintenance	The contents and the form can be varied: such as the back painting system diagram, repair/maintenance quality standards, safety measures, fill in two tickets, and

explanation	1 time/ person / month	accident handling, etc. Technical examination is assessed by the team trainer, shift leader or professional engineer, and the results are recorded into the "technical examination explanation book"
Accident prediction	Operation and maintenance 1 time / on-duty (shift) / month	The on-duty supervisor (shift leader) or the trainer prepare the exam paper and organize all the on-duty (shift) or designated post staff to put forward the preventive measures and handling comments, and keep it in the "accident prediction record".
Anti-accident drill practice	Operation: 1 time /on-duty (shift)/ quarter; 1 time/ whole plant	According to the seasonal, frequent or special safety inspection problems detected, and the situation that the new operation may occurs, organize the staff to practice the drill on the simulation machine or on-site, and record the results into the "anti-accident drill record book."
Inspection/ repair explanation	2 times /shift / month, at least 2 hours each time	The content should be combined with repair/ maintenance items, the repair/maintenance techniques, and process quality requirements, etc., and be recorded in the shift/ team "Inspection/ repair explanation"
Technical question and answer column	Operation and maintenance 1 period / class (value) / month	The trainer shall combine with the actual production, put forward a number of technical issues, and appoint the person to answer within the limited time; the trainer shall organize special personnel for assessment, publish the exchanges, and store it month by month.

9.4 Environmental Monitoring Plan

9.4.1 Construction Phase Monitoring Parameters

Noise level monitoring:

Use of heavy construction equipment may increase the noise level at the work location as well as near the school and residential buildings adjacent to the project site. Therefore, comprehensive noise monitoring during different stages of construction is essential.

Process waste monitoring:

Records of generated process wastes should be kept according to the regulations concerning types of waste. Registration sheets for hazardous waste and for process non-hazardous waste should be maintained.

Health status monitoring: Thiri Mingalar Bawdi Meditation Center (Yeikthar), Muslin Youth Center and School are very close to the construction site. The school children and elder people are therefore highly vulnerable to noise, dust and vibration effect. A health baseline of school children ad elder people from nearby the project site should be prepared before the construction activities begin. During the construction phase, health status of these people and children should be regularly monitored and compared with the health baseline. Mitigation measures should be taken if any problem is detected. There is a well - organized health clinic within the project compound.

Table 9.4-1 Monitoring plan during construction phase of the project

Issue	Parameters	Monitoring Frequency
Noise level	Noise at different locations	Every week, particularly during operation of heavy equipment
Process waste	Solid waste	Every week
Health	Health status of school children	Once every 3 months by own clinic developed by UREC at project site

Note: Actual monitoring time and location will be decided by MOECAF. The Contractor will be responsible for carrying out the monitoring during the construction phase.

9.4.2 Operational Phase Monitoring Parameters

Table 9.4-2 provides a summary of the monitoring schedule for the operational phases, respectively for the proposed power plant. The proposed monitoring locations of ambient air and noise and surface water are shown in Figure 9.4-1.

Table 9.4-2 Monitoring Plan During Operational Phase of the Project

Issue	Potential impacts	Parameters to be monitored	Location	Measurement and Method	Frequency	Responsibility	Cost
General	Inspection of mitigation compliance	General compliance with operation manual	Project Compound	Visual inspection	Daily	Safety Production Department	Included in operation and maintenance cost
Air emissions	Stack emissions	CO, NO_2, SO_2, PM10, PM2.5 and temperature	Main Stack	CAMS*	Continuous	Control Room Team	Installation included in EPC Cost, Monitoring and Maintenance Cost
Air emissions	Ambient air quality	NO_2, SO_2, PM10, PM2.5 (24 hour average)	4 locations	Standard Method	Twice per Year	Third party environmental consultant	Monitoring and Maintenance Cost
River water	Surface water	Water temperature	At cooling water discharge point	Standard Method	Monthly	Safety Production Department	Monitoring and Maintenance Cost
River water		Arsenic, Cadmium, Total Chromium, Copper, Iron, Lead,	At wastewater discharge point	Standard method	Quarterly	Third party environmental consultant	Monitoring and Maintenance Cost

		Mercury, Oil and grease, pH, TSS, Total residual chlorine, Zinc					
Water Quality	Ground Water	Arsenic, Cadmium, Total Chromium, Copper, Iron, Lead, Mercury, Oil and grease, pH, TSS, Total residual chlorine, Zinc	5 locations	Standard method	Biannually (twice per year)	Third party environmental consultant	Monitoring and Maintenance Cost
Noise level	Increase in ambient noise levels	Noise level in Leq	5 locations	24 hours	Quarterly	Third party environmental consultant	Monitoring and Maintenance Cost
Waste	Block mud in drain and cause flooding	Amount and condition of mud in the drain Amount of solid waste and collection system	- Public drain - Plant compound	Visual	Twice per month	Third party environmental consultant	Monitoring and Maintenance Cost
Gas Pipeline	Accidentally Leakage	Flow and pressure	Central Control Room	Monitor Monitoring	Continuous	Safety Production Department	Monitoring and Maintenance Cost
Occupational health and safety	Accidents or incidents due to operation and maintenance activities	Health status and safety	Project Compound/ factory	As to be defined in the Health and safety Plan	As defined in Health and Safety Plan	Safety Production Department	Monitoring and Maintenance Cost
CSR activities	Community development	Activities	Local communities around the power plant	Number of beneficiaries and outcome of the activities	Periodic and need based	Administration department	Monitoring and Maintenance Cost

Actual monitoring time and location will be decided by Client. During the operation phase, the monitoring may be carried out by a competent Contractor.

** Continuous monitoring if a CAMS is established*

Legend:

Red color = Air & Noise Monitoring Points

Blue color = Ground Water Monitoring Points

Yellow color = Surface Water Monitoring Points

Green color = Only Noise Monitoring Point

Figure 9.4-1 Monitoring Location of Air, Noise And Surface Water

9.4.3 Costs for Mitigation Measures

Table 9.4-3, 9.4-4 and Table 9.4-5 show the estimated cost for mitigation measures for construction period, operation period and cost for environmental monitoring.

Table 9.4-3 Estimated Cost for Mitigation Measures during Construction Period

Activity/Issues	Potentially Significant Impacts	Proposed Mitigation Measures	Cost Mitigation Measure (USD)	Responsible Parties
Influx of workers	• Generation of sewage and solid waste	• Construction of sanitary latrine and septic tank system (one latrine for 20 persons) • Erecting "no litter" sign, provision of waste bins/cans, where appropriate • Waste minimization, recycle and reuse • Proper disposal of solid waste (in	24000	Contractor (Monitoring by HSE section and/or third party)

	• Possible spread of disease from workers	designated waste bins) • Regular medical monitoring of workers	7200	
Transportation of equipment, materials and personnel; storage of materials	• Increased traffic/navigation • Generation of noise, especially affecting the nearby school and residential areas • Deterioration of air quality from increased vehicular movement, affecting people in the surrounding areas • Wind-blown dust from material (e.g., fine aggregate) storage areas	• Scheduling of deliveries during non-school hours and after regular working hours • Protecting school going children from traffic hazard during construction phase, with installation of proper traffic sign andwarnings • Speed reduction to 10 km per hour within the school zones • Keeping vehicles under good condition, with regular checking of vehicle condition to ensure compliance with national standards • Watering unpaved/dusty roads (at least twice a day) • Sprinkling and covering stockpiles • Covering top of trucks carrying materials to the site and carrying construction debris away from the site	1650 11500	Contractor (Monitoring by HSE section and/or third party)
Construction activities, Including operation of Construction equipment	• Generation of noise from construction activities (general plant and access road construction), especially affecting the nearby school and residential areas	• Use of noise suppressors and mufflers in heavy equipment • Avoiding, as much as possible, construction equipment producing excessive noise during school hours and also at night • Avoiding prolonged exposure to noise (produced by equipment) by workers • Creating a buffer zone between the school, residential and construction site to reduce disturbance to elder people and to protect school children from health hazard • Not using equipment such as stone crushers at site, which produce significant amount of particulate matter	13450	Contractor (Monitoring by HSE section and/or third party)

	• Deterioration of air quality from wind-blown dust and possible use of equipment, such as stone (aggregate crushers) • Accidents • Spills and leaks leading to soil and water contamination • Employment of work/labor force	• Keeping construction equipment and generators in good operating condition • Using equipment, especially generators with high levels of emission control • Immediate use of construction spoils as filling materials • Immediate disposal/sale of excavated Materials • Regular inspection and maintenance of equipment • Environmental health and safety briefing • Provision of protective gear • Good house keeping • Proper handling of lubricating oil and fuel • Collection, proper treatment, and disposal of spills • Local people should be employed in the project activities as much as possible.		

Table 9.4-4 Estimated Cost for Mitigation Measures during Operation Period

Activity/ Issues	Potentially Significant Impacts	Proposed Mitigation and Enhancement Measures	Cost Mitigation Measure (USD)	Responsible Parties
Power Generation	• Emission from the power plant	• Using stack as specified in the bid document • Using low nitrogen oxide burners, as specified in the bid document • Installation of stack emission monitoring equipment for major pollutants. An in-house Continuous Air Monitoring Station (CAMS) may be established. • In stack design due consideration should be given to proper insulation • Planting of trees around the project site, especially along the boundary of the school and residential areas located close to the project site • Restrictions may also be imposed on installation of industries in the area that emit significant amount of particulate matter. •Cost for instrument and equipment of continuous flue gas monitoring system •greening cost •Low NOx combustion technology	3500 3000	Monitoring team (HSE section and/or Third party) Monitoring team (HSE section and/or Third party)
	• Generation of noise	• Provision of silencers for generators and turbines • Planting of trees around the project site • Regular plant maintenance • Regular noise monitoring, especially at the school and residential quarters located • Use of ear-muffs and ear-plugs by plant personnel working in the generator and turbine facilities of the plant • Good housekeeping • Proper construction and maintenance of wastewater disposal system for the plant premises • Ensuring proper storage, treatment, and	3500 3000 4000 12000	

		disposal of all solid waste • Monitoring of effluent quality from treatment plant (monitoring requirement and cost estimate provided) • Monitoring of river water quality (monitoring requirement and cost estimate provided) •Wastewater disposal		
Waste generation	• Inappropriate disposal of sewage causing environmental pollution • Generation of solid waste including sludge from demineralizer. • Possible water pollution			
Pumping water from Ngamoeyeik Creek	Mud from muddy water caused deposition of mud in the public drainage	Construction of settling pond in Ngamoeyeik Creek	Additional Budget (U Energy)	Monitoring team (HSE section and/or Third party)
Discharge the wastewater	Mud from muddy water caused deposition of mud in the public drainage	Design and Construct the new drainage way from Power plant to Ngamoeyeik Creek	Additional Budget (U Energy)	

Table 9.4-5 Estimated Cost for Environmental Monitoring during Construction and Operation Period

Issue	**Parameters**	**Monitoring Frequency**	**Cost Per Year (USD)**
Stack emissions	CO, NOx, PM10, PM2.5 and temperature	Continuous	5600
Ambient air quality	CO, NOx, PM10, PM2.5, temperature	Quarterly	5400 * 3 = 16200
River water (at cooling water discharge point)	Water temperature and DO	Once a month (March-May, October- December)	12 * 12 = 144
Ground water quality	Arsenic, Cadmium, Total Chromium, Copper, Iron, Lead, Mercury, Oil and grease, pH, TSS, Total residual chlorine, Zinc	Biannually (twice per year)	2850 *2 = 5700
Effluent quality (At wastewater discharge point)	pH, DO, Sulfate, TSS, TDS, BOD, COD, Total N, Total P Arsenic, Cadmium, Total Chromium, Copper, Iron, Lead, Mercury, Oil and grease, Total residual chlorine, Zinc	Quarterly	2850 *3 = 8550
Noise level	Noise at different locations	Quarterly	560 *3 = 1680
Occupational health and safety	Accidents or incidents due to operation and maintenance activities	As defined in Health and Safety Plan	240*12 =2880

CHAPTER X

PUBLIC CONSULTATIONS AND DISCLOSURE

10.1 Introduction

As noted in Chapter 6, the baseline socio-economic study was carried out to understand the current situation of people living in and around the proposed project site and to get feedback from them regarding different aspects of the proposed power plant project. The specific objectives of the socio-economic study were:

- to understand people's socio-economic condition
- to understand extent of people's access to current basic services
- to understand people's perception regarding possible impacts of proposed power plant project, and
- to get feedback from people regarding mitigation measures.

As noted in Chapter 6, in addition to questionnaire survey, the stakeholder meeting and several informal discussions have also been carried out for assessment of socio-economic impacts of the proposed power plant project. In Chapter 6, the baseline socio-economic condition of areas surrounding the project site has been described based on the results of the questionnaire survey. This Chapter presents the major findings from the discussions and meetings.

10.2 Source of Project Information

It is also important to survey whether the people in the project area know about the project or not. If they know about the project they can prepare for the impacts of the project. The survey results showed that most of the respondents have already known about the project.

The survey also stressed on the sources of information about the project which the respondents received. There are 3 main sources of information about the project received by the respondents. These are;

1. Information from authority,
2. Information from neighbours, and
3. Information from public media

The result of the survey showed that information about the project is distributed from authority and public media. But these are not directly informed to the affected persons. Therefore, it is necessary to give information about the project to the people who are living around the project area for full cooperation.

Another integral component of assessing a project's potential impacts is to identify and prioritize the project's stakeholders. Stakeholders are defined as those people, or groups, who are potentially impacted by or interested in the project. For some projects, the most vocal opposition may come from stakeholders outside the affected area. It is therefore important to include in the stakeholder analysis those groups or organizations that are not adversely affected, but whose interests determine them as stakeholders.

Following the initial identification stakeholders, a more in-depth look at stakeholder group interests has been undertaken to consider how they will be affected and to what degree, and what influence they could have on the project.

In this survey, preliminary stakeholder identification exercise has been undertaken. The exercise involved the following steps:

Interviews with project stakeholders in General Administrative Officer and Heads and Elderly persons of No.9 and No.10 (North) wards from Thaketa Township. Following the identification of project stakeholders, each stakeholder

group was assessed on the basis of their likely interest in, and influence over the project. Focus Group Meetings are conducted afterwards. The stakeholder map provides a visual representation of project stakeholders.

During the present study, high interest and low influenced group, especially of local people are analyzed as principal component for the management of the developer.

10.3 Public Consultation Meeting

The social impact assessment team visited project area on 9th April 2013 and 29th April 2013. A series of meetings were conducted as detailed in below.

No.	Date	Place of meeting	Participants	Meeting Arrangement
1.	9.4.2013	Thaketa Gas Turbine office	Officer, Thaketa Gas Turbine and REM Company	REM Company
2.	9.4.2013	GAD Office, Thaketa Township	Township officer and REM	REM Company
3.	10.4.2013	No.10 (North)Ward	Respondents and REM	Head of No.10(N) Ward
4.	11.4.2013	No.9 and No.10(N) Ward	Respondents and REM	Head of No.9 and No.10(N) ward
5.	29.4.2013	GAD Office, Thaketa Township	Township Administrator, GAD, Thaketa Township, Elderly Persons of No.9 and No.10(N) wards and REM	REM Company

The list of participants attended in the meetings, questionnaire form and power point presentation of PCM 1 are shown in Appendix - 9.

10.3.1 Attendance List

About 15 stakeholders (of the High Interest, Low Influence Group of Stakeholder Map) and 6 REM consultants attended the meeting.

1) General Administrative Department

2) Electricity Department

3) Two persons from Township Supporting Committee

4) (9) Ward Administrator

5) (10 - South) Ward Administrator

6) (10 - North) Ward Administrator

7) (2) Ward Administrator

8) (3) Ward Administrator

9) (8) Ward Administrator

10) (9) Ward, 2 persons who are interested in.

10.3.2 Meeting Minutes of Public Consultation

Time	9:00 AM – 10:00 AM
Date	29 April, 2013
Venue	Thaketa Administrative Office, Thaketa Township, Yangon Region.
Agenda	**(1)** Opening Ceremony **(2)** Explanation on the project by REM Team Leader **(3)** Questions and Answers **(4)** Closing Ceremony
Agenda (1)	**9:00** - Opening Ceremony
Agenda (2)	**9:05** - Explanation on the project by REM Team Leader Team leader explained about the objectives of the project, detailed information on the project, plan map of the project, production system and protection system, the role of EIA and proposal to set up CSR office. To distinguish the project facts and figures, a PowerPoint presentation (in Myanmar Language) was applied by using LCD Projector.
Agenda (3)	**9:35** - Questions and Answers
Question: **U Hla Kyi** (9 ward, Head of Ward)	When will the factory construction finish?
Answer: **REM**	We don't know at this time but this project is joint venture with Government.
Comments and Suggestion: **U Hla Kyi** (9 ward, Head of Ward)	We worried about the noise pollution. Plesase reduce noise pollution and air pollution. The big trucks are always running across the main road and very dangerous for children and street walkers.
Question: **U Hla Kyi** (9 ward, Head of Ward)	Who owned this project? Government or Private?
Answer: **REM**	It is B.O.T project and joint work with UREC.
U Hla Kyi (9 ward, Head of Ward)	Is it possible to distribute the information about the project to the villagers?
Answer: **REM**	Photocopies of Project Presentation Handouts would be distributed through the General Administration Office.
Agenda (4)	10:00 – Closing Ceremony

Photo Records

Presentation and Discussion

Presentation and Discussion

10.3.3 Meeting Minutes of Public Consultation at Thirimingalar Monastery

Time	9:00 AM – 10:00 AM
Date	10 April, 2013
Venue	Thirimingalar Monastery, Thaketa Township, Yangon Region.
Agenda	(1) Opening Ceremony (2) Explanation on the project by REM Team Leader (3) Questions and Answers (4)Closing Ceremony
Agenda (1)	**9:00** - Opening Ceremony
Agenda (2)	**9:05** - Explanation on the project by REM Team Leader Team leader explained about the objectives of the project, detailed information on the project, plan map of the project, production system and protection system, the role of EIA and proposal to set up CSR office. To distinguish the project facts and figures, a PowerPoint presentation (in Myanmar Language) was applied by using LCD Projector.
Agenda (3)	**9:35** - Questions and Answers
Suggestion: **Monk**	Thank you for your project information. I don't refuse this project because this project area is a disposal area and we cannot use it. How about my monastery? It will be moved to another place? If it is necessary to move to other area, we agree with it.
Administrators (9 and 10 (North) Wards)	It is needed to provide the following requirements of the local people. - Water scarcity - Fly-proof toilet - Good drainage system - Clinic - Library
Agenda (4)	10:00 – Closing Ceremony

Photo Records

Thirimingalar Monastery

Discussion

Discussion

Thirimingalar Monastery

Interview with respondents in No. 10 (North) Ward

Interview with respondents in No. 10 (North) Ward

10.4 Public View on Transport in the Project area

According to the result of the survey, there are three main bus lines passing through the project area. These are,

(1) No.146 bus line from South Dagon,

(2) No.42 bus line from Yuzana Garden,

(3) No.89 bus line and

(4) No.34 bus line.

No.34 bus line started from the terminal near the Gas Turbine Project area and there are 34 buses in that line.

The main road is Ayeyarwun Road. Buses from public passenger bus lines and trucks carrying heavy logs passed through this main road. Trucks carrying heavy logs mostly pass the project area during the dry season between February and March. These timber trucks mainly carry teak and hard woods. Vacant trucks have 8 tonnes in weight and 15 tonnes when they carry the logs. Therefore, these trucks gave so much trouble for the road in front of

the project area. Moreover, 30 to 40 trucks regularly enter to the project area and about 50 trucks regularly go out from the project area.

10.5 Public Opinion on the Project

To access the public opinion, some questions were set up and asked to respondents in the project area.

10.5.1 Awareness of Nature Gas-Combined Cycle Power Plant

About 66 percent of the respondents noticed on Nature Gas-Combined Cycle Power Plant and among them 80 percent of answers mentioned that there would be no change in the existing environmental conditions due to the power plant. (FIGURE 10-1)

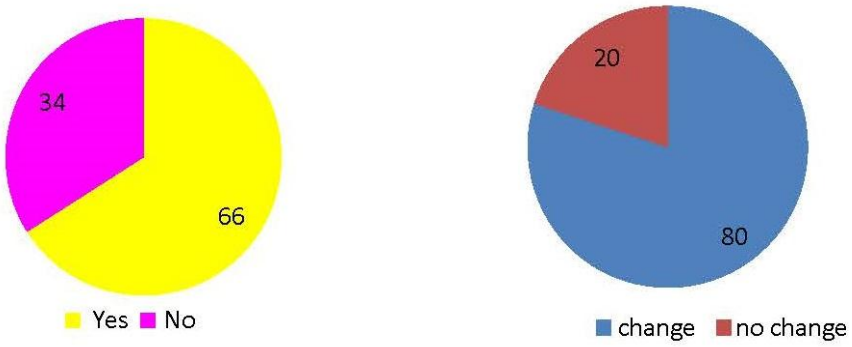


Figure 10-1 Receiving Information about the project

Their considerations on the improvement of the project are concerned with general development, job opportunities, better environment and availability of electricity supply. More than 30 percent of respondents from No.9 and No.10 (North) wards considered that they can access more electricity supply which is generated from their power plant project. (FIGURE 10-2)

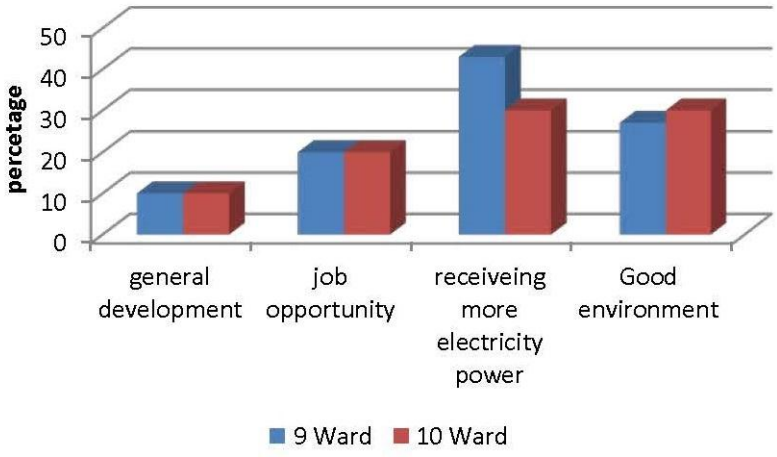


Figure 10-2 Suggestions of Respondents

10.5.2 Relation of Noise Problems to Combined Cycle Power Plant

According to the respondents there would be some possible noise, smell and fire problems related to Nature Gas-Combined Cycle Power Plant. These include scary on the terrible sound from the plant, mental effect of a loud sound produced by machine processes, afraid of possible fire accidents and the foul smell from gas leakage from the pipes.

10.6 Overview on the project

Generally, the respondents from the project area are highly satisfied (96 per cent) and not satisfied (4 per cent) on the project. From the view point of business, 98 per cent of respondents are highly satisfied and 2 per cent are not satisfied on the project.

Respondents of the survey from this Project are very satisfied and satisfied on the project related to social welfare, environment, social status, socio- economic conditions, education and health status. However, 2 per cent of the respondents are in neutral view on the project for aspects of socio-economic environment.

Most of the respondents are satisfied with the overviews of the project on their region and most of the respondents from No.9 and No.10 (North) wards fully satisfied with the project.

Recommendation

Based on the survey results, it is recommended to;

1. Operate the plant by using modernized techniques,
2. Reduce a terrible sound from the plant,
3. Eliminate a loud noise produced by machine processes,
4. Prevent possible fire disaster, and
5. Maintain the gas pipes from unnecessary leakage.

In order to these precautions, stakeholder engagement plan (SEP) including grievance management plan is established as described in Chapter 9 and it is necessary to appoint SEP manager for public consultation on possible impacts of the plant. U Energy Thaketa Power Co., Ltd. will communicate this procedure to its external stakeholders to raise awareness and offer transparency of how stakeholders can voice their grievances. Various channels for external stakeholders to vocalize their grievances formally include:

Telephone:	Stakeholders can call U Energy Thaketa Power Co., Ltd.'s head office on 095018038 and request to speak to a stakeholder contact officer.
Email:	Grievances can be sent to dongfan@urecei.com
Face to face:	Stakeholders can voice their grievance to any U Energy Tharketa Power employee who will then escalate using the correct process.

10.7 Public Disclosure and Future Consultation Plan during the Operation Phase

The proposed project is planned to implement on BOT basis. So, the permission is needed to access following activities and it has to be asked from Department of Electric Power Planning, Ministry of Electricity and Energy.

Public consultation meeting (PCM) and public disclosure (PD) offer an opportunity for people to participate in the decision-making process for project design, development, and implementation of the Project. It provides a platform for project-affected persons and different stakeholders to express their views on possible impacts of the proposed intervention on environmental and social parameters.

Information on the Project is disseminated to the public and then comments and opinions are collected to incorporate into the EIA study. So, stakeholder engagement plays an important role in the EIA process. Stakeholder engagement refers to a process of sharing information and knowledge, seeking to understand the concerns of others and building

relationships based on collaboration and partnership. It is a long-term process that requires the building of trust through open dialogue and the delivery of commitments.

10.7.1 Public Disclosure

Open meetings have to be carried out with residents of the affected communities (e.g., at schools, public/ religious or associations premises). Separate meetings also should be performed with vulnerable groups and local NGOs, as needed and appropriate. Brochures, posters, informative leaflets at key communities' centers, and General Administration Department, in particular to inform about the operation schedule and project information and forthcoming community meetings will be applied in disclosure of the project.

10.7.2 Public Consultation Meeting

The public consultation meeting of preparation of EIA stage was held in June 2019.

Table 10.7-1 Public Consultation Meetings for EIA Study

Stage	Date and time	Venue	Participants	Gender of villagers
EIA study stage	Tuesday, 25 June 2019 9:00 - 12:00 a.m.	Thaketa Power Plant Compound	73 persons	Men: 57 Women: 16 Total: 73

The List of Invitees for Public Consultation Meeting

Invitees	- Director, Environmental Conservation Department, Yangon Region - Officer, General Administration Department, Thaketa Township - Yangon Electricity Supply Cooperation, YESC - Yangon City Development Committee, YCDC - Officer, Department of Education, Thaketa Township - Officer, Irrigation and Water Utilization Management Department, Thaketa Township - Officer, Information and Public Relations Department, Thaketa Township - Members of Parliament (Pyithu Hluttaw, National Hluttaw and Regional Hluttaw) Thaketa Township - Heads of wards around the Project area - Local residents in and around the Project area - Other Organizations and individuals who are interested in the Project

Source: REM Study Team

Methodology and Approach

The project proponent was prepare the invitation letter together with the notice of the meeting in Myanmar language and announced to the invitees, who are residents around the proposed project, relevant governmental organizations, non-governmental organizations (NGOs), community-based organizations (CBOs) and anyone who are interested.

Basically, information on the meeting will be announced to the invitees one week in advance of the meeting by sending invitation letters to the respective invitees.

The meeting invitation was also announced in newspaper such as the Kyaemon (mirror) and Myanma Ahlin (New Light of Myanmar) for public participation.

The presentation and handouts are prepared and explained in Myanmar language. The opinions from the participants will be recorded in the question and answer session. Additionally, feedback forms will be provided to the participants so that those who are hesitant to speak out in public could share their views and comments.

Additionally, feedback forms were provided to the participants so that those who are hesitant to speak out in public could share their views and comments. Moreover, assistant staff were available to fill out the form in case the participant needs help in writing/reading.

Source: REM Study Team

Figure 10.7-1 Advertisement of Newspaper for PCM

Results of Consultation during Preparation of EIA Report

The summary of consultations is shown in Table 10.7-1. Pictures of the PCM are shown in Figure 10.7-1.

Table 10.7-2 Summary of Public Consultation Meeting at EIA Preparation Stage

Time and Date	9:00 am – 12:00 pm, 25 June 2019
Venue	Thaketa Power Plant Compound
Invitee	- Deputy Director, Environmental Conservation Department, Yangon

	Region - Officer, General Administration Department, Thaketa Township - Yangon Electricity Supply Cooperation, YESC - Yangon City Development Committee, YCDC - Officer, Department of Education, Thaketa Township - Officer, Irrigation and Water Utilization Management Department, Thaketa Township - Officer, Information and Public Relations Department, Thaketa Township - Members of Parliament (Pyithu Hluttaw, National Hluttaw and Regional Hluttaw) Thaketa Township - Heads of wards around the Project area - Local residents in and around the Project area - Myanmar Environmental Assessment Association (MEAA) - Myanma Ahlin, Kyay Mon (The Mirror) (Media)
Attendees	73 persons Men: 57 Women: 16 Total: 73
Agenda	9:00 – 9:10 Registration 9:10 – 9:30 Announce the meeting opening. Opening speech by U Kyaw Htwe, Parliament Member of upper house, Chairman of Local and Overseas Labour Affairs Committee, Chairman of National league for Democracy, Thaketa Township. Opening speech by Deputy Director U Aung Thu Kyaw of Environmental Conservation Department, 9:30 – 10:30 Daw Khin Ohnmar Htwe and Daw Lae Lae Win Principle Consultant, Resource and Environment Myanmar (REM), explain detail about the EIA report. 10:30 – 11:30 Question and Answer 11:30 – 11:45 Closing Remark by U Energy Thaketa Power Co. Ltd 11:45 – 12:00 Site Visit within the Thaketa Power Plant
Language used	In local language, Myanmar language
Q & A Session	In total 9 questions were raised from the participants and discuss with the Project Proponent and coordination organization.
Feedback Sheet	There are 8 comments in PCM sessions were submitted.

Source: REM EIA Study Team

Figure 10.7-2 Pictures of Public Consultation Meeting

Summarized questions and responses are shown in Table 10.7-2. As a whole, 9 questions were raised from the participants and discussed with the Project Proponent.

Table 10.7-3 Main Question and Response at PCM at the EIA Preparation Stage

No.	Opinion/Question	Explanation and Response
1	It is found that the discharge muddy water from the power plant into the drain and the drain is full of mud and flood into our Quarter since last year and we solved for removing these mud by	We will upgrade the technology for pumping water from the Ngamoeyeik creek. The pump water contains mud in dry season because water level is low. Now, we have installed the filter in pump station

No.	Opinion/Question	Explanation and Response
	ourselves. In this year, we cleaned again cooperate with the power plant representatives. How to solve this problem in future? We also noticed that the black water discharged from the power plant once per one or two week and caused fish dead so we also would like to know how to solve this problem.	to reduce the mud in pumping water. And also we will check the drainage before rainy season and maintain to drain thoroughly into the creek. We also cooperate with the relevant department to improve good drainage system.
2	The impact of both positive and negative of this power plant have been suffered in Ward 10 (North) since construction period. In every case the power plant manager ever helps to solve the problem. Last year, half of the compound of Basic Primary School 18 was flooded because of flooded water from main drains of power plant, Kwaytma Housing and ward 10 (north). I would like to know this will happen again and suggest to upgrade the drainage and collect these mud into the pond to settle so that there is no flooded muddy water in the quarters.	There have already installed filter in pumping station to prevent muddy water. The power plant manager will monitor the drainages to have good flow system in all seasons.
3	Have you installed the filter in pumping station?	Yes, we have already installed.
4	I would like to know the staff of 53 persons is from Thaketa or other places?	All are not from Thaketa and most of them are from Thaketa.
5	CSR is mainly concern on surrounding area of power plant and are there any plan for awareness raising program or capacity building for workers?	According to the advice of MOEE, CSR includes for the surrounding environment and the staffs of power plant. If the staff face with any problem, the company will fully support for that. According to the OHS Law, there is fully support for the overtime and one holiday day per week. Our factory treats all of the local and foreigner staff same and commitment to follow the Labour rules. There are plans to monitor well.
6	Are there any department or organization in your factory to comply with the labor law and standards by the Government? Do you have master plan for staff?	Our factory commit to comply labor law and rules of Ministry of Labour.
7	The electric power is being started to distribute in previous year, so what kind of distribution. Have you connected main distribution line? How do you set a price? Are there any price changes?	The electric power from Thaketa power plant connect with 66 kV Sub-station and distribute through 66 kV power transmission line to Yangon. The price for a 30 years is set up in power purchase agreement with the government and does not change in price during 30 years.

No.	Opinion/Question	Explanation and Response
8	I would like to know when third party reply the comment from ECD that make decision by themselves or not. Do you follow the YCDC Law, 2018? How does connect with YCDC for solid waste disposal from the factory?	The ESIA report has already submitted in 2014 and the report has been reviewed by MOCAEF and reviewed again by ECD in 2015 to 2018 and gave comments. REM has revised the report according to the ECD's comments. Today meeting is part of the ECD's comments and REM will incorporate this meeting result in revised ESIA report. And then, the report will be submitted to ECD.
9	How to take action when the project developer will not comply the law and rule?	This is very important also now face with this problem. Ministry of Natural Resources and Environmental Conservation issued EIA procedure in 2015. In this procedure, law enforcement is contained. In this EIA procedure, it also includes tax and penalty. There are two part to penalty. For the management part, this can solve within the department. If it cannot solve within the department, the department will sue at the court with the decision according to the permission of Ministry. And decision is made by the Ministry.
	Additional answer by U Energy Thaketa Power Co., Ltd.	U Energy Thaketa Power Co., Ltd. will perform as per suggestion and make the best for case of muddy water. Moreover, the retention pond for filtering mud from water will construct in the bank of Ngamoeyeik Creek cooperate with the Directorate of Water Resources and Improvement of River Systems. According to the meeting with GAD, members of Parliament and Township Development Committee, the drain from the power plant to Ngamoeyeik creek will construct as straight line to prevent flooding. In this case, U Energy Thaketa Power Co., Ltd. need permission from Myanma Railway to construct the drain. The domestic solid waste from the power plant will be collected separate dust bin and YCDC come and collect in designated days. All of the staff throw the waste systematically.

Source: REM

On feedback form, 8 opinions or comments were submitted by the participants. Major opinions or comments are summarized in Table 10.7-3. The most common opinion was supporting for the Project, while there were some opinions which should be considered to mitigate environmental and social impact.

The main concern of the stakeholders are:

- flooding caused by discharge of muddy water from the cooling tower plant

- job opportunity for people living in Thaketa Township
- disclose project activities to people living surrounding of the power plant

Regarding the muddy water discharge issues, U Energy Thaketa Power Co., Ltd. will discuss with relevant organization (e.g. MOEE and Myanma Railway) for drain design and developing mitigation measures including permission form Myanmar Railway.

Before doing any major activities, U Energy shall announce in notice board and meeting with people living nearby the project area for main activities of the project during operation period as timely manner.

Table 10.7-4 Major Comments in Feedback form at EIA Preparation Stage

No.	Opinion/Comment
1	- Display with LED board in front of the power plant about the monitoring of air quality, water quality and soil quality result. - Allow to visit school children, people from surroundings and NGOs to the site for viewing condition of power plant. - Supporting and collaboration with ward representative in order to get excellent flood protection and drainage system. - Solid waste (mud) from cooling system was discharged separately. - Holding stakeholder meeting once a year for the clearance of doubts. - Helping for the flooding that became because of the plant. - Planting trees and flowers to be beautiful plant surrounding. - Create and inform the job opportunities for the local people.
2	- The environmental impact assessment report prepared in accordance with section 63 of procedure and resubmit again - The potential environmental impacts of the project explained in this PCM should be reported back to the Ministry including surrounding villagers, local, organization and local administrative organizations, community-based organization and attendance list. - Examine ways the issue form this PCM and identity the mitigation measures and methods. Report back to the Ministry - Follow the comments from Ministry certainly and there are no separate comments for this.
3	- The mud is reaching to the Kwema housing so discuss with the plant and already drawn by manpower and also financial. Because of annually occur, bad water flow rate, Mosquito hideouts, and the mud ditch up to about 5 feet and its dangerous for the children so don't throw the mud into the drain or throw with suitable method. - The plant disposes black water weekly when this water reached to drain and the fish are died. So, I would like to request disposes after treatment or with pipe. - The power plant and Kwema housing only far with fence however Thaketa is including in the township when the electricity is cut out and pay the bills to Thaketa township but inform to Dagon Seikkan. Our housing is the most suffer these effect of cooling gas so please help our housing not to cut off the electricity.
4	- All of the project should be informed transparently to the surrounding people before the start of any project.

	- Should explain how to discharge wastewater. - There is no staff from nearby the project.
5	- Warmly welcome the project because of the supporting electricity for the country and people. However, priority is not to impact surrounding environment and people. - Don't cause the smell and hazardous that will affect the public health and people. - Not to make the warmer the atmosphere and sufficient and excessive noise emerged. - Prevent waste and wastewater from the plant that potentially affect the environment. e.g wastewater form the plant, mud and blocked of drainage. - After operation of the plant, the unexpected risk should be considered. - The best international practice shall choose for mitigating risk on the environment and the public if possible. - Ensure fair benefit between the county, company and public. - Consider to choose the best condition because it will face with throughout the generations
6	- Follow as per said in this meeting to avoid damage to the environment. - There is impact to any public, informed to the public quickly and act correctly. - Fair and equal the employees' rights. - Perform the better water flow to avoid of flooding and blocking of drainage in the ward.
7	- Welcome activities without causing damage natural resources. - Reuse the waste and support the technician not to damage the environment and human resources.
8	- U Energy power plant is located in our entire 10 north quarter situated in the drainage flow path. - So, do the better drainage system to avoid of blocking drainage in the rainy season. - I would like to request the plant do for the better water flow that were blocking in front of plant. - Work properly not to effect the environment because of the wastewater and mud form the plant. - To alleviate poverty by creating job opportunities mainly for the people near this power plant. - Inform and communicate with the township, responsible person when do anything that will expose to the out of power plant.

The detailed of public consultation meeting is presented in Appendix-10.

CHAPTER XI

CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusions

There is not necessary to have alternative plan but to add more power generating units to the existing power system of Myanmar within a shortest possible time frame. This is due not only to meet the increase in demand, but also due to old technology and aging of the existing power generating units, many of which will near their life cycle very shortly. Both, base load and peaking plants are necessary to be added to the system, so that the whole system can run economically and efficiently. Gas turbines are most suited for meeting the peaking demand and also have the capacity to run at continuous base load.

In accordance with the agreement with UREC, an Environmental Impact Assessment (EIA) of the proposed 93 MW (Phase 1) Combined Cycle Power Plant at Thaketa has been carried out, which included development of an Environmental Management Plan (EMP), covering both the construction and operational phases of the project.

In this study, the effects of the project activities on physico-chemical, ecological and socioeconomic (i.e., human interest related) parameters during both construction and operation phases have been assessed. The impacts have been identified, predicted and evaluated, and mitigation measures suggested for both construction and operation phases of the proposed power plant. The important physico-chemical environmental parameters that are likely to be affected by the project activities include air quality and noise level. The study suggests that most of the adverse impacts on the physico-chemical environment are of low to moderate in nature and therefore, could be offset or minimized if the mitigation measures are adequately implemented. Since the project site is located in a developed area that does not appear to be very sensitive ecologically, the impacts of project activities on most ecological parameters (e.g., floral and faunal habitat and diversity) are mostly insignificant.

Noise level has been identified as a significant potential impact of the proposed power plant during both the construction and operation phases. The noise generated from construction activities during the construction phase might become a source of annoyance at the school and residence site located close to the project site. Mitigation measures have been suggested in order to reduce noise exposure.

The project workers should not be exposed to the noise produced by the construction equipment for a prolonged period to prevent permanent hearing loss. A rotational work plan is advised for the workers and operators of this equipment. During the operational phase, high level of noise is expected to be generated within the confines of the turbine and generator installations. Prolonged exposure to such high level of noise may cause permanent hearing loss. Therefore, proper protective measures should be adopted during the operation and inspection of this equipment.

Some adverse impact during the operation phase of the plant will come from thermal emission and NOx and PM emission from the power plant. However, modeling study suggests that the effect of increased NOx and PM in the ambient air due to emission from the power plants will not be very significant.

The proposed plant will be constructed within a designated area beside the existing Thaketa gas turbine power plant compound. So there is no need for land acquisition. Additionally, there is no settlement in this designated area, and the area is not used for any income generation activities. Therefore, no population will be displaced and no resettlement will be required for the construction of the power plant, and no loss of income is associated with the proposed project.

During operation phase, no significant negative impact is anticipated on socio-economic environmental parameters. Significant positive impacts are expected due to improvement in power supply. This will reduce load shedding in Yangon city and contribute to the national economy. Well-being of the surrounding population, especially Thaketa town, will be significantly improved due to generation of electricity during peak hours.

During public consultations carried out as a part of the ESIA study, people welcomed the proposed power plant project at Thaketa. However, they recommended installing a plant of good quality, which will be able to provide uninterrupted power and will be able to keep anticipated air and noise pollution to a minimum level.

11.2 Recommendations

The environmental assessment carried out for the proposed combined cycle power plant (CCPP) at Thaketa Power Plant, suggests low to moderate scale of adverse impacts, which can be reduced to acceptable level through recommended mitigation measures as mentioned in the EMP. It is therefore recommended that the proposed 106 MW CCPP may be installed at the Thaketa Power Plant Complex, provided the suggested mitigation measures are adequately implemented. It is also recommended that the environmental monitoring plan be effectively implemented in order to identify any changes in the predicted impacts and take appropriate measures to off-set any unexpected adverse effects.

It is the obligation of the Client (UENERGY) to comply with present Environmental Management Plan (EMP) before commencement of work and a detail action plan should be ready in HSE Section of the Project. The detail procedures should cover the all affected environmental values, all potential impacts on environmental values, mitigation strategies, relevant monitoring together with appropriate indicators and performance criteria, reporting requirements and, if an undesirable impact or unforeseen level of impact occurs, the appropriate corrective action available.

11.3 List of Commitments

A consolidated summary list of environmental and social impacts and mitigation measures commitments that U Energy Thakeyta Power Co., Ltd. will be expected to adopt in order to manage and mitigate potential impacts associated with the project development is provided below in Table 11.1

Table 11.1 Project Key Commitments

Commitment Source	Commitment
Chapter 2 ESIA Report	China's Union Resources and Engineering Company (UREC) will follow National Law, By Laws, Regulations and Guidelines Relevant to Yangon Tharketa Combine Cycle Power Plant.
Chapter 2 ESIA Report - Pollution	China's Union Resources and Engineering Company (UREC) will specifically commit itself to the prevention of pollution through the implementation of processes, practices and techniques to avoid, reduce and control the creation, emission and discharge of any type of pollutant and waste.
Chapter 2 ESIA Report – Use of Natural Resources	China's Union Resources and Engineering Company (UREC) will specifically commit itself to minimize the use of consumptive resources and promote the reduction and recycling of waste products where possible.
ESIA section - Table 2.6-1 Air quality standard	China's Union Resources and Engineering Company (UREC) will follow NEQG standard for the ambient air quality.
ESIA section - Table 2.6-2 Industrial Wastewater Effluent Standard	China's Union Resources and Engineering Company (UREC) will follow Industrial Wastewater Effluent Standard of NEQG.
ESIA section - Table 2.6-3 Ambient Noise Standard for resident and industrial area at Operation Stage	China's Union Resources and Engineering Company (UREC) will follow NEQG standard for noise during construction and operation.
International Standard	China's Union Resources and Engineering Company (UREC) will follow World Bank Group and International Finance Corporation's Environmental Health and Safety Guidelines.
ESIA Section 3.4.2 Technical Specifications of Principal Machine	China's Union Resources and Engineering Company (UREC) will use with modernize machinery of multiple-shaft combined cycle unit, which is consist of Type 6FA Gas Turbines & Generator, one Heat recovery steam Generator, one Condensing Turbine under ISO condition and site actual annual mean meteorological condition for operation

	of natural gas power plant.
ESIA Section 3.5.5 Main criteria of water saving design	China's Union Resources and Engineering Company (UREC) will install the measure facility such as meter, control valve of water level to convenient manage and monitor, and to avoid polluting the water.
ESIA Section 3.5.14 and 3.5.17 Treatment of Domestic Sewage and Industrial Wastewater	China's Union Resources and Engineering Company (UREC) will install the domestic and industrial wastewater treatment units to comply effluent standards.
ESIA Section 3.6 HVAC system	China's Union Resources and Engineering Company (UREC) will construct the turbine house to install ventilation system with natural wind inlet and mechanical exhaust ventilation, Constant temperature and humidity air-cooled air conditioners.
ESIA Section 3.9 Ultra-Low Carbon Burner and DLN Combustion Technology for Power plant emission control	GE6F03, heavy duty, 18-stage compressor, Three-stage turbine featuring air-cooled design, cold end output, axial exhaust, DLN 2.6 combustion, SFC startup will be installed for air emission control. NOx mg/Nm^3 CO mg/Nm^3
ESIA Section 3.10 Electric generation process by turbine type	The flue gas will be exhausted from the exhaust chamber of the gas turbine, by way of transitive pass, tee damper, bypass chimney, and blind plate, into HRSG.
ESIA Section 3.11 Emission Control (Environmental Protection)	China's Union Resources and Engineering Company (UREC) will install the control measure for smoke pollution, HRSG system (Stack included in the system), Emission Load and Limit Value of Smoke Pollutant, Zero Ash Content for Total Emission and Limit Value of Air Pollutant in Project.
ESIA Section 3.5.8 Noise Level	China's Union Resources and Engineering Company (UREC) will control the noise level of cooling tower in maximum 85 dB within working place.
ESIA Section 9 Mitigation and management of impacts	China's Union Resources and Engineering Company (UREC) will comply with the management system for occupational health safety, environmental and social management plan such as; • Ambient Air Quality Management Plan • Drainage and Erosion Management Plan • Traffic Safety Management Plan • Noise & Vibration Management Plan • Waste Management Plan (hazardous and non – hazardous wastes) • Wastewater Management Plan (Sanitary Water) • Oil and Chemical Spill Contingency Management Plan • Flora and Fauna Management Plan • Emergency Response Plan • Community Emergency Response • Fire Emergency Response Plan • Emergency Response Plan for Explosion • Emergency Response Plan for Leak and Spill of Hazardous Materials • Emergency Response Plan for Structure or Equipment Failures • Emergency Response Plan for Injuries and Illnesses • Emergency Response Plan for Natural Disasters • Response plan for Severe Thunderstorm • Stakeholder Engagement Plan • Disclosure Plan • Grievance Mechanism Procedure • Support of relevant trainings • Evaluation and monitoring plan • Occupational Health and Safety Management Plan • Community Health Management Plan (Construction and Operation)

	• Community Development Plan • Workers' Accommodation Management Plan • Security Plan • No Leakage Management All management, environmental protection and HSE management system will be followed and complied with ISO 9001, ISO 14001 and OHSAS18001.
ESIA Section 9 Mitigation and management of impacts	Surface water must be saved from any harmful effluent emission and waste dumping from project site using Wastewater Management plan.
Possibility of employment opportunities	The labor recruitment policy must be formulated in such a way that local laborers can easily get chance of employment in the power plant project.
Occupational health hazard	Arrangement of PPE such as gloves, helmet, sunglasses and other tools, dress and uniforms for each worker so that the workers can keep themselves safe from any kinds of accident.
Waste generation and discharge to natural environment	Provision of waste management team with given responsibility of waste collection, hauling, disposal and overall management and the department must be vested under Health, Safety and Environmental Department.
Controlling impacts on water resources	China's Union Resources and Engineering Company (UREC) will manage to control impacts on water resources as followings; - Water reuse and recycling. - Water conservation program - Direct emission of harmful effluents and waste from power plant must be restricted. - Provide Closed system facilities to minimize emission of effluents from power plant area
Impact on ecosystem habitat quality and ecosystem health due to deposition fly ash during accidental release	Zero fly ash emission in the stack system will be installed.
Employment opportunities	The local labors will be recruited permanently and temporarily both technical and non-technical posts. Some posts should be reserved for the local workers. This recruitment may help to reduce the poverty status of the whole study area.
Working Environment	Proper training, PPE, awareness, warning signal for passerby and adoption of welding standard practice.
Maintenance Activities	Regular maintenance of equipment, careful handling, following safety procedure, labeling of chemical specification and potential hazards, keeping Material Safety Data sheet.
Operation	Safe design, regular inspection, continuous monitoring, computerized controlling system and monitoring. Installation of fire defense and fighting systems.
	Maintaining of the specific standard for all electric fittings and cables, insulation of covering of electric cable with noninflammable fire.
	Control system to monitor and regulate temperature, intake air, and furnace system. Monitoring fuel quality & safety system. Provision of firefighting and safety.
	Chemical use safety, Limited entry, use of PPE, available spill kits in case of accident, safety shower, eye wash and first aid facilities.
	Limited entry in storage, PPE, available spill kits in case of accident, safety shower, eye wash and first aid facilities.
	Keeping all safety & precaution measures in order, maintaining first aid & well-equipped primary health centre & training on awareness.
Occupational Hazard Assessment	China's Union Resources and Engineering Company (UREC) will comply the IFC EHS General Guideline (2007) and Occupational health and Safety (2018) for workers.
Side Development Plan	China's Union Resources and Engineering Company (UREC) will develop and implement Construction waste management, air quality management plan, acoustic management plan, and socio-economic management plan.
Management plan	China's Union Resources and Engineering Company (UREC) will develop and

	implement ambient air and acoustic management plan, natural gas transportation and handling plan, waste management plan, water resource conservation plan, waste water management plan, ecological management plan, greenbelt development plan, socio-economic management plan, specific hazard and risk management plan, and safety and emergency plan.
ESIA Section 9.4 Environmental Monitoring Plan	The compliance monitoring report along with the checklist should be indexed and annexed with the monthly and annual monitoring report. A format of compliance monitoring checklist will be prepared during detail design stage. It may be required to submit the annual monitoring report to Department of Environmental Conservation for renewing of the Environmental Clearance Certificate each year.
ESIA 9.3.12.6 CSR Program	China's Union Resources and Engineering Company (UREC) plan and reserve for cooperate social responsibility (CSR) (during operation period), two percent (2%) of yearly net profit of the project.
ESIA Section 11 Conclusion and Recommendation	China's Union Resources and Engineering Company (UREC) will develop ISO 9001 for management system, 14001 for environmental management system for better compliance with environmental protection and conservation for sustainable environment.

Appendix 6

CV of ESIA Team

Khin Ohnmar Htwe

Senior Consultant
Social Impact Assessment

Personal Data

Date of Birth	25 July 1965
Gender	Female
Marital Status	Married
NRC Number	12/ Ah Sa Na (N) 105339
Present Employment	Senior Consultant, R&E Myanmar
Postal Address	No. 1, Shwe Mann St. University Estate, University of Mandalay, Maha Aung Myay Ts' Mandalay
Contacts: Tel/ Fax/ e-mail	02-72615; 09-5190112 khinohnmarhtwe@gmail.com

Educational Achievement

MA (Geography), BA (Geography), Univ. of Yangon

Professional Experiences

Experience in Environmental Research	• Environmental Images of Rural People in Maubin Township, Ayeyawaddy Division • Assessing Cooperation among villagers before and after natural disaster in Maubin Township, Ayeyarwaddy Division • Traffic Survey for Myanmar-China Gas Pipeline Project (Myanmar Section) (with IEM Thailand Ltd.) (CNPC) (2009) • Social and Health impact assessment for Mong Hkok Coal-fire Power Plant (460MW) Project (Italian-Thai Development) (2010) • SIA of the Yeywar-Shwesaryan Power Transmission Line – Ministry of No.2 Electric Power (with Gunkul Power Systems Ltd.) (2011) • SIA of the Baluchaung-Shwemyo Power Transmission Line – Ministry of No.2 Electric Power (with Gunkul Power Systems Ltd.) (2011) • SIA of the Dawei Deep Sea Port and Industrial Development Project – Italian-Thai Development Co. Ltd. (with TEAM Consultant.) (in progress)
Other Professional experiences	Tutor, Department of Geography, University of Yangon Assistant Teacher, Shinpo Japanese Language School
Research Project and Work Concerning Lake Inlay	1.Analysis on Periodic Market System in Rural Shan State, The Case of Inle Lake (2003-2005) 2. Environmental Images and Conservation Practices of Rural Society, The Case of Inle Lake (2003-2005) 3. Spatial Seasonal Variation of Agriculture in Inle Lake (2003- 2005)

4. Adaptation to Nature: House Types and House Styles in Inle Lake (2007)
5. Adaption to Nature : House Types and House Styles in Rural Environment, Phase I, Inle Lake (Pet Research) (2008)

1. **General:**

Position Title and No.:	Director/Principal Consultant (Physical Environment)
Name of Key Expert:	Zaw Naing Oo (Mr)
Name of the Firm proposing the Key Expert:	Resource and Environment Myanmar Co., Ltd.
Date of Birth:	22nd March, 1968
Nationality:	Myanmar
Country of Citizenship/Residence:	Myanmar

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2. Education:	Diploma in Environmental Management M.Sc., Yangon University, 1998 (Geology/ Economic Geology) B.Sc., Yangon University, 1992 Environmental Management Systems Auditor/Lead Auditor Training Course (ISO 14001:2004)

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3. Employment Record relevant to the assignment:

Period	*Employing organization and your title/ position*	*Country*	*Summary of* **activities** *performed relevant to the Assignment:*
2009 to date	Director, Principal Consultant, EIA and EMP, Resource & Environment Myanmar Co., Ltd.	Myanmar	Management of multi-disciplinary planning, environmental monitoring and audit and environmental management projects
2007 – 2009	Project Manager, Soil Investigation Pte. Ltd., Singapore	Myanmar	Site Investigation for Downtown Line MRT Project, Site Investigation for Project C916- Construction of Station and Tunnel at Beauty World Station Reporting SI work and Rock Mass Quality for design and construction of MRT Station and Tunnel Additional SI Work for C-855 Tunnel Section Reporting for SI work for design and construction of Station and Tunnel, Supervise & reporting CPT test, Supervise and reporting geophysical works (resistivity and surface wave) along the tunnel line.
1997 – 2007	Demonstrator, Assistant Lecturer, Geology Department, Yangon University .		Practical works on petrology, aerial photo interpretation and remote sensing for undergraduate students Feasibility study, surveying, geotechnical investigation, geological mapping, data base and reporting of Ta-sang Hydropower project, Union of Myanmar Conduct lecture on Petrology and Mineralogy of Gold Deposit, Structural Geology, Remote Sensing and GIS Application in mineral exploration, Field leader for undergraduate geology students, field training in various parts of Myanmar, Geology and geotechnical investigation of upper Bu village multipurpose dam project, Union of Myanmar.
	Contact information for reference:	Soe Thura Tun, Managing Director of Resource & Environment Myanmar Co., Ltd. soethuratun@enviromyanmar.net	

4. Membership in Professional Associations and Publications: _ Myanmar Geosciences Society (MGS), Faculty Member of Myanmar Environment Institute (MEI).

5. Language Skills:

	Speaking	*Reading*	*Writing*
English	Good	Good	Good
Myanmar	native	native	native

6. Reference to Prior Work/Assignments that Best Illustrates Capability to Handle the Assigned Tasks

No.	*Title*	*Client*	*Poisson*	*Period*
1	EIA of Myanmar-China Gas Pipeline Project	CNPC IEM (Intern. Environmental Management Co. Ltd.)	Project Director	2009-2010
2	ESHIA of Mai Khot Coal Power Project	IPC (Italian Thai Power Co. Ltd.)	Project Director	2011
3	ESHIA of Upper Yeywar – Shwezaryan 230 kV Transmission Line	Ministry of Electric Power (1) & GK Power Systems Ltd.	Project Director	2011
4	ESHIA of Baluchaung- Shwemyo 230 kV Transmission Line	Ministry of Electric Power (1) & GK Power Systems Ltd.	Project Director	2011
5	Socioeconomic Assessment for Rakhine Region	Myanmar Engineering Society	Project Director	2012
6	Environmental Baseline Survey of Dawei Deep Sea Port and Industrial Development	Italian Thai Devlopment and Team Engineering Consultant	Project Director	2012
7	ESHIA of Thaketa Gas Turbine Project	BKB Co. Ltd.	Project Director	2012
8	SIA of Main Road Project, Dawei	Italian Thai Development and Seatac Group	Project Director	2012
9	ESHIA of Modi Taung Gold Project	National Prosperity Co. Ltd.	Project Director	2012
10	EIA of 500 MW CCPP at Hlawga	Htoo & HIE, China	Project Director	2012
11	EIA of MCC Cement Plant, Mawlamyaing	SCG Thailand & Pacific Link Myanmar	Project Director	2013
12	IEE for the Project of Manufacturing of construction materials and factory utensils (Welded H-Beams and Pipes)	Prime Metal Company Ltd.	Project Director	2013
13	IEE for the project of Manufacturing of Garment at Hlaingtharyar, Yangon	South Bay Manufacturing Co., Ltd	Project Director	2013
14	IEE for the project of Manufacturing of Garment at Intagaw, Bago	Hung Kiu (Myanmar) Garment Manufacturing	Project Director	2013
15	IEE for the project of Manufacturing of Garment at Pathein City	Hakers Enterprise (Myanmar) Co., Ltd.	Project Director	2013
16	IEE for the project of Manufacturing of Garment at Dagon South, Yangon	Myanmar Sein Pann Manufacturing	Project Director	2014
17	Environmental Impact Assessment of Shweli River II Hydropower Project	Hydrolancang International Energy Company Ltd. and KHIDI	Project Director	2012
18	Environment And Social Consideration Study on The Project for Rehabilitation of Education Colleges in the Republic of the Union of Myanmar	Yamashita Sekkei Inc. and KRI International Corp.	Project Director	2013

No.	*Title*	*Client*	*Poisson*	*Period*
19	Environmental and Social Information Collection Survey for the Project for the Strategic Urban Development Plan of The Greater Yangon	Nippon Koei Co., Ltd	Project Director	2012
20	Actual Environmental Survey for Feasibility Study for the Construction of Bago River Bridge	ALMEC Corporation, NIPPON KOEI Co., Ltd.	Project Director	2013-2014
21	Actual Environmental Survey for Feasibility Study for the Construction of Thaketa River Bridge	ALMEC Corporation, NIPPON KOEI Co., Ltd.	Project Director	2013-2014
22	ESIA for Baseline study of Thilawa Special Economic Zone Class A	Nippon Koei Co., Ltd.	Project Director	2013
23	Environmental and Social Survey for Environmental Impact Assessment Studies under the Project for Electric Power Development in the Thilawa Area	Nippon Koei Co., Ltd.	Project Director	2014
24	Survey for Preparation of Abbreviated Resettlement Plan for Feasibility study for the construction of new Thaketa and Bago River Bridge	Nippon Koei Co., Ltd.	Project Director	2013-2014
25	ESIA of Upper Yeywa Hydropower Project	Department of Hydropower Implementation (DHPI), Ministry of Electric Power (MOEP).	Project Director	2015

End of document

Present Position - Principal Consultant, Ecologist (Flora)

Name - Dr. Tin Tin Khaing

Date of birth - 13th August, 1966

Religion - Buddhist

Position - Lecturer

Department - Botany, Sagaing University

Education - B.Sc(Hons), Yangon University

M.Sc, Yangon University

Ph.D, Mandalay University

Home address - **Teacher Hostel, Sagaing University**

Phone No - **09 444036432**

Email - **tintinkhaing@gmail.com**

ESIA Experiences:

- **Floristic Study on Angiospermae of Kyaukse Township in Mandalay Region.**
- **ESIA study for Coal Fired Power Plant Project in Tachilaik Township, 2014**
- **ESIA study for 5000 ton/day Cement Project in Kyaukse Township, 2014**

Present Position - Principal Consultant, Ecologist (Fauna)

Name - Dr. Sandar Win

Date of birth - 30 April 1968

Religion - Buddhist

Employment record

Position - Lecturer

Department - Zoology, Kyaukse University

Education - Ph.D (Zoology)

Field Study - Environmental pollution and fish diseases

Responsibility - Teaching and guide to graduate and MSc (Supervisor)

Guide to Ph.D (Co-supervisor) and some research papers were writing.

Advisor of Fisheries Federation, Mandalay Region

Publication - Journal of Myanmar Academy of Arts and Science,
Vol (8)4, 2009, 2010
Universities Research Journal Vol (3)4, 2010

Home address - No 2/38, 66x16 Street, Nanshae Pyitawthar, Mandalay

Phone No - 09 402514981

Email - dr.sandarwinphd@gmail.com

ESIA Experiences:

- **Floristic Study on Angiospermae of Kyaukse Township in Mandalay Region.**
- **ESIA study for Coal Fired Power Plant Project in Tachilaik Township, 2014**
- **ESIA study for 5000 ton/day Cement Project in Kyaukse Township, 2014**

Chit Myo Lwin

Name of Consultant	-	Chit Myo Lwin
Present Position	-	Project Manager
Name of Firm	-	Resource and Environment Myanmar Co., Ltd. (REM)
Nationality	-	Myanmar
Profession	-	Environmental Geology
Date of Birth	-	19 September 1988
Years with Firm/Entity	-	2009 Nationality - Myanmar
Membership in Professional Society		- Myanmar Geosciences Society (MGS) - Faculty Member of Myanmar Environment Institute (MEI)
Detailed of Tasks Assigned		- Collect Environmental Baseline Data and prepare baseline data report - Manage baseline data team and co-ordination with Client

Profile

Mr. Chit Myo Lwin obtained his B.Sc. degree in geosciences and became professional geologist in Myanmar since 2009. At present he is a project manager of Sustainable Environment Myanmar Co., Ltd. He has six years of experience in the field of Geosciences and EIA, and currently he works as a project team leader of environmental baseline data collection team in an area of Environmental Impact Assessment and Environmental Management in various projects.

Professional History

2014 to date - Project Manager, Principal Consultant, EIA and EMP, Resource & Environment Myanmar Co., Ltd.

2013 – 2014 - Geoscientist and project coordinator in Siam Cement Company (SCG)

2009 - 2013 - Physical Environmental Consultant, Resource and Environment Myanmar Co., Ltd.

Geoscientist : Conduct project on gold mineral exploration in Ba Mauk Township (Upper Sagaing Region), Limestone exploration in Mon and Kayin States, geology and geotechnical investigation of Tanintharyi hydropower project, raw material exploration for cement in MCL cement plant (Mawlamyine) in Union of Myanmar.

Coordinator : Project coordinator between developer and contractors for cement plant (Siam Cement Plant in Mawlamyine) and negotiation with government and local people for project development at site as well.

Consultant : Physical environmental consultant in EIA surveys of different projects such as oil and gas sector, multi-hydropower project, gas turbine project, cement plant, city development, deep sea port project and so on.

Project Manager: EIA study for Kyaukse Cement Plant, Sittwe Reclamation for city development

Selected Relevant Experience in the Environmental and Social Impact Assessment, and Geoscience

Environmental Impact Assessment and Environmental Management on:

S/n	Project name	Owner of the project	Person to contact and telephone	Completion time	Remarks
1	Gold exploration in Bank Mauk Tsp.	Care Mineral Cooperation (CMC)	Than Tun (MD) 959 5151309	June, 2009	Submitted to Ministry of Mine
2	EIA of Myanmar-China Gas Pipeline Project	CNPC IEM (Intern. Environmental Management Co. Ltd.)	Ron Livingston (MD) 662 6366390	November, 2010	Submitted to Myanma Oil and Gas Enterprise
3	Geotechnical and geological surveys in Hydropower project at Taninthar yi	ITD (Italian Thai Development Co. Ltd.)		April, 2011	ITD (Italian Thai Development Co. Ltd.)
4	ESHIA of Mai Khot Coal Power Project	IPC (Italian Thai Power Co. Ltd.)	Vudtichai Eksangsri (CVO) 66 85 2495 655	October, 2010	Submitted to Ministry of Energy
5	ESHIA of Upper Yeywar – Shwezaryan 230 kV Transmission Line	Ministry of Electric Power (1) & GK Power Systems Ltd.	Zeya Thura Mon (MD) +(95-1) 502016-18	September, 2011	Submitted to Ministry of Electric Power Enterprise
6	ESHIA of Baluchaung-Shwemyo 230 kV Transmission Line	Ministry of Electric Power (1) & GK Power Systems Ltd.	Zeya Thura Mon (MD) +(95-1) 502016-18	November, 2011	Submitted to Ministry of Electric Power Enterprise
7	Socioeconomic Assessment for Rakhine Region	Myanmar Engineering Society	U Than Myint +95 9 5136467	November, 2011	UNDP Multi Hazard Project
8	Environmental Baseline Survey of Dawei Deep Sea Port and Industrial Development	Italian Thai Devlopment and Team Engineering Consultant	Dr. Sirinimit Boonyuen (MD, Env Unit) +662-509-9000 ext. 2305	May, 2012	Submitted to the Special Economic Zone Committee
9	ESHIA of Thaketa Gas Turbine Project	BKB Co. Ltd.	Dr. Sone Han (Local Rep./ Proj. Director) +95 9 5183631	May, 2012	Submitted to MIC
10	SIA of Main Road Project, Dawei	Italian Thai Development and Seatac Group	Pracha Jantarasarsophon tsiajao@yahoo.com	July, 2012	Submitted to the Special Economic Zone Committee
11	ESHIA of Modi Taung Gold Project	National Prosperity Co. Ltd.	Thiha Zaw Lin Project Director	March, 2012	Submitted to MIC
112	EIA of 500 MW CCPP at Hlawga	Htoo & HIE, China	Zhuang Jinxiang 18669086755 zhuangjx_love@126.com	Feb. 2013	Submitted to MIC
13	5000 t/d cement plant in Mawlamyine as geoscientist and coordinator	Siam Cement Company	Mongkon Pornchunchoovongmongkonp@scg.co.th	Oct 2013-May 2014	
14					
15	ESIA for Baseline study of Thilawa Special Economic	Nippon Koei Co., Ltd.	-	December, 2013	MOECAF

	Zone Class A				
16	Environmental and Social Survey for Environmental Impact Assessment Studies under the Project for Electric Power Development in the Thilawa Area	Nippon Koei Co., Ltd.		September , 2014	MOECAF
17	Environmental Baseline Survey for environmental and social consideration for energy sector rehabilitation program in Myanmar	Nippon Koei Co., Ltd.		October, 2014	MOECAF
18	Survey for Preparation of Abbreviated Resettlement Plan for Feasibility study for the construction of new Thaketa and Bago River Bridge	Nippon Koei Co., Ltd.		September , 2014	Ministry of Construction
19	ESIA of Upper Yeywa Hydropower Project	Department of Hydropower Implementation (DHPI), Ministry of Electric Power (MOEP).			MOEP
20	5000 t/d cement plant of Kyaukse	Myanmar Conch Co., Ltd.		2015	MOECAF
21	Reclamation project for city development in Sittwe	Su Htoo San Co., Ltd.		2015	MOECAF

Education - Diploma in Geographic Information System & Remote Sensing
B.Sc. (Geology)

Language - Burmese mother tongue and English

6. Reference to Prior Work/Assignments that Best Illustrates Capability to Handle the Assigned Tasks (Example)

No.	*Title*	*Client*	*Poisson*	*Period*
1	Mandalay EMP project	Mandalay ECD (Environmental Conservative Department)	Assistant project manager	Nov. 2014 to Oct.2015
2	Myin Gyan IPP project (Independent Power Plan) (EIA)	ERM Co,.ltd	Assistant project manager	June.2014 to May 2015
3	Thaung Khone Core Fire Power Plant project (EIA)	JICA	Assistant project manager	August.2014 to Nov 2014
4	Thilawa SEZ Zone A Development Monitoring project (EIA) Phase_1 construction stage	MJTD	Assistant project manager	Jan.2014 to Dec 2015

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Curriculum Vitae (CV)

1. General:

Position Title and No.:	Consultant (Microbiology)
Name of Key Expert:	Nyan Linn Maung (Mr)
Name of the Firm proposing the Key Expert:	Resource & Environment Myanmar Co., Ltd.
Date of Birth:	8th June, 1988
Nationality:	Myanmar
Country of Citizenship/Residence:	Myanmar

2. Education: B.Sc (Microbiology)

3. Employment Record relevant to the assignment:

Period	***Employing organization and your title/ position***	***Country***	***Summary of* activities *performed relevant to the Assignment:***
2015 - present	Resource &Environment Myanmar Co., Ltd. Consultant (Microbiology)	Myanmar	Responsible for ecology survey for IEE and EIA studies.
2012 - 2014	Resource and Environment Myanmar Co., Ltd. Assistant Environmental Technician	Myanmar	Responsible for physical environment for IEE and EIA studies.

Contact information for reference: Zaw Naing Oo, Director of Resource and Environment Myanmar Ltd. zawnaingoo@enviromyanmar.net

4. Membership in Professional Associations and Publications:

5. Language Skills:

Language	*Speaking*	*Reading*	*Writing*
English	Fair	Fair	Fair
Myanmar	Native	Native	Native

6. Reference to Prior Work/Assignments that Best Illustrates Capability to Handle the Assigned Tasks

No.	*Title*	*Client*	*Poisson*	*Period*
1	Shweli Hydropower project	KHIDI Kunming Engineering Co., Ltd.	Assistant Environmental Technician	September 2012
2	Letpadaung Taung Ecology and Traffic Survey	-	Assistant Environmental Technician	December 2012
3	Dawei new Terminal	-	Assistant Environmental Technician	2014
4	Naw Chan Hka Hydropower	Power China Kunming Cooperation Co., Ltd.	Assistant Environmental Technician	2014
5	Air, Noise, Soil and water quality survey for Thilawa (SEZ)	Nippon Koei	Assistant Environmental Technician	2014
6	Myingyan (IPP) project	-	Assistant Environmental Technician	-
7	Tachileik coal mine	-	Assistant Environmental Technician	-
8	Upper Yeywa environmental survey	-	Assistant Environmental Technician	-
9	Miela Hydropower project	Special Region No.4 Government	Consultant	February 2015
10	Sittwe reclamation project	Su Htoo San Co.,Ltd and BXT Construction and Development Company	Consultant	September 2016
11	Star City Yangon Resident	Thanlyin Estate Development Ltd.	Consultant	September 2015
12	Upper Baluchaung Hydropower Project	Neo Energy Co., Ltd.	Consultant	June 2015
13	Thilawa SEZ Class B	Nippon Koei	Consultant	October 2015
14	Thayet Cement Plant	Myanmar Jidong Co., Ltd.	Consultant	September 2016
15	Namtu-Bawdwin Mining Project	Win Myint Mo Co., Ltd.	Consultant	December 2016

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6. Reference to Prior Work/Assignments that Best Illustrates Capability to Handle the Assigned Tasks

No.	*Title*	*Client*	*Poisson*	*Period*
1	Air quality, vibration and noise measure for Domestic Terminal, Yangon.	Joint with private company	Assistant Environmental Technician (Air quality, noise and vibration)	June 2014
2	Caustic Soda Plant, Tha Htone	Joint with MSR (Myanmar Survey Research)	Assistant Environmental Technician (Air quality)	July 2014
3	Yangon Circular Railway Upgrade Project	JICA	Assistant Environmental Technician (Air quality, noise)	29 Aug 2014
4	Thilawa SEZ Class A	Nippon Koei	Assistant Environmental Technician (Air quality & noise)	15 Aug 2014
5	Miela Hydropower Project	Special Region No.4 Government	Consultant (Forest & vegetation)	February 2015
6	Sittwe Reclamation Project	Su Htoo San Co.,Ltd and BXT Construction and Development Company	Consultant (Forest & vegetation)	April 2015
7	Star City Yangon Resident	Thanlyin Estate Development Ltd.	Consultant (Forest & vegetation)	September 2015
8	Upper Baluchaung Hydropower Project	Neo Energy Co., Ltd.	Consultant (Forest & vegetation)	June 2015
9	Thilawa SEZ Class B	Nippon Koei	Consultant (Forest & vegetation)	October 2015
10	Thayet Cement Plant	Myanmar Jidong Co., Ltd.	Consultant (Forest & vegetation)	September 2016
11	Namtu-Bawdwin Mining Project	Win Myint Mo Co., Ltd.	Consultant (Forest & vegetation)	December 2016

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Curriculum Vitae

Proposed Position - Director

Name of Firm - Resource & Environment Myanmar Co., Ltd.

Name of Staff - Win Maung (Dr.)

Profession - Principal Consultant (Ecology, Flora and Fauna)

Date of Birth - 3 July 1954

Years with Firm/Entity - 2006 Nationality - Myanmar

Membership in Professional Society- Member of Myanmar Zoological Society; member of Myanmar arts and science academy, member of the DAAD alumni (German Academic Exchange Service Alumni) (Myanmar), and chairman of the DAAD alumni (Myanmar); National Review Group Member of a FAO,

Detailed of Tasks Assigned - Ecology and Biodiversity Conservation, Marine Ecosystem Programme, , Zoologist, Wildlife Conservation Society (Myanmar), Offshore Baseline Environmental Survey, Environmental Impact Assessment, Conducted different fauna surveys, Terrestrial Environmental Baseline Study, and teaching Ecology at Myanmar Environmental Institute.

Key Qualification

Selected Relevant Experience in Present Employment Since 1982

2006 to date	Principal Consultant/ Patron, Resource and Environment Myanmar Co., Ltd.
2011 to date	Founder and President, Myanmar Environment Institute (MEI)
2010-2010	Pro-Rector, Sittway University, Rakhine State, Myanmar
2007-2010	Professor, Department of Zoology, University of Yangon, Myanmar
1982-2007	Demonstrator, Assistant Lecturer and Associate Professor in Department of Zoology, University of Yangon, Myanmar

Environmental Impact Assessment and Environmental Management on:

Collaboration on "Environmental Impact Assessment", "Environmental Baseline study" and "Environmental Monitoring Survey" with Myanmar Ivanhoe Company Ltd.

2001-2008) (Kyisintaung Coppermine project and Modi-taung Gold Mine project), and on animal ecology and Biodiversity Conservation with Smithsonian Institute, USA (2003-2005).

Published a book namely "Turtles and tortoises of Myanmar" published by Wildlife Conservation Society (Myanmar).

Published "A guide book to fauna and flora of some parts of total pipeline area, Tanintharyi Division" (2004).

Conducted different fauna surveys along the Total pipeline area (1997-2004);

EIA for MICCL Copper Mine Project (2002),

Ivanhoe Gold Mine Project (2003),

Namkok Hydropower Project (1995),

Yeywa Hydropower Project (2002),

Shwe and Mya Yakhine Offshore Baseline Environmental Survey (2007).

Terrestrial Environmental Baseline Study for Onshore Midstream Facilities and Pipeline Landing (Shwe Gas pipeline (Daewoo), Rakhine State)(2008),

CNPC Myanmar-China Gas Pipe Line EIA (2009),

Mong Hkok Coal Fire Power Plant EIA (2010),

Upper Yeywar-Shwesaryan and Baluchaung – Shwemyo Power Transmission Line EIA (2011),

ESIA of Modi taung gold deposit

EIA for the 5,000 tons/year Electrolytic Zinc Factory and associated facilities

Ngaw Chang Hka Hydro power project at Kachin Satate. 2014, May.

Education Ph.D, Wuerzburg University, Germany (1990)
M.Sc. (Zoology), Mandalay University, Myanmar (1982)
B.Sc. (Zoology), Mandalay University, Myanmar (1977)

Name: **U MYINT AUNG**

Present Position: Principal Consultant

Nationality: Myanmar

Profession: Botany, Forest Ecology and Biodiversity

Specialisation:

- Mangrove forest of Okinawa, Vegetation study in Aomori Prefecture, Vegetation study in Nagoya, Japan, Phytosociological study of mangrove vegetation, Ecological study of mangrove vegetation, Floristic diversity, land degradation and conservation in agricultural land, Mangrove Soil and Growth Performance of Cultivated Mangrove Species, Diversity of plant species in Letpadaung hills and their socio-economic status in surrounding villages , Geobotanical analysis on the associated plant species and relationship to rocks and mineralization.

Qualifications:

- B.Sc. (Hons.), University of Yangon, 1991
- M.Sc. (Tissue Culture), University of Yangon, 1995
- Ph.D. (Environment and Natural Sciences), Yokohama,National University, Japan, 2004s

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Related Research Experience

- Mangrove forest of Okinawa, Japan (with Japanese Scientists) 2001
- Vegetation study in Aomori Prefecture, Japan (with Japanese Scientists) 2001
- Vegetation study in Nagoya, Japan (with Japanese Scientists) 2001
- Mangrove forest of Phuket, Thailand (with Japanese Scientists) 2003
- Mangrove forest of Ayeyarwady Delta, Myanmar (with Japanese Scientists) 2002-2003
- Vegetation study in Oita, Japan (with Japanese Scientists) 2003
- Phytosociological study of mangrove vegetation in Byone-hmwe Island, Ayeyarwady Delta, Myanmar - Relationship between floristic composition and Habitat- (2004)
- Ecological study of mangrove vegetation in the Ayeyarwady Delta, Myanmar (2004)
- Floristic diversity in the Yangon Division (2005)
- The study of land degradation and conservation in agricultural land in Magway Township, Magway Division (2005)
- The Study of Mangrove Soil and Growth Performance of Cultivated Mangrove Species in the Pyindaye Reserve Forest Area, Bogalay Township, Ayeyarwady Delta (2005)
- Diversity of plant species in Letpadaung hills and their socio-economic status in surrounding villages (2005)
- Geobotanical analysis on the associated plant species and relationship to rocks and mineralization at Kyaukmyet area, Salingyi Township, Sagaing Division (2006)
- Biodiversity impact assessment in Tamanthi hydro-power and multipurposes dam, Sagaing Division (2006)
- Ex situ conservation of *Dipterocarpus* species in the Taninthari Nature Reserve Forest

(2008)

- Geobotanic study on plant community and accumulation of trace elements in plants and soils with special reference to Khwayaiktaung, Heho, Southern Shan State (2008)
- Vegetation study on Kelatha Mountain, Bilin Township, Mon State (2008)

Language

Burmese mother tongue and English and Japan Languages.

Curriculum Vitae (CV) for Key Expert

1. General:

Position Title and No.:	Senior Consultant (Ecology)
Name of Key Expert:	Kyaw Naing Oo (Mr)
Name of the Firm proposing the Key Expert:	Resource & Environment Myanmar Co., Ltd.
Date of Birth:	30th November, 1985
Nationality:	Myanmar
Country of Citizenship/Residence:	Myanmar

2. Education: B.Sc (Zoology)

3. Employment Record relevant to the assignment:

Period	***Employing organization and your title/ position***	***Country***	***Summary of* activities *performed relevant to the Assignment:***
2015 - Present	Resource &Environment Myanmar Co., Ltd. Senior Consultant (Fauna)	Myanmar	Responsible for studies on environmental and social fields including EIA and environmental management.
2009 - 2015	Biodiversity and Nature Conservation Association (BANCA) Mammlogist	Myanmar	Responsible for studies on environmental and social fields including EIA and environmental management.
Contact information for reference:		Zaw Naing Oo, Director of Resource and Environment Myanmar Ltd. zawnaingoo@enviromyanmar.net	

4. Membership in Professional Associations and Publications: BANCA (Biodiversity and Nature Conservation Association)

5. Language Skills:	*Language*	*Speaking*	*Reading*	*Writing*
	English	Fair	Fair	Fair
	Burmese	native	native	native

6. Reference to Prior Work/Assignments that Best Illustrates Capability to Handle the Assigned Tasks

No.	*Title*	*Client*	*Poisson*	*Period*
1	EIA and SIA of Myintsone Project	BANCA (Biodiversity And Nature Conservation Association	Mammalogy	From 2009 January to 2009 may
2	EIA and SIA of Kunlon Project	BANCA (Biodiversity And Nature Conservation Association	Mammalogy	From 2010 March to 2010may
3	RAP of Myintsone	BANCA (Biodiversity And Nature Conservation Association	Mammalogy	From 2010 January to 2010 February
4	Thayet Cement Project (EIA)	Myanmar Jidong	Mammalogy	2015 Setember
5	Thilawa (SEZ) Class B Development (EIA)	Nippon KOEI	Mammalogy	January 2015
6	Biodiversity in Tanintharyi Lenya National Park	FFI (Fauna and Flora International)	Mammalogy	May 2015
7	Gurney Pitta Project from Tanintharyi	FFI (Fauna and Flora International)	Fauna	From 2012 to 2014

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Curriculum Vitae (CV) for Key Expert

1. General:

Position Title and No.:	Environmental Technician (Air Quality)
Name of Key Expert:	Soe Yu Htun (Mr)
Name of the Firm proposing the Key Expert:	Resource & Environment Myanmar Co., Ltd.
Date of Birth:	28th February, 1989
Nationality:	Myanmar
Country of Citizenship/Residence:	Myanmar

2. Education: B.Sc. (Geology)

3. Employment Record relevant to the assignment:

3 years professional experience since 2012

Period	***Employing organization and your title/ position***	***Country***	***Summary of* activities *performed relevant to the Assignment:***
2010 - Present	Resource &Environment Myanmar Co., Ltd. Environmental Technician	Myanmar	Responsible for studies on environmental and air monitoring fields including EIA in Myanmar.
	Contact information for reference:		Zaw Naing Oo, Director of Resource and Environment Myanmar Ltd. zawnaingoo@enviromyanmar.net

4. Membership in Professional Associations and Publications: Life Member, Myanmar Geosciences Society

5. Language Skills:

	Speaking	*Reading*	*Writing*
English	Intermediate	Intermediate	Intermediate
Myanmar	Native	native	native

6. Reference to Prior Work/Assignments that Best Illustrates Capability to Handle the Assigned Tasks (Example)

No.	*Title*	*Client*	*Poisson*	*Period*
1	Mandalay EMP project	Mandalay ECD (Environmental Conservative Department)	Assistant project manager	Nov. 2014 to Oct.2015
2	Myin Gyan IPP project (Independent Power Plan) (EIA)	ERM Co,.ltd	Assistant project manager	June.2014 to May 2015
3	Thaung Khone Core Fire Power Plant project (EIA)	JICA	Assistant project manager	August.2014 to Nov 2014
4	Thilawa SEZ Zone A Development Monitoring project (EIA) Phase_1 construction stage	MJTD	Assistant project manager	Jan.2014 to Dec 2015

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Curriculum Vitae (CV) for Key Expert

1. General:

Position Title and No.:	Project Manager/Senior Consultant (Physical Environment)
Name of Key Expert:	Thura Aung (Mr)
Name of the Firm proposing the Key Expert:	Resource and Enviroment Myanmar Co., Ltd.
Date of Birth:	2nd May, 1976
Nationality:	Myanmar
Country of Citizenship/Residence:	Myanmar

2. Education: B.Sc. (Honours) (Geology), M.Sc. (Geology), M.Res. (Geology)

3. Employment Record relevant to the assignment:

Period	***Employing organization and your title/ position***	***Country***	***Summary of* activities *performed relevant to the Assignment:***
2012 to date	Resource & Environment Myanmar Co., Ltd. Project Manager	Myanmar	Responsible for studies on environmental and social fields including EIA in Myanmar.
2009 – 2011	Resource & Environment Myanmar Co., Ltd. Consultant	Myanmar	Responsible for studies on environmental and social fields including EIA in Myanmar.
	Contact information for reference:	Soe Thura Tun, Managing Director of Resource & Environment Myanmar Co.,Ltd. soethuratun@enviromyanmar.net	

4. Membership in Professional Associations and Publications: Secretary (Myanmar Earthquake Committee)
Life Member (Myanmar Geosciences Society)
Member (AOGS)

5. Language Skills:

	Speaking	*Reading*	*Writing*
English	Good	Good	Intermediate
Myanmar	Native	Native	Native

6. Reference to Prior Work/Assignments that Best Illustrates Capability to Handle the Assigned Tasks

No.	*Title*	*Client*	*Poisson*	*Period*
1	ESIA of Upper Yeywa Hydropower Project	Department of Hydropower Implementation (DHPI), Ministry of Electric Power (MOEP).	Project Manager	2015
2	Environmental and Social Survey for Environmental Impact Assessment Studies under the Project for Electric Power Development in the Thilawa Area	Nippon Koei Co., Ltd.	Project Manager	2014
3	IEE for the project of Manufacturing of Garment at Dagon South, Yangon	Myanmar Sein Pann Manufacturing	Project Manager	2014
4	Actual Environmental Survey for Feasibility Study for the Construction of Bago River Bridge	ALMEC Corporation, NIPPON KOEI Co., Ltd.	Project Manager	2013-2014
5	Actual Environmental Survey for Feasibility Study for the Construction of Thaketa River Bridge	ALMEC Corporation, NIPPON KOEI Co., Ltd.	Project Manager	2013-2014
6	Survey for Preparation of Abbreviated Resettlement Plan for Feasibility study for the construction of new Thaketa and Bago River Bridge	Nippon Koei Co., Ltd.	Project Manager	2013-2014
7	ESIA for Baseline study of Thilawa Special Economic Zone Class A	Nippon Koei Co., Ltd.	Project Director	2013
8	IEE for the project of Manufacturing of Garment at Hlaingtharyar, Yangon	South Bay Manufacturing Co., Ltd	Project Manager	2013
9	IEE for the project of Manufacturing of Garment at Intagaw, Bago	Hung Kiu (Myanmar) Garment Manufacturing	Project Manager	2013
10	Environmental and Social Information Collection Survey for the Project for the Strategic Urban Development Plan of The Greater Yangon	Nippon Koei Co., Ltd	Project Manager	2012
11	EIA of 500 MW CCPP at Hlawga	Htoo & HIE, China	Project Manager	2012
12	Environmental Impact Assessment of Shweli River II Hydropower Project	Hydrolancang International Energy Company Ltd. and KHIDI	Project Manager	2012
13	EIA of Myanmar-China Gas Pipeline Project	CNPC IEM (Intern. Environmental Management Co. Ltd.)	Consultant	2009-2010

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Name: **U NGWE MOE**

Present Position: Principal Consultant

Nationality: Myanmar

Profession: Safety and Environmental Management

Specialisation: Risk Assessment , Permit To Work Supervisor Level, Mechanical And Electrical Isolation ,Confine Space Entry, Emergency Response Plan, Waste Management, Fire Safety, Manual Handling , Identification, Evaluation And Control Of Hazards , Use Of Breathing Apparatus , Gas Tester, Site Defensive Driving, Environmental Management Plan.

Qualifications:

- Bachelor of Chemical Engineering (YIT)
- Diploma in Environmental Engineering (Yangon Technological University)

Selected Relevant Experience in Present Employment Since 2000

June 2000 – Sept 2003	Environmentalist (onshore), Premier Oil Myanmar Limited, Yetagun Offshore Project (Gas Production),
September 2003 – June 2004	Safety Officer (onshore), Petronas Carigali Myanmar Limited, Yetagun Offshore Gas Project, Union of Myanmar
June 2004 – April 2005	HSE Supervisor, 22-KM MOL Reroute Project, Al Hashedi , Sana'a, Yemen
October 2007 – November 2011	**Environmental & Safety Coordinator,** Daewoo International Corporation (Myanmar E&P), Development of Shwe Gas Fields, Yangon
Jan 2012 – October 2012	**Environmental & Safety Advisor**, Hyundai Heavy Industries, Barzan Offshore Project, Raslaffan Industrial City, Qatar
October 2012 – to date	**Principal Consultant,** Resource & Environment Myanmar Co. Ltd.

Employment History

June 2000 – Sept 2003	Environmentalist (onshore), Premier Oil Myanmar Limited, Yetagun Offshore Project (Gas Production),
September 2003 – June 2004	Safety Officer (onshore), Petronas Carigali Myanmar Limited, Yetagun Offshore Gas Project, Union of Myanmar
June 2004 – April 2005	HSE Supervisor, 22-KM MOL Reroute Project, Al Hashedi , Sana'a, Yemen
October 2007 – November 2011	**Environmental & Safety Coordinator,** Daewoo International Corporation (Myanmar E&P), Development of Shwe Gas Fields, Yangon
October 2012 – to date	**Principal Consultant,** Resource & Environment Myanmar Co. Ltd.

Language

Burmese mother tongue and English

Curriculum Vitae

A. Personal Data

1. Name:	Miss Lai Lai Win
2. Date of Birth:	22nd November 1983
3. Gender (male/female):	Female
4. Nationality:	Myanmar
5. Marital Status:	Single
6. Qualification:	1. B.S (Biotechnology), 2. M.S (Bioinformatics), 3. Ph.D (Molecular Biotechnology), 4. M.S (Environmental Engineering and Management), AIT, Thailand.
7. Current Address:	Room 20, Building 24, U Wisara Housing, Dagon Township, Yangon
8. E-mail:	lailaiwyn@gmail.com
11. Office Address:	**B-702, Delta Plaza, Shwegondaing Road, Bahan Township, Yangon, MYANMAR**
12. Office Phone No.:	**+95 9 73013448**
13. Fax:	**+95 1 552901**
14. Mobile No.:	+95 9797241421, +95 9969113803
15. ECD Consultant Registration No.:	Reg. No. 00148

B. Academic Background

Year Attended		Degree/Diploma	Major Fields of Study	Name of Institution/ Place/Country
From	To			
2015	2017	Master of Science M.S	Environmental Engineering and Management	Asian Institute of Technology, Thailand.
2008	2011	Doctoral Ph.D (Molecular Biotechnology)	Molecular Biotechnology	Mandalay Technological University, Myanmar
2006	2008	Master of Science M.S(Bioinformatics)	Bioinformatics	Mandalay Technological University, Myanmar
2002	2005	Bachelor of Science B.S(Biotechnology)	Biotechnology	Yangon Technological University, Myanmar.

C. Professional Experiences

Year		**Position**	**Name of Institution/ Place/Country**
From	**To**		
2004	2006	Demonstrator	Department of Biotechnology, YTU, Myanmar
2006	2007	Tutor	Department of Biotechnology, YTU, Myanmar
2008	2013	Assistant Lecturer	Department of Biotechnology, MTU, Myanmar
2013	2015	Lecturer	Department of Biotechnology, MTU, Myanmar
2011	2013	ESIA Review Member	Government Stakeholder at ECD, Naypyitaw
2013	2014	Assistant ESIA Consultant (Biodiversity)	Lapadaung Copper Mine
2017	Present	Freelance/Principal Consultant	Resource & Environment Myanmar (REM), Yangon
2017	Present	Trainer	Myanmar Environment Institute

D. Workshops/Trainings

- First workshop/meeting on research collaboration between Thailand BIOTEC and Mandalay Technological University for ASEAN network on microbial utilization (12-13th November 2013)
- Training on EIA guidelines organized by Vermont University (29th July 2014)
- Workshop on Application of Nuclear Technologies in Agriculture and Life Sciences (11-15th August 2014), Mandalay Technological University, Myanmar.
- DAAD ProGrant DIES Proposal Writing Program, Hochiminh City/Hanoi City, Vietnam (25-31st January 2015/Online Learning (6-Months)/16-22nd August 2015).
- Urban Environment and Health in Asia (UEHAS) and Graduate Program in Sustainable Science Global Leadership Initiative (GPSS-GLI) of the University of Tokyo in collaboration with Chulalongkorn University, Integrated Management of Urban Environment for Sustainable Development, Thailand (11th August 2016).
- Short Term Training on Safety and Quality and Innovative Food Production Systems, collaborated by ASIFOOD and Asian Institute of Technology, funded by the Erasmus+ Program of the EU (20-26th May 2018)
- ISO 9001:2015 Quality Management System Awareness and Implementation Course by Guardian Independent Certification (Myanmar) Co., Ltd., 19-20th June 2018.
- ISO 14001:2015 Environmental Management System, Guardian Independent Certification (Myanmar) Co., Ltd., Myanmar
- Occupational First Aid Course by WIN OSHE Safety Academy on 2nd July 2018
- CAS-TWAS International Training Program for Water and Sanitation, Beijing & Yancheng, People Republic of China, April 14-26, 2019.
- Social Risk Management (IFC, Australian Aid, UK Aid, Reeman Consulting, Community Insights Group (CiG) and MEAA), Yangon, Myanmar, 17 – 22th June 2019.
    - Part 1: Social Impact Assessment and Management
    - Part 2: Land Acquisition and Resettlement
- Environmental and Social Impact Assessment, 7-14th October 2019, AITVN, Hanoi Office, B3 Building, University of Transport and Communication, Lang Thuong Ward, Dong Da District, Hanoi, Vietnam

E. Projects Undertaken

No.	Project Name	Position	Task/Duty	Period
1.	Lapadaung Mountain Copper Mine	ESIA Reviewer	Reviewing ESIA Report (as Government Stakeholder)	2011-2013
2.	Pyin Gyi Mountain Lithium Mine	ESIA Consultant (Biodiversity)	Baseline Survey and Scoping Report	2013-2014
3.	Questionnaire Survey of Community's Concerns on Thailand Drinking Water Quality	Surveyor and Analyst	Group Survey with International colleagues	2016
4.	YTL Cement Plant	ESIA Consultant	Impact Assessment and Preparation of ESIA Report	2017-2018
5.	Mawlamyine Cement Plant	ESIA Consultant	Meeting Facilitations, Impact Assessment and Preparation of ESIA Report	2017-2018
6.	Pyataung Limestone Quarry	ESIA Consultant	Meeting Facilitations, Impact Assessment and Preparation of ESIA Report	2017-2018
7.	Deedoke Hydropower	Social Team Leader	Conduct Baseline Social Survey and Public Consultation meetings	2018
8.	Coal Fire Power Plant	ESIA Consultant	Meeting Facilitations, Impact Assessment and Preparation of ESIA Report	2017-2019
9.	Shwe Ayeyar Nadi Soap Factory	ESIA Consultant	Meeting Facilitations, Impact Assessment and Preparation of ESIA Report	2017-2019

10.	Jetty and Canal	ESIA Consultant	Meeting Facilitations, Impact Assessment and Preparation of ESIA Report	2017-2019
11.	Transmission Line Project (IEE)	ESIA Consultant	Preparation of Executive Summary	2019
12.	Shwe Daehan Co., Ltd. (Manufacturing, Sales and sales Services of motor vehicles and motor vehicles: Hyundai)	ESIA Consultant	Main Speaker in Public Consultations	2019
13.	Twente Canal Development Project	ESIA Consultant	Main Speaker in Public Consultations, Impact Assessment, Waste Management and Preparation of ESIA report	2018-2019
14.	Japan-Myanmar Aung San Vocational and Training Education	ESIA Consultant	Preparation of EMP report	2019
15.	Lead Smelting & Refining Process	ESIA Consultant	Main Speaker in Public Consultations, Impact Assessment, Waste Management and Preparation of ESIA report	2019
16.	Myanmar Conch Cement (Mandalay)	ESIA Consultant	Impact Assessment	2019
17.	Rehabilitation of Gas Turbine for Existing Tharketa Power Station (Package - 1)	National Environmental Specialist	Review EMP and monthly reports and Supervise EMP and Monitoring Activities	2019

18.	Renovation Works of Transmission Systems in Tharketa, Ahlone, Ywarma and Hlawga Substations, Yangon (Package - 2)	National Environmental Specialist	Review EMP and monthly reports and Supervise EMP and Monitoring Activities	
19.	Ahlone International Port Terminal	ESIA Consultant	Main Speaker in Public Consultations, Impact Assessment, Waste Management and Preparation of ESIA report	2019
20.	Production and Marketing of Iron and Steel	ESIA Consultant	Main Speaker in Public Consultations, Impact Assessment, Waste Management and Preparation of ESIA report	2019
21.	Zinc Smelting &Refining Process	ESIA Consultant	Main Speaker in Public Consultations, Impact Assessment, Waste Management and Preparation of EMP report	2019

F. Language Proficiency

	Myanmar (Mother tongue)			English		
	Spoken	Written	Reading	Spoken	Written	Reading
Fair/Basic Knowledge						
Working Knowledge				*		
Excellent Knowledge	*	*	*		*	*

G. Paper published

1. **Lai Lai Win: "*Study on the Cellulolytic Activity of Trichoderma spp. and their Application in Rapid Composting Process for Bio-organic Fertilizer*",** December 2009, The 1st International Conference on Science and Engineering, Sedona Hotel, Yangon, Myanmar.

2. **Lai Lai Win**: "***Isolation and Identification of Serratia marcescens and Implementation of Serratia species Identification Program Using Java Language***", July 2007, Mandalay Technological University, Mandalay, Myanmar.

3. **Lai Lai Win**: "Formulation of the Biostimulator Product from Fungal Species, *Aquilaria* for Agarwood Oil Formation", Department of Biotechnology, Mandalay Technological University, Myanmar.

4. **Lai Lai Win**: "Environmental Sustainability of Aerated Lagoons Treatment Processes for Community Wastewater", May 2017, Asian Institute of Technology, Thailand.

5. Lai Lai Win: "Assessment of Environmental Sustainability of Aerated Lagoons Treatment Processes for Community Wastewater", Poster & Oral presentation, 8th-9th January 2020, the first International Conference on Environmental and Sustainability Development, Sule Shangrila Hotel, Myanmar.

ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ 电力能源部水运河道管理局

လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန 申请审批水取水信函

လျှပ်စစ်ဓာတ်အားထုတ်လုပ်ရေးလုပ်ငန်း 2017.2.6

စာအမှတ် ၊ ၅၆၉ / U Energy(ပစအ) /၂၀၁၇

ရက်စွဲ ၊ ၂၀၁၇ ခုနှစ် ၊ ဖေဖော်ဝါရီလ (၆)ရက်

သို့ DG

ညွှန်ကြားရေးမှူးချုပ် Department of Directorate of Water Resources and

ရေအရင်းအမြစ်နှင့် မြစ်ချောင်းများဖွံ့ဖြိုးတိုးတက်ရေးဦးစီးဌာန Improvement of River System

နေပြည်တော် Ministry of Transportation

အကြောင်းအရာ။ U Energy Thaketa Power Co.,Ltd ၏ (၁၀၆)မဂ္ဂါဝပ် သဘာဝဓာတ်ငွေ့နှင့် စွန့်ပစ်အပူသုံးဓာတ်အားပေးစက်ရုံအတွက် ရေစက်(Pump Boat) တည်ဆောက် ခွင့်ပြုပါ ရန်ကိစ္စ။

၁။ အထက်အကြောင်းအရာပါကိစ္စနှင့်စပ်လျဉ်း၍ လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန၊ လျှပ်စစ်ဓာတ်အား ထုတ်လုပ်ရေးလုပ်ငန်း၊သာကေတသဘာဝဓာတ်ငွေ့သုံးဓာတ်အားပေးစက်ရုံပိုင် မြေပေါ်တွင် လျှပ်စစ်နှင့်စွမ်းအင် ဝန်ကြီးဌာန နှင့် U Energy Thaketa Power Co., Ltd တို့ပူးပေါင်း၍ BOT စနစ်ဖြင့် (၁၀၆)မဂ္ဂါဝပ် သဘာဝဓာတ်ငွေ့နှင့် စွန့်ပစ်အပူသုံးဓာတ်အားပေးစက်ရုံ တည်ဆောက်ခြင်းလုပ်ငန်း ဆောင်ရွက်လျှက်ရှိ ပါသည်။

၂။ တည်ဆောက်လျှက်ရှိသောဓာတ်အားပေးစက်ရုံ၏ အအေးပေးစနစ်အတွက်လိုအပ်သောရေကို ငမိုးရိပ် ချောင်း မှ ရယူသုံးစွဲရမည်ဖြစ်ပါသည်။ ငမိုးရိပ်ချောင်းမှရေကိုအချင်း ၃၀၀မီလီမီတာ ပိုက်(၂)ခုဖြင့်သွယ်တန်း တပ်ဆင်ရယူရန် လျာထားပါသည်။ ငမိုးရိပ်ချောင်းထဲတွင် ရေစက် (PumpBoat)တည်ဆောက် ၍သုံးစွဲလိုပါသည်။စက်တည်ဆောက်မှု ဒီဇိုင်းအရ ရေသုံးစွဲလိုသည့်ပမာဏမှာ 7536m^3/day ဖြစ်ပါ သည်။ငမိုးရိပ်ချောင်းကမ်းစပ်၌ ရေစက် (Pump Boat) တည်ဆောက်ရန်သုံးစွဲလိုသည့် မြေဧရိယာမှာ အလျား (၃၈)မီတာနှင့် အကျယ် (၉)မီတာခန့် ဖြစ်ပြီး ငမိုးရိပ်ချောင်း ထဲတွင် တည်ဆောက်မည့် Pump Boat ၏အရွယ်အစားမှာ အလျား(၂၁.၂)မီတာ ၊အကျယ်(၁၁.၆)မီတာဖြစ်ပါသည်။

၃။ ရေစက်(Pump Boat)ကို ငမိုးရိပ်ချောင်း ကမ်းစပ်ရှိ ၆၆ကေဗွီ ကျိုက္ကဆံ ဓာတ်အားလိုင်း ငမိုးရိပ်ချောင်းကျော် Tower အနီးရှိ သာကေတဓာတ်အားပေးစက်ရုံ၏ရေနွေးငွေ့တာဘိုင်စက် စတင်လည်ပတ်စဉ်က အသုံးပြုခဲ့သော ရေတွန်းပန့်ရုံ အဆောက်အဦအဟောင်း နေရာအနီးဝန်းကျင်တွင် တည်ဆောက်ခွင့်ပြုပါရန်နှင့် ရေတွန်းပန့်ရုံအဆောက်အဦအဟောင်းအနီးတွင် တည် ဆောက် ခွင့်မပြုနိုင်ပါက အခြားသင့်တော်သော နေရာ၌ တည်ဆောက်ခွင့်ပြုပါရန်အတွက်လည်း ညွှန်ကြားရေးမှူးချုပ်၊ မြို့ပြနှင့်အိမ်ရာဖွံ့ဖြိုးရေးဦးစီးဌာနသို့ ညှိနှိုင်း အကြောင်းကြားထားပြီးဖြစ်ပါသည်။

၄။ သို့ဖြစ်ပါ၍ U Energy Thaketa Power Co., Ltd ၏ (၁၀၆)မဂ္ဂါဝပ် သဘာဝဓာတ်ငွေ့နှင့်စွန့်ပစ် အပူသုံးဓာတ်အားပေးစက်ရုံအတွက် ငမိုးရိပ်ချောင်းထဲတွင် ရေစက် (Pump Boat) တည်ဆောက်ခွင့်ပြုပါရန် အောက်ဖော်ပြ ပါ စာရွက်စာတမ်းများ ပူးတွဲလျှက် ညှိနှိုင်းအပ်ပါသည်။

ပူးတွဲလျှက်(၁) U Energy Thaketa Power Co., Ltd ၏ (၁၀၆)မဂ္ဂါဝပ် သဘာဝဓာတ်ငွေ့နှင့် စွန့်ပစ် အပူသုံးဓာတ်အားပေးစက်ရုံစီမံကိန်း ဆောင်ရွက်လျှက်ရှိသည့်မြေနေရာပြပုံ ။

(၂) ရေစက် (Pump Boat) တည်ဆောက်လိုသည့်ငမိုးရိပ်ကမ်းစပ်နေရာပြဓာတ်ပုံ။

(၃) U Energy Thaketa Power Co., Ltd ၁၀၆)မဂ္ဂါဝပ် သဘာဝဓာတ်ငွေ့နှင့်စွန့်ပစ် အပူသုံးဓာတ်အားပေးစက်ရုံရေပိုက်လိုင်းသွယ်တန်းမည့်ပိုက်လိုင်းလမ်းကြောင်းပြပုံ။

(၄) U Energy Thaketa Power Co.,Ltd မှတည်ဆောက်မည့် ရေစက်(Pump Boat) ဓာတ်ပုံ။

(၅) Layout Of pipes Outside The Plant

(၆) Section Drawing of Pontoon And Supporting Piers

(၇) Layout Of Drawing of Pontoon And Supporting Piers

(၈) General Layout Drawing of Water Intake Pontoon

(၉) Detail Drawing Of Water Intake Pontoon

(၁၀) Detail Drawing Of Blow-Off Chambers And Automatic Exhaust Wells

6.2.2018

ဦးဆောင်ညွှန်ကြားရေးမှူး(ကိုယ်စား)

(သန်းနိုင်ဦး၊ အင်ဂျင်နီယာချုပ်)

မိတ္တူ/-

- ဝန်ကြီး (လျှပ်စစ်၊ စက်မှုလက်မှု၊ လမ်းပန်းဆက်သွယ်ရေးနှင့် ဆောက်လုပ်ရေးဝန်ကြီးဌာန)၊ ရန်ကုန်တိုင်း ဒေသကြီးအစိုးရအဖွဲ့။
- ညွှန်ကြားရေးမှူးချုပ်၊ မြို့ပြနှင့်အိမ်ရာဖွံ့ဖြိုးရေးဦးစီးဌာန၊နေပြည်တော်။
- အင်ဂျင်နီယာချုပ်၊အပူစွမ်းအင်သုံးစက်ရုံများဌာန၊လျှပ်စစ်ဓာတ်အားထုတ်လုပ်ရေးလုပ်ငန်း ၊ နေပြည်တော်။
- တိုင်းဒေသကြီးဦးစီးမှူး၊ ရေအရင်းအမြစ်နှင့် မြစ်ချောင်းများဖွံ့ဖြိုးတိုးတက်ရေးဦးစီးဌာန၊ ရန်ကုန်တိုင်းဒေသကြီး။
- ရုံးလက်ခံ။

ရေအရင်းအမြစ်နှင့်မြစ်ချောင်းများဖွံ့ဖြိုးတိုးတက်ရေးဦးစီးဌာန
တိုင်းဒေသကြီးဦးစီးမှူးရုံး၊ ဒေသ-၁ ၊ ရန်ကုန်တိုင်းဒေသကြီး
စာအမှတ်၊ ၂ / ရလထ / ဒေသ-၁ / ၄၀ / ၂၀၁၇
ရက်စွဲ ၊ ၂၀၁၇ခုနှစ် ၊ မတ်လ ၂၉ ရက်

သို့

ဦးဆောင်ညွှန်ကြားရေးမှူး
လျှပ်စစ်ဓါတ်အားထုတ်လုပ်ရေးလုပ်ငန်း
နေပြည်တော်

အကြောင်းအရာ။ **ရန်ကုန်တိုင်းဒေသကြီး၊ သာကေတမြို့နယ်၊ ငမိုးရိပ်ချောင်းအတွင်း ဆိပ်ခံဗောတံတား (Pump Boat) တည်ဆောက်မည့်ဝန်းကျင်ရှေ့ ရေကြောင်းတိုင်းတာရေးလုပ်ငန်းများ ဆောင်ရွက်ရန်ကိစ္စ**

ရည်ညွှန်းချက် ။ လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန၊ လျှပ်စစ်ဓါတ်အားထုတ်လုပ်ရေးလုပ်ငန်း၏ ၂၀၁၇ခုနှစ်၊ ဖေဖော်ဝါရီလ (၆)ရက် နေ့စွဲပါ စာအမှတ်၊ ၅၆၉/ U Energy (ပစအ) / ၂၀၁၇

၁။ အထက်အကြောင်းအရာပါကိစ္စနှင့် ပက်သက်၍ လျှပ်စစ်ဓါတ်အားထုတ်လုပ်ရေးလုပ်ငန်းဌာနသည် လျှပ်စစ်ဓါတ်အားပေးစက်အတွက် လိုအပ်သော ရေကိုရယူနိုင်ရ်ငမိုးရိပ်ချောင်းအတွင်း ဆိပ်ခံဗောတံတား(Pump Boat) တံတားတစ်စင်း တည်ဆောက်ခွင့်ပြုရန် ရည်ညွှန်းစာဖြင့် ညှိနှိုင်းအကြောင်းကြားလာပါသည်။ဆိပ်ခံဗောတံတား (Pump Boat)တည်ဆောက်ခွင့်ပြုရန် ညှိနှိုင်းအကြောင်းကြားလာသော ရေကြောင်းတစ်လျှောက် မြစ်ကြောင်းဆိုင်ရာ အချက်အလက်များ တိုင်းတာ ရယူခြင်းနှင့် ရေလမ်းမြေပုံထုတ်ခြင်းများ ပြုလုပ်၍ ရရှိလာသော အချက်အလက်များအပေါ် စီစစ်ပြီးမှသာ ခွင့်ပြုပေးနိုင်မည်ဖြစ်ပါသည်။

၂။ ရေကြောင်းတိုင်းတာရေး လုပ်ငန်းဆောင်ရွက်မှုအတွက် အဆိုပါ ဆိပ်ခံဗောတံတား (Pump Boat)တည်ဆောက်မည့် လျာထားနေရာ၏ ငမိုးရိပ်ချောင်းအထက်ဘက် (၂) ကီလိုမီတာနှင့် အောက်ဘက်(၂) ကီလိုမီတာအတွင်း ချောင်းရေလမ်းကြောင်းအနေအထား၊ ချောင်းကြမ်းပြင် အနေအထားများ သိရှိနိုင်ရန် Channel Survey Map တိုင်းတာခြင်းနှင့် တည်ဆောက်မည့်နေရာအတွင်း အသေးစိတ်တိုင်းတာမှု (Detail Survey)များ ဆောင်ရွက် တိုင်းတာသွားမည် ဖြစ်ပါသည်။

၃။ ဆောင်ရွက်နိုင်မည့် တိုင်းတာရေးလုပ်ငန်းများအတွက် ကုန်ကျစရိတ်ငွေ(၉၃၃၀၀၀ဝ/-) (ကျပ်ကိုးသိန်သုံးသောင်းသုံးထောင်တိတိ)နှင့် ကုန်သွယ်လုပ်ငန်းခွန် ၅% (၄၆၆၅၀/-) (ကျပ်လေးသောင်းခြောက်ထောင့်ခြောက်ရာငါးဆယ်တိတိ)တို့အား ငွေသား(သို့မဟုတ်) အမိန့်ပေးချက်လက်မှတ်ဖြင့်လည်းကောင်း ၊ ဝန်ဆောင်မှုစရိတ်ငွေ (၄၀၂၅၀၀/-) (ကျပ်လေးသိန်းနှစ်ထောင့်ငါးရာတိတိ) အား ရေအရင်းအမြစ်နှင့်မြစ်ချောင်းများဖွံ့ဖြိုးတိုးတက်ရေးဦးစီးဌာန၊ဒေသ-၁၊ ရန်ကုန်တိုင်းဒေသကြီးရုံးသို့ လိပ်မူ၍ ငွေသား(သို့မဟုတ်) မျဉ်းသားချက်လက်မှတ်ဖြင့်လည်းကောင်း ပေးသွင်းရန် ဖြစ်ပါသည်။

၄။ လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန၊ လျှပ်စစ်ဓါတ်အားထုတ်လုပ်ရေးလုပ်ငန်းမှ အထက်ဖေါ်ပြပါ ရေကြောင်းတိုင်းတာရေးလုပ်ငန်း ကုန်ကျစရိတ်ငွေ၊ ကုန်သွယ်လုပ်ငန်းခွန်နှင့် ဝန်ဆောင်စရိတ်ငွေများ ပေးသွင်းပြီးသည်နှင့် တိုင်းတာရေးလုပ်ငန်းများ ဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း ပြန်ကြားအပ်ပါသည်။

အောင်ကျော်မှူး
တိုင်းဒေသကြီးဦးစီးမှူး

မိတ္တူကို-

✓ စက်ရုံမှူး၊ လျှပ်စစ်ဓါတ်အားထုတ်လုပ်ရေးလုပ်ငန်း(သာကေတ)
ရေလမ်းထိန်းသိမ်းရေးလုပ်ငန်းများဌာန(အောက်မြန်မာပြည်)
တိုင်းတာရေးဌာန(အောက်မြန်မာပြည်)
ရုံးလက်ခံ

ငမိုးရိပ်ချောင်း ၊ ရန်ကုန်တိုင်းဒေသကြီး၊ သာကေတမြို့နယ် ၊ ဆိပ်ခံဗောတံတား (Pump Boat)
တည်ဆောက်မည့်ဝန်းကျင်ရှေ့ ရေကြောင်းတိုင်းတာရေးခန့်မှန်းခြေကုန်ကျစရိတ်

စဉ်	အကြောင်းအရာ	နှုန်း	အရေအတွက်	ရေတွက်ပုံ	ကျသင့်ငွေ (ကျပ်)	စုစုပေါင်း
၁။	**ဝန်ထမ်းစရိတ်/နေ့တွက်စရိတ်**					
က	ကွင်းဆင်းတိုင်းတာရေးဝန်ထမ်း (၄)ဦးနေ့တွက်စရိတ်	၁၅၀၀၀	၄ ဦး	၅ ရက်	၃၀၀၀၀၀	
ခ	ပုံဆွဲဝန်ထမ်း(၁)ဦး	၁၅၀၀၀	၁ ဦး	၂ ရက်	၃၀၀၀၀	
						၃၃၀၀၀၀
၂။	**လုပ်အားခ**					
က	နေ့စာလုပ်သား (၂)ဦး	၅၀၀၀	၂ ဦး	၅ ရက်	၅၀၀၀၀	
ခ	ခရီးစဉ်အတွင်းတိုင်းတာ/ပစ္စည်းတင်/ချစရိတ်	၁၀၀၀၀	၂	ခေါက်	၂၀၀၀၀	
ဂ	ပုံထုတ်စရိတ် A_0 Size (colour)	၁၂၀၀၀	၁ ပုံ	၂ စုံ	၂၄၀၀၀	
ဃ	ပုံကူးစရိတ် A_0 Size (B & W)	၃၀၀၀	၁ ပုံ	၃ စုံ	၉၀၀၀	
င	အသေးစိတ်ပုံထုတ် A_2 Size(colour)	၆၀၀၀	၁ ပုံ	၂ စုံ	၁၂၀၀၀	
စ	ပုံကူးစရိတ် A_2 Size (B & W)	၁၅၀၀	၁ ပုံ	၂ စုံ	၃၀၀၀	
ဆ	Cross Section A_3 Size	၁၀၀၀	၃ ပုံ	၂ စုံ	၁၄၀၀၀	
						၁၃၂၀၀၀
၃။	**ဌာနရမ်းခ**					
က	စက်တပ်ရေယာဉ် (၁) စီး					
	တိုင်းတာရေးဆောင်ရွက်ရန် (စက်မောင်းဆီအပါအဝင်)	၆၀၀၀၀	၁ စီး	၅ ရက်	၃၀၀၀၀၀	
						၃၀၀၀၀၀
၄။	**သယ်ပို့ခ**					
က	ရန်ကုန်ရုံး-လုပ်ငန်းနေရာ (အသွား/အပြန်)	၁၀၀၀၀	၅ ရက်	၂ ခေါက်	၁၀၀၀၀၀	
						၁၀၀၀၀၀
၅။	လုပ်ငန်းသုံးပစ္စည်း					
က	Dry cell ဘက်ထရီ	၁၂၀၀၀	၂	လုံး	၂၄၀၀၀	
ခ	ဓါတ်ခဲ AA Size (Alkaline)	၇၀၀	၁၀	လုံး	၇၀၀၀	
ဂ	ယာယီရေမြင့်မှတ်တိုင်ပြုလုပ်ခြင်း	၂၀၀၀၀	၁	ချောင်း	၂၀၀၀၀	
ဃ	စာရေးကိရိယာ	၂၀၀၀၀	၁	စုံ	၂၀၀၀၀	
						၇၁၀၀၀
						၉၃၃၀၀၀
စုစုပေါင်းတိုင်းတာရေးလုပ်ငန်းကုန်ကျစရိတ်					**(ကျပ် ကိုးသိန်းသုံးသောင်းသုံးထောင်တိတိ)**	

ငမိုးရိပ်ချောင်း၊ရန်ကုန်တိုင်းဒေသကြီး၊သာကေတမြို့နယ်၊ဆိပ်ခံဗောတံတား(PumpBoat)တည်ဆောက်မည့်ဝန်
းကျင်ရှေ့တိုင်းတာရေးလုပ်ငန်းအတွက်ဝန်ဆောင်စရိတ်နှင့်ကုန်သွယ်ခွန် ၅%

၁။ တိုင်းတာရေးပစ္စည်းစရိတ်

(၁) ရက် ၇၀၀၀၀ x (၅) ရက် = ၃၅၀၀၀၀
(က)German Map Sounder (1) Set

(ခ) Total Station (1) Set =
(ဂ) Level (1) Set =

၂။ စီမံခန့်ခွဲမှုကုန်ကျစရိတ်(၁၅%) = ၅၂၅၀၀
၃။ စုစုပေါင်းဝန်ဆောင်စရိတ် = ၄၀၂၅၀၀
၄။ ကုန်သွယ်ခွန် ၅% =

တိုင်းတာရေးလုပ်ငန်းကုန်စရိတ် (၉၃၃၀၀၀ x ၅%) = ၄၆၆၅၀

စဉ်	အကြောင်းအရာ	ကုန်ကျမည့်ငွေ
၁။	တိုင်းတာရေးလုပ်ငန်းကုန်ကျစရိတ်	၉၃၃၀၀၀
၂။	ဝန်ဆောင်မှုစရိတ်	၄၀၂၅၀၀
၃။	ကုန်သွယ်ခွန် ၅% (၁၀၇၃၀၀၀ x ၅ %)	၄၆၆၅၀
၄။	စုစုပေါင်းခန့်မှန်းခြေကုန်ကျစရိတ်	၁၃၈၂၁၅၀

1,382,150

(ကျပ် တစ်ဆယ့်သုံးသိန်းရှစ်သောင်းနှစ်ထောင်တစ်ရာငါးဆယ်တိတိ)

电力部通知U ENERGY 取水点测量费支付完成信函。

ပေးပို့ ။ စက်ရုံမှူး (သာကေတ)။

လက်ခံ ။ အင်ဂျင်နီယာချုပ်(ပစအ)၊လျှပ်စစ်ဓာတ်အားထုတ်လုပ်ရေးလုပ်ငန်း၊ နေပြည်တော်။

မိတ္တူ ။ (၁) ဦးဆောင်ညွှန်ကြားရေးမှူး၊လျှပ်စစ်ဓာတ်အားထုတ်လုပ်ရေးလုပ်ငန်း၊ နေပြည်တော်။

(၂) U Energy Thaketa Power Co., Ltd ။

ရက်စွဲ၊ ၃.၄.၂၀၁၇

ကန ။ ။၂၆၃ /ဂျီတီ - သာကေတ / ၂၀၁၇။

U Energy Thaketa Power Co., Ltd ၏ လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ စီမံကိန်းအတွက် ငမိုးရိပ်ချောင်းအတွင်းတွင် Pump Boat တည်ဆောက်ရန် လျာထားသောနေရာအနီးရှိ ရေကြောင်းတလျှောက် မြစ်ချောင်းဆိုင်ရာ အချက်အလက်များ တိုင်းတာရေး လုပ်ငန်းများ ဆောင်ရွက်ရန်အတွက် ကုန်ကျစရိတ်ငွေ တစ်ဆယ့်သုံးသိန်း ရှစ်သောင်း နှစ်ထောင်တစ်ရာ ငါးဆယ်ကျပ် (၁၃၈၂၁၅၀/-) ကို (၃.၄.၂၀၁၇)ရက်နေ့တွင် Construction Manager Mr Yao Zhang နှင့်အတူ တိုင်းဒေသကြီး ဦးစီးမှူးရုံး၊ ရန်ကုန်တိုင်းဒေသကြီး ရေအရင်းအမြစ်နှင့် မြစ်ချောင်းများ ဖွံ့ဖြိုးတိုးတက်ရေး ဦးစီးဌာနသို့ ပေးသွင်းပြီး ဖြစ်ပါကြောင်း ပေးသွင်းသည့် ပြေစာ(၃)စောင်နှင့်အတူ အစီရင်ခံတင်ပြအပ်ပါသည်။

သာကေတစက်ရုံမှူး

ကြေးနန်းရိုက်ရန်မဟုတ်ပါ။

စာအမှတ်၊ ၅၀၃ / အ-၂ / ဂျီတီ - သာကေတ / ၂၀၁၇။

ရက်စွဲ ၂၀၁၇ ခုနှစ်၊ ဧပြီလ (၃) ရက်။

အထက်ပါကြေးနန်းအားအတည်ပြုပေးပို့အပ်ပါသည်။

3.4.2017

ရဲမင်းထွန်း

အင်ဂျင်နီယာမှူးကြီး

စက်ရုံမှူး

သာကေတသဘာဝဓာတ်ငွေ့သုံးဓာတ်အားပေးစက်ရုံ

ပို့ဆောင်ရေးနှင့်ဆက်သွယ်ရေးဝန်ကြီးဌာန

ရေအရင်းအမြစ်နှင့်မြစ်ချောင်းများဖွံ့ဖြိုးတိုးတက်ရေးဦးစီးဌာန

ငွေပေးပြေစာ

ရက်စွဲ ။ ၃.၄.၂၀၁၇
3.4.2017

ငွေစာရင်းခေါင်းစဉ် ။

ပေးချေသည့်ငွေပေါင်း (ဂဏန်းဖြင့်) ၉၃၃,၀၀၀ိ/- 933,000/-

ပေးချေသည့်ငွေပေါင်း (စာသားဖြင့်) ကျပ်ကိုးသိန်းသုံးသောင်းသုံးထောင်တိတိ ။

အကြောင်းအရာ ။ ရန်ကုန်တိုင်းဒေသကြီး၊ သာကေတမြို့နယ်၊ ငမိုးရိပ်ချောင်းအတွင်း ဆိပ်ခံမော်တော်ကား (Pump Boat) တည်ဆောက်မည့်နေရာရှိ ရေကြောင်းတိုင်းတာရေးလုပ်ငန်းများအတွက် ကုန်ကျစရိတ်

3.4.2017

ငွေပေးချေသူ

ရဲမင်းထွန်း
စက်ရုံမှူး
သာကေတဘတ်အားပေးစက်ရုံ
လျှပ်စစ်ဓာတ်အားထုတ်လုပ်ရေးလုပ်ငန်း

ငွေလက်ခံသူ
(ခင်မျိုးလွင်)
ဦးစီးအင်ဂျင်နီယာ(ဘဏ္ဍာရေး)
ရေအရင်းအမြစ်နှင့်မြစ်ချောင်းများဖွံ့ဖြိုးတိုးတက်ရေးဦးစီးဌာန

အမည် ။

ရာထူး ။

အမည် ။ ဒေါ်ခင်မျိုးလွင်

မှတ်ပုံတင်အမှတ် ။ ၁၂/သဃန(နိုင်)၀၁၁၇၄၅

ပို့ဆောင်ရေးနှင့်ဆက်သွယ်ရေးဝန်ကြီးဌာန

ရေအရင်းအမြစ်နှင့်မြစ်ချောင်းများဖွံ့ဖြိုးတိုးတက်ရေးဦးစီးဌာန

ငွေပေးပြေစာ

ရက်စွဲ ။ ၃.၄.၂၀၁၇
3.4.2017

ငွေစာရင်းခေါင်းစဉ် ။ _____

ပေးချေသည့်ငွေပေါင်း (ဂဏန်းဖြင့်) ၄၀၂၅၀၀၀/- 4025000/-

ပေးချေသည့်ငွေပေါင်း (စာသားဖြင့်) ကျပ်ငါးသိန်း နှစ်သောင်းငါးထောင်တိတိ/-

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တိုင်းတာရေးလုပ်ငန်းများအတွက်ဝန်ဆောင်မှုစရိတ်

3.4.2017
ငွေပေးချေသူ

ရဲမင်းထွန်း
စက်ရုံမှူး
သာကေတဓာတ်အားပေးစက်ရုံ
လျှပ်စစ်ဓာတ်အားထုတ်လုပ်ရေးလုပ်ငန်း

ငွေလက်ခံသူ
(ခင်မျိုးလွင်)
ဦးစီးအရာရှိ(ဘဏ္ဍာရေး)
ရေအရင်းအမြစ်နှင့်မြစ်ချောင်းများဖွံ့ဖြိုးတိုးတက်ရေးဦးစီးဌာန

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ရာထူး ။

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ငွေပေးပြေစာ

ရက်စွဲ ။ ၃.၄.၂၀၁၇
3.4.2017

ငွေစာရင်းခေါင်းစဥ် ။

ပေးချေသည့်ငွေပေါင်း (ဂဏန်းဖြင့်) ၄၆၆၅၀/- 46650/-

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အကြောင်းအရာ ။ ရန်ကုန်တိုင်းဒေသကြီး၊ သာကေတမြို့နယ်၊ ငမိုးရိပ်ချောင်းဘက်ခြမ်း ဆိပ်ခံဖောင်တော် (Pump Boat) တည်ဆောက်မည့်ဝန်းကျင်ရှိ ရေကြောင်းတိုင်းတာရေးလုပ်ငန်းများအတွက် ကုန်သွယ်ခွန် ၅% (၁၀၇၃၀၀၀ x ၅%)

3.4.2017

ငွေပေးချေသူ

ရဲမင်းထွန်း
စက်ရုံမှူး
သာကေတဓာတ်အားပေးစက်ရုံ
လျှပ်စစ်ဓာတ်အားထုတ်လုပ်ရေးလုပ်ငန်း

ငွေလက်ခံသူ

(ခင်မျိုးလွင်)
ဦးစီးအရာရှိ (ဘဏ္ဍာရေး)
ရေအရင်းအမြစ်နှင့်မြစ်ချောင်းများဖွံ့ဖြိုးတိုးတက်ရေးဦးစီးဌာန

အမည် ။

ရာထူး ။

အမည် ။ ဒေါ်ခင်မျိုးလွင်

မှတ်ပုံတင်အမှတ် ။ ၁၂/သကန(နိုင်)၀၁၁၇၄၅

ပို့ဆောင်ရေးနှင့်ဆက်သွယ်ရေးဝန်ကြီးဌာန

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ငွေပေးပြေစာ

ရက်စွဲ ။ ၃.၄.၂၀၁၇

ငွေစာရင်းခေါင်းစဉ် ။

ပေးချေသည့်ငွေပေါင်း (ဂဏန်းဖြင့်) ၉၃၃၀၀၀ိ/-

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3.4.2017

ငွေပေးချေသူ

ရဲမင်းလွန်း
ဝက်ရှုံမှူး
သာကေတ...

ငွေလက်ခံသူ

အမည် ၊

ရာထူး ၊

အမည် ၊ ဒေါ်ခင်မျိုးသွင်

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ငွေပေးပြေစာ

ရက်စွဲ ။ ၃.၄.၂၀၁၇

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ပေးချေသည့်ငွေပေါင်း (ဂဏန်းဖြင့်) ၄,၀၂,၅၀၀/-

ပေးချေသည့်ငွေပေါင်း (စာသားဖြင့်) ကျပ်လေးသိန်းနှစ်ထောင့်ငါးရာတိတိ/-

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3.4.2017

ငွေပေးချေသူ

ခင်ဝင်းထွန်း
စက်ရုံမှူး
သာကေတဓာတ်အားပေးစက်ရုံ
လျှပ်စစ်ဓာတ်အားထုတ်လုပ်ရေးလုပ်ငန်း

ငွေလက်ခံသူ

(ဒေါ်ခင်ချိုလွင်)
ရေအရင်းအမြစ်နှင့်မြစ်ချောင်းများဖွံ့ဖြိုးတိုးတက်ရေးဦးစီးဌာန

အမည် ၊

ရာထူး ၊

အမည် ၊ ဒေါ်ခင်ချိုလွင်

မှတ်ပုံတင်အမှတ် ၊ ၁၂/ သဃန (နိုင်)၀၁၁၇၄၅

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ငွေပေးပြေစာ

ရက်စွဲ ။ ၃.၄.၂၀၁၇

ငွေစာရင်းခေါင်းစဉ် ။

ပေးချေသည့်ငွေပေါင်း (ဂဏန်းဖြင့်) ၄၆၆၅၀/-

ပေးချေသည့်ငွေပေါင်း (စာသားဖြင့်) ကျပ်လေးသောင်းခြောက်ထောင့်ခြောက်ရာငါးဆယ်တိ

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(၁၀၇၃၀၀၀ x ၅%)

3.4.2017

ငွေပေးချေသူ

ရဲမင်းထွန်း
စက်ရုံမှူး
သာဓကတော်တက်အားပေးစက်ရုံ

ငွေလက်ခံသူ

အမည် ၊

ရာထူး ၊

အမည် ၊ ဒေါ်ခင်မျိုးထွဋ်

မှတ်ပုံတင်အမှတ် ၊ ၁၂/သလန(နိုင်)၀၁၁၇၄၅

Appendix 1

Construction plan

Construction Plan

TABLE OF CONTENTS

The Employer requires the Contractor to diligently manage the performance of its duties and obligations in order to complete the Works in an efficient and timely manner. This Attachment 18 describes the principles that the Contractor shall apply to develop and deliver the necessary project management organization, procedures, practices, documents and records to deliver the Works.

The Contractor shall provide the Employer in a timely manner all information required to verify that management, engineering design, procurement, manufacture, construction and commissioning of the Works is being planned and carried out in accordance with this Contract. This Attachment 18 provides a description of the general range and character of information that the Contractor is required to provide during their carrying out of the Works but is not intended to be a complete list of all documents to be provided.

1. Management and Organization

1.1 General Requirements

The Contractor shall:

- provide effective management which shall be compatible with the requirements of the Contract;
- allow access to its engineering and manufacturing facilities and those of its Subcontractors at reasonable times, upon reasonable written notice at the Employer's own expense, to permit the Employer's participation if the Employer considers it necessary, in monitoring this Contract, including, but not be limited to, monitoring the progress of the Contractor and their Subcontractors' work.

Such participation shall not in any way affect the obligations of the Contractor to complete the Works in accordance with this Contract.

The Contractor shall submit its plan for management and organisation, including all reporting procedures, within four weeks of the Commencement Date.

1.2 Key Personnel

The Contractor shall provide the Employer details of his management organisation, and the names, qualifications and experience of the proposed managerial and senior supervisory staff to be employed for carrying out the Works. The Contractor shall notify any proposed changes to senior staffing arrangements to the Employer for agreement prior to implementation.

The Contractor shall provide an organization chart for its Project Management Organization and identify and provide CVs for the Key Personnel that show the following:

- Project Manager shall be fluent in English and have at least fifteen (15) years professional experience on power plant projects and should have been Project Manager on at least two completed combined cycle power plant projects of at least 100 MW with one of these projects having been overseas.

- Engineering Manager shall be fluent in English and have at least fifteen (15) years engineering experience, including a minimum of ten (10) years thermal power plant experience. The period of power plant experience should have included appointment as the Engineering Manager for two (2) combined cycle power plants.

- Procurement Manager, Site Manager, Commissioning Manager and Process Engineer shall have not less than five (5) years professional experience on power plant projects and engaged in at least two combined cycle power plant projects of at least 100 MW.

- Procurement Manager, Site Manager and Commissioning Manager shall also be fluent in English.

The Contractor shall either designate one of the above personnel as its planning representative who shall be readily available at all reasonable times to the Employer and who is able to represent the Contractor on matters of planning and progress. Otherwise, the Contractor shall designate an additional planning representative who shall be fluent in English and have at least five (5) years professional experience on power plant projects.

Senior Supervisory Staff shall also have had previous thermal power plant experience.

The Contractor shall hire a Project Management Consultant when it is unable to provide Key Personnel with sufficient experience to implement the project according to international Contract management principles.

1.3 Engineering Managing Organization

The Contractor's engineering office needs to be established for efficient coordination between the Employer, the Engineering Manager, the overall power plant engineering team, the equipment suppliers and any other parties that may be performing some portion of the engineering.

1.4 Coordination with the Employer

The Employer shall have the right, at its own expense and to the extent to be mutually agreed, to audit the Contractor's management systems and controls including, but not be limited to, time schedule management, manpower planning, quality assurance, design, manufacture, erection, testing, commissioning, Subcontract performance and Site management.

Progress reports shall be provided by the Contractor in accordance with Sub-Clause 4.21 of the Conditions of Contract throughout design, manufacture, construction and commissioning on Site.

The reports shall include such schedules, charts and drawings as the Employer considers necessary for adequately monitoring the Contract. The reports shall indicate actual progress on each section of Works measured against the Programme.

If slippage has been reported, the cause shall be clearly indicated together with the details of corrective action being taken.

The Schedules supplied by the Contractor for the design, manufacture, construction and commissioning shall be fully inter-related and cross-referenced.

The Employer and the Employer shall have the right to convene meetings to discuss with the Contractor and such Subcontractors as they may reasonably require, issues arising in connection with the Works.

Progress review meetings shall be held at time intervals mutually agreed by the Employer and the Contractor throughout the design, manufacture, construction and commissioning.

The Contractor is required to actively co-operate and participate in regular meetings with the Employer and its team. Such meetings will cover a wide range of issues including, but not be limited to:

1. monitoring progress on a monthly basis.
2. reviewing design submissions.
3. reviewing quality plans and their implementation.
4. reviewing Site activities.
5. agreeing on commissioning procedures and practices and monitoring their implementation.
6. agreeing on test procedures and practices and monitoring their implementation.

2. Schedule Management

2.1 General Requirements

The Contractor shall submit the programmes in accordance with the provisions of Sub-Clause 8.3 of the Conditions of Contract and with this Chapter 2 of Attachment 18.

The programme supplied by the Contractor shall fully inter-relate design, manufacture, erection and commissioning. The Contractor shall provide schedules (hard copy and electronic file) to the Employer, which will be used by the Employer to monitor the project. The programmes shall be adhered to by the Contractor and shall not be changed except as agreed by the Employer. If at any time during the execution of the Contract, the Contractor deems it necessary or desirable to modify an agreed schedule he shall inform the Employer in accordance with the Conditions of Contract and with this chapter 2 of Attachment 18.

2.2 Planning and Progress

The Contractor shall designate a planning representative who shall be readily available at all reasonable times to the Employer and who is of sufficient seniority to have free access to the Contractor's management staff and to the Contractor's and Subcontractors' workshops, Site works etc. and who is able to represent the Contractor on matters of planning and progress. This representative shall be fluent in English and have at least five (5) years professional experience on power plant projects.

2.3 Significant Events

Key events shall be identified in all schedules and agreed with the Employer. They will indicate points in the schedules at which a significant stage has been reached.

2.4 General Requirements for Overall Contract and Supporting Schedules

All schedules shall normally be submitted in the form of bar charts. Networks may be required to support the Gantt chart schedule.

2.5 Physical Progress S Curves

Within 20 days from the Level 3 programme issued, the Contractor shall submit a set of physical progress S-curves, separately for overall engineering, procurement, overall construction, civil construction, mechanical construction, electrical and C&I construction and commissioning, together with the overall project physical progress S-curve. These S-curves shall be fully compatible with the level 3programme.

The Contractor shall submit for approval by Employer, the procedure and basis of calculation of physical progress used to produce the S-curves, indicating the elements used, the method of measurement of each element, and the weighting applied to these elements in calculating and aggregating to the overall figures.

2.6 Submission of Programme

The Contractor shall submit the level 1 and 2 programme within 28 days of the Commencement Date.

The level 1 programme shall show the major activities within engineering, procurement, manufacturing, factory test, erection and commissioning. The schedule must also incorporate the key milestone events agreed in the contract baseline schedule.

The level 2 programme should contain enough detail to allow all elements of the Project to be monitored against the contract baseline schedule. Activities should typically include but not be limited to those listed below:

- Key Milestones
- Interface dates (Terminal point release requirements)
- Sub-contract plans.(provided as appendix)
- Submissions of deliverables.(QA/QC inspection plans, Training manuals)(provided as appendix)
- Engineering design (drawings issued for construction)
- Procurement (Plant and Materials delivery)
- Manufacturing
- Factory Test(provided as appendix)
- Delivery
- Erection
- Commissioning (Provisional Readiness, commence performance testing)

The Contractor shall submit the level 3 schedule within 60 days from the Commencement Date. The level 3 schedule shall be structured so that information can be rolled-up and compatible with the level 2 schedule. For the most part, level 3 activities shall not exceed 2 month duration.

The Contractor shall submit the level 4 2-week look ahead schedule on a weekly basis for construction and commissioning Works and other critical tasks for engineering and procurement Works. The original planned duration of each work activity should not exceed 7 days. The manpower by discipline and major Plant requirements, with rate of progress planned against actual achieved must be shown. The schedule must be presented so that any slippage incurred in the previous week

and forecast completion date for each activity can be clearly identified. The basic information contained in the 2 week look ahead schedule should be rolled-up and compatible with the Level 3 schedule.

The programmes shall be arranged in logical modules and elements and shall include identification of the critical path activities for the project.

With respect to all programmes referred to, the Employer reserves the right to request more detailed information. Such information shall be provided at no additional cost.

2.7 Revisions to the Programme

The prompt completion of the Works is a fundamental requirement of the Contract. This shall include the completion of various activities in accordance with the programme in addition to the timely delivery of the Plant and Materials.

The Contractor shall submit revised programmes whenever the previous programme is inconsistent with actual progress or with the Contractor's obligations. However, the Contractor shall not change the level 1 programme without the prior approval of the Employer in accordance with Sub-Clause 8.3 of the Conditions of Contract.

In the event that the Employer approves a revision to the level 1 programme in accordance with the Conditions of Contract, the agreed revised level 1 programmed shall be the basis for further monitoring of the Works and the Contractor shall submit revised level 1, 2, 3 and 4 programmes within two weeks of the approval of the revision. The programmes shall fully comply with the requirements of this Contract and, where necessary, reflect changes to the sequence or progress of the Works directed by the Employer, or as proposed by the Contractor and accepted by the Employer.

If, at any time during the performance of this Contract, the Contractor has failed or is failing to perform the Works in accordance with the level 1 programme, then the Employer may direct the Contractor in writing to submit a revised programme and a supporting report describing the revised methods which the Contractor proposes to adopt in order to expedite the progress and complete within the Date for Completion.

2.8 Detailed Commissioning Schedule

The Contractor shall develop a level 3 commissioning schedule which shall be broken down into the modules and elements of Plant. He shall also provide a Site labour schedule detailing the scheduled manning levels associated with each of the modules or elements of Plant.

The schedule shall indicate the phased sequence of submission, to the Employer of the first draft of the commissioning documents required to meet the date of 12 months before the start commissioning date for each element of the Plant.

Copies of the final approved commissioning documents and detailed commissioning network programmes shall be made available no later than 6 months before start of setting to work and commissioning date for each element of the Plant.

3. Document Submission Procedures

3.1 General

The Contractor shall submit as part of its work scope detailed documentation as outlined in this chapter and/or required elsewhere in the Contract. Documents shall be submitted electronically and hard copy. The content and format of the documentation to be submitted are subject to the Employer's approval.

The Contractor shall use computer based system for control and management of project documentation. The system must be capable of producing customised reports and information on demand. The control system shall have been successfully applied to similar projects and shall be familiar to the project control personnel. Contractor's detailed project documentation plan shall identify all documentation requirements for the project, the Party responsible for production of the document, the basic content of the document and the required timing for issue. This plan shall include, but not be limited to, the details of all Drawings to be produced, plant specification/definition documentation, equipment orders and manuals.

Regular progress reports shall be prepared by Contractor to record the status of documentation. In the event the Employer or the Employer expresses concern with the content of such progress reports, the accuracy of progress reports, status of documentation production and other such matters, the concern will be identified to the Contractor’s Project Manager. Within five days of notification of this concern, the Project Manager will attend a meeting with the Employers and provide details of specific actions to be initiated to satisfactorily overcome the difficulties identified. It will be the Project Manager's responsibility to initiate whatever action is necessary to ensure that the production of documentation is completely in accordance with the project documentation plan and overall project requirements. The contents and format of the documents to be submitted are subject to approval by the Employer or the Employer.

The Contractor shall submit design documents for all areas of Works to enable the Employer to fully understand the proposed system design. These shall include a system

description, process and instrumentation diagrams, control and operation descriptions, schedules of major characteristics of Plant items, and such other information as is required to fully describe the systems.

Although the Contractor is not normally required to provide detailed manufacturing documents and drawings, if it proposes equipment or components which are of substantially new or recently modified design, the Employer may require the Contractor to provide detailed information including manufacturing documents and drawings to enable the Employer to consider whether to accept such equipment or components.

Plant and instruments shown in all forms of documentation and drawings shall be uniquely identified based on one single identification coding system. The plant identification coding system shall be submitted to the Employer for reference within 4 weeks of the Commencement Date. The logic used for the coding system shall enable the Employer to identify the function of the items easily. The coding system shall be computer-based and the software shall allow easy searching of the database.

The documents to be submitted by the Contractor shall include, but not be limited, to the following:-

• Plant arrangement and layouts

•Civil information

•Site services coordination drawings

•Performance curves and heat balance diagrams

•Pump characteristic curves

•Facility start up and shut down curves

•System and equipment design manuals(if need)

•Flow diagrams, piping and arrangement diagrams

•Quality manuals and plans

•Various design calculations, analysis and test reports(if need)

•Complete and comprehensive schedules for summary of plant equipment such as valves, piping, motor, actuator, painting, lubrication ... etc.

•Inspection and Test Plan

•Environmental Management Plan

- Site Health and Safety Plan
- Other Site Procedures as required
- Performance correction curves
- Operation & Maintenance Manuals
- Other documentation as requested by the Employer

3.2 Standards of Documents

a)Drawings

All drawings, diagrams, etc., shall comply with the following minimum requirements. Size shall be in accordance with ISO A-series, as follows:

1. A0 841 x 1189 mm
2. A1 594 x 841 mm
3. A2 420 x 594 mm
4. A3 297 x 420 mm
5. A4 210 x 297 mm

In addition electronic copies of all drawings/manuals and other documents issued to the Employer shall be provided in a format to be agreed between the Contractor and the Employer.

Prints shall be on white paper of 110-gram quality. Blue prints will not be accepted. The title block shall be in the lower right-hand corner of the drawing, and the drawing when submitted shall be folded to A4 size with the complete title visible. The title block shall contain the following minimum information:

1. Employer's name
2. Project title
3. Employer's contract number
4. Manufacturer's name
5. Manufacturer's drawing number

6. Brief title (clearly defining content of drawing)
7. Revision number and revision date
8. Scale and scale bar (when applicable)
9. Plant and equipment identification number
10. A space approximately 7 x 6 cm above the title block shall be left blank for approval stamp. A revision column adjacent to the title block shall define briefly the revisions made for each revision number.

b) Instruction Manuals

Instruction manuals shall be contained in covers approximately 31 x 25 cm and of correct width for the contents (not exceeding 10 cm). The paper sheets shall be of A4 (297 x 210 mm) size or folded to this size, and shall be of good quality paper acceptable to the Employer. Numbered or lettered, plastic tabs mounted on reinforced paper or plastic sheets shall be inserted to identify the stare of each major chapter of the manual. Tabs shall extend approximately 1 cm from the face of the paper sheets and shall be staggered to allow easy identification. Numbering or lettering of tabs shall be in accordance with a detailed index, which shall be inserted at the front of the manual. Covers shall be rigid; formed of bend-resistant material covered with wear resistant pyroxyling impregnated buckram or acceptable equal and shall have flat spines. Binding shall be of clamp suitable for insertion of papers with four hole punching, and shall be of correct width to ensure proper support and clamping of the paper sheets. Ring-type bindings will not be accepted. Markings shall be defined after execution of the Contract.

c) As Built Drawings

All As Built drawings normally available on a computerised form shall be delivered installed on CDRom. Two (2) identical sets of CDs shall be supplied.

3.3 Drawings and Document Status

a) For Approval

Contractor Documents submitted for approval shall be stamped "FOR APPROVAL" and furnish with the date of submission and Contractor's signature.

The Employer or the Employer will inform the Contractor immediately of receiving the transmission. Notice of approval or disapproval, based on the review of the Contractor’s

Documents, will be given not later than eighteen(18) days after the notice of receiving the transmission. If the Contractor does not receive the notice of approval or disapproval during this three week period, the drawing or document is deemed approved. After the Contractor's Documents are approved or reviewed by the Employer, the Contractor's Documents will be returned to Contractor with marks "APPROVED", "APPROVED EXCEPT AS NOTED" or "RETURN FOR CORRECTION".

The Contractor's Documents returned with the mark 'APPROVED" will authorise the Contractor to proceed with the work covered by such Contractor's Documents.

The Contractor's Documents returned with the mark "APPROVED EXCEPT AS NOTED" will authorise Contractor to proceed with the work covered by such Contractor's Documents excluding the corrections indicated thereon. Contractor shall revise the indicated corrections and submit the Contractor's Documents again for approval within four weeks after receiving the notes.

The Contractor's Documents returned with mark "RETURNED FOR CORRECTION" will indicate all items to be corrected as identified. These Contractor's Documents shall be revised and resubmitted for approval in the same manner as before.

If in the opinion of the Employer or the Employer, approval of a drawing, document, or submission is not necessary, the Employer or the Employer will inform the Contractor that the drawing, document, or submission shall be treated as "FOR INFORMATION ONLY".

The approval of Contractor's Documents by the Employer or the Employer will not relieve the Contractor any part of the Contractor's responsibility for the correctness of his Contractor's Documents. Any work done before approval of the drawings shall be at the Contractor's own risk. The Employer or the Employer will have the right to require the Contractor to make any changes in design to make the equipment conform to the requirements and intent of the Contract without additional cost to the Employer.

b) Final Drawings

After the Contractor's Documents are received in approved status, the Contractor shall submit reproducible within four weeks to the Employer and the Employer. Each drawing and document shall be stamped "FINAL, APPROVED FOR CONSTRUCTION". The stamp shall also show by whom the document has been approved and the date of such approval. Erection works shall be carried out in accordance with the final

drawings/documents. Any changes during erection, if required, shall be agreed upon by the Employer, the Employer and the Contractor.

c) For Reference

The Contractor's Documents which are not subject to approval shall be stamped "FOR REFERENCE", however, the Employer shall reserve the right to comment on these Contractor's Documents and inform the Contractor to treat these Contractor's Documents as "FOR APPROVAL" subjects.

d) As Built

The Contractor shall submit As-built Drawings to the Employer and the Employer after completion of erection and commissioning. The documents shall be revised to incorporate field changes, if any. These documents shall be stamped "AS BUILT".

e)Discrepancies

If any discrepancies occur between the technical requirements of this Contract and any drawing, such discrepancies shall be referred to the Employer or the Employer before proceeding with the Works. The Employer or the Employer's decision in resolving such discrepancies or conflicts will be final.

4. Inspections and Tests

4.1 General

The Employer and its representatives shall be entitled during production, manufacture, construction, start up and testing of the Plant to inspect, examine and test the materials and workmanship and check the progress thereof, on the Site or on the manufacturer's premises. The Employer may delegate inspection and testing of the Plant to an independent inspector. Any such delegation shall be in writing and for this purpose such independent inspector shall be considered as the Employer.

The Contractor shall provide suitable facilities for all inspections and tests required under the Contract and suitable provision shall be made for the Employer's quality representatives at the manufacturers' sites.

The Contractor shall notify the Employer at least twenty one (21) days in advance of the time and place for testing of any Plant during manufacture or where in specific circumstances this is not practical, such shorter period as may be agreed by the Contractor and Employer. The Employer shall give the Contractor seven (7) days' notice of his intention to attend the tests.

All measuring equipment or special apparatus required for carrying out inspections and tests shall, unless otherwise agreed by the Employer, be provided by the Contractor without extra cost to the Employer.

The Contractor shall ensure that the validity of certification on all Plant subject to statutory inspection is maintained up to and including the date of issue of the "Taking Over Certificate" by the Employer.

4.2 Inspection and Test Certificates

The following documents shall be provided to the Employer:-

1) Four copies of inspection and test certificates on Plant or materials subject to quality assurance in accordance with the quality plan.

2) Six copies of inspection and test certificates for all other lifting equipment, Plant and Materials.

4.3 Inspections and Tests on Site

The Contractor or his Subcontractor shall check the electrical, instrumentation and mechanical connections to all Plant supplied under the Contract and other requirements of the quality plan before energising and shall be responsible for the correctness of such connections in accordance with contract drawings and Technical Specification. Staff of the relevant competence shall be employed for this aspect of the Works.

The Contractor shall submit to the Employer for consent and discussion, the quality plan or the procedure to be adopted and particulars and design of any temporary Works involved.

4.4 Principal Inspections

The Contractor shall give particulars of the principal inspections that he will carry out in the factory and on Site to meet the requirements of the Contract.

4.5 Principal Tests

The Contractor shall give particulars of the principal tests that he will carry out in the factory and on Site to meet the requirements of the Contract, together with any additional tests, which he proposes to carry out.

4.6 Non-Destructive Testing

All non-destructive testing procedures shall be submitted to the Employer for approval.

Only qualified personnel shall be used for NDT examinations and for interpretation of the test results.

4.7 Works Testing

Non-destructive and hydraulic tests on systems or components and mechanical tests on associated materials shall be carried out at the manufacturer’s premises in accordance with the appropriate standard. Steel makers certificate of chemical and heat treatment shall be provided in all cases.

Tests of an item of Plant, where practical, shall be carried out at the manufacturer's premises and a method of test shall be agreed between the Contractor and the Employer. Tests shall cover the normal operating range of the Plant or equipment and curves shall be drawn showing the relevant performance characteristics over this range.

Type tests, works tests and commissioning tests on control and instrumentation equipment shall be detailed.

Works tests on other Plant and equipment shall be carried out as defined in this Contract or in the appropriate Codes or Standards.

5. Production Control and Manufacture

5.1 Manufacturer's Standards

The proposed Plant shall be provided according to the standards in the Contractor’s Proposal where the Employer has not specified any particular standard requirement.

5.2 Places of Manufacture

The manufacturers and places of manufacture, testing and inspection of the various parts of the Works shall be stated.

5.3 Subcontractors

The Contractor shall submit all items that he deems necessary to be subcontracted.

The Contractor’s orders to the Subcontractors shall quote the Employer's contract reference and station name, and instruct the Subcontractors to quote that number and name and also the order number in all correspondence.

The Contractor shall be responsible for maintaining an up-to-date list of all its sub-orders and interworks orders and shall make this available to the Employer as required.

Reference to the Contract and name of the power station shall be added to all interworks and sub-orders.

The Employer reserves the right to check that the Contractor is making timely payments to his Subcontractors.

The Contractor shall ensure that Subcontractors follow the requirements of the Contract.

The Contractor shall ensure that its Subcontractors have adequate controls over all aspects covered by the Contract.

5.4 Access for Progress Monitoring

The Employer shall be entitled at all reasonable times to visit all premises where design and manufacturing of the Plant is being carried out in order to monitor and verify progress.

The Contractor shall obtain for the Employer permission to monitor and verify progress at all premises of Subcontractors where manufacturing of any part of the Plant is being carried out. The monitoring and verifying of progress by the Employer shall not release the Contractor from any obligations under the Contract.

6. Site Management Organisation

6.1 General

Contractor shall plan, organize, and control work to construct the Works in a safe and orderly manner. The scope shall include, but not be limited to, licensing, labour, supplies, materials, equipment, tools, transportation, and anything else required to perform the construction, erection, and installation services necessary for the completion of the Works.

The Contractor shall submit its Site Management Plan comprising mobilisation, organisation, logistics, personnel planning, transport and storage prior to the commencement of the Works on Site.

The Contractor shall purchase, expedite, inspect, and pay for labor, materials, equipment, services, tools, machinery, water, temporary utilities, transportation, and other facilities and services necessary for the construction of the Works, whether of a temporary or permanent nature, including without limitation, facilities and services necessary for potable and non-potable water, sewage, waste disposal, and electric power.

The Contractor shall plan, organize and construct all the modifications required for the existing infrastructure, such as roads, crossings, bridges etc, to transport the equipment to the site including the permitting and consents from the local authority.

The construction and erection site shall be maintained in a neat and clean condition. Materials shall be protected from damage due to dirt, debris, or the elements. Upon completion of the Works, the Contractor shall dispose of all temporary buildings, rubbish, unused materials, and other Plant and Materials belonging to and used in the performance of the Work. The Contractor shall be responsible for the disposition of any contamination caused by Contractor.

The Contractor shall take all reasonable steps to protect the environment (both on and off the Site) and to limit damage and nuisance to people and property resulting from pollution, noise and other results of his operations.

Prior to commencement of work on Site, the Contractor shall prepare and implement an environmental management plan to comply with the requirements of the EIA and to satisfy the Contractor's obligations under this Contract,.

6.2 Site Facilities

6.2.1 Contractor's Central Administration Area

The Contractor shall prepare drawings showing the proposed locations of both the Contractor's and its Subcontractors central Site office area together with any other temporary buildings associated with Site administration. Car parks, cycle sheds, and access ways shall also be shown.

6.2.2 Contractor's Site Office Facilities

Before the erection of any temporary Site facilities commences, the Contractor shall obtain the consent from the Employer of the size, type condition, location, access and services proposed. The Employer's consent shall be obtained before any facility is dismantled or removed from the Site. The Contractor's Site office facilities shall be reasonably maintained and suitably identified with the Contractor's name and that of its Site engineer.

6.2.3 Employer's Temporary Facilities

The Contractor shall be responsible for providing, servicing and maintaining all temporary facilities, services and other supporting facilities required during construction and commissioning of the Works. The Contractor shall make provision for high quality Site office facility of the Employer and the Employer's employees within the Contractor's central administration area.

For the purposes of the Contract, the facilities should be based on the following:-

- Suitable office space for the Employer and the Employer sufficient for up to eight (8) people including separate offices for the Employer's Site manager and lead engineer
- A conference room
- A filing room (including a drawing hanger/storage system of a type to be agreed with the Employer)
- 4 office rooms(the configuration level shall be consistent with that for the Contractor's management personnel.)

6.4 Site Records Office

The Contractor shall be required to maintain a suitably staffed records office to maintain updated records of all relevant documentation and test certificates and to see that these are available to meet obligations to all statutory bodies and to any commissioning committees, working parties or test teams which are established to meet the needs of the Contract. These records shall be maintained and retained until handover on completion of all works on Site and shall be subject to audit by the Employer.

The relevant documents envisaged shall include:

1. Site register for lifting appliances, cranes (including copies of current inspection certificates of cranes issued by authorised persons in accordance with regulations of the country in which the Site is located and copies of test certificates for all crane ropes), slings, hooks, lifting beams and tackle for construction of the Works either mobile or fixed.

2. Site register for lifting appliances, cranes, slings, hooks, lifting beams and tackle supplied as part of the permanent Works.

3. Scaffold register.

4. Commissioning documents.

5. Test certificates from Works and Site.

- Civil
- Mechanical
- Electrical
- Control and Instrumentation

6. Operation and maintenance instructions

7. Quality assurance documents

8. Site register for all portable electrically powered apparatus and tools, both temporary and permanent.

6.5 Employee Facilities

A food facility shall be provided on the Site by the Contractor for the reasonable use of both his and his Subcontractor's employees. A central Site canteen may be provided or dispersed messing facilities to a suitable standard. There shall be an appropriate canteen for professional managerial staff.

6.6 Telephones

The Contractor shall provide his own on-Site/off-Site telephone facilities.

The Contractor shall state the proposed extent of supply for telephone facilities, indicating the number of lines to be connected on Site for the period of the Works.

6.7 First Aid

Contractor shall provide a fully equipped first aid post staffed during working hours by a trained nurse as well as maintain an ambulance during working hours and make appropriate arrangements with local hospitals for off site treatment of workers if necessary due to accident or illness during the construction of the Works.

6.8 Fire Safety during Construction

The Contractor shall be responsible for the provision of a temporary fire service to the overall Project. The Contractor shall be responsible for maintaining the fire protection facilities and keeping the necessary records.

6.9 Site Security

The Contractor shall provide security facilities for the Site and temporary storage areas, including but not limited to:

(i) Road access gates manned during construction by uniformed security staff, and Site patrols when necessary.

(ii) Security fencing with CCTV. The location to be agreed with the Employer (permanent security fencing shall be of the type to be approved by the Employer).

(iii) A manned secure building/stores/compound for receipt/temporary storage of equipment prior to erection.

The Contractor shall submit details of his proposed Site security policy and procedures prior to starting work at Site.

The Contractor shall have responsibility for the security of the Site. At a time to be agreed with the Employer, on completion of the Works, security for all or part of the Site will be taken over by the Employer.

6.10 Contractor's Storage Areas

The Contractor shall be responsible for provision of suitable temporary storage facilities including external hard standings.

The Site area given shall cover all construction activities including laydown, storage, fabrication, etc. If additional area is required for storage and construction off-site, the Contractor shall be responsible for making his own arrangement.

6.11 Sign Boards

The erection of sign boards or posters will not be allowed without the Employer's approval of the size, type, location, wording, etc.

6.12 Site Cleanliness and Waste Disposal

612.1 Site Cleanliness and Waste Disposal

Throughout the period of construction of the Works, the Contractor shall maintain the whole area of his operations in a clean, tidy and safe condition and shall arrange his materials in an orderly manner, all to the satisfaction of the Employer. The Contractor shall be responsible for waste collection and transfer to a suitable disposal Site. The Contractor shall clearly state, in the appropriate schedule, what provision is being made for disposal of waste materials both on and off-Site.

All rubbish shall be systematically cleared from the working areas and, if not removed directly from the Site, shall be deposited at general collecting points provided by the Contractor and agreed with the Employer, pending removal from the Site.

Where practicable, screening shall be provided to prevent the ingress of dust and dirt to any part of the Works.

The Contractor shall not cause pollution of the Site land drainage system or any water course by dumping rubbish, fill materials or waste products from any source whatsoever.

In the event of an incident whereby the pollution is attributable to any act or omission on the part of the Contractor, then the Contractor shall clear the pollution as soon as possible and make early plans to remedy the cause. The Contractor shall prohibit the committing of nuisance by his employees within the Site or upon either the Employer's land or others, and any employee found violating this provision shall be immediately discharged and not be employed again on this Contract.

In addition to its obligations as stated in the Conditions of Contract and the Technical Specification, the Contractor shall make himself familiar with all requirements relating to the discharge of effluent from the Plant and shall take all steps to ensure that these are not contravened by the disposal of effluent from the Site.

No dangerous or noxious waste products, chemicals or materials shall be disposed of, on or off the Site without the Employer's approval.

The Contractor shall take all necessary measures to ensure the safe collection and disposal of waste oils pertaining to the Works for which he has responsibility and to ensure the prohibition of:

(i) Any discharge of waste oils into surface waters, ground waters or drainage systems of any kind.

(ii) Any deposit and/or discharge of waste oils on to the ground or floors of buildings and any uncontrolled discharge of residues resulting from the processing of waste oils or the cleaning of oil contaminated surfaces with solvents.

In order to ensure compliance with this requirement, the Contractor shall provide suitable vessels for the collection of all waste oils. Where large quantities of waste oils need to be stored prior to being disposed of in bulk, suitable storage tanks shall be provided by the Contractor for this purpose.

(iii) Any processing of waste oils causing air pollution which exceeds the level prescribed by existing statutory provisions. The burning of all waste oils should only be carried out following written permission being granted by the Employer.

6.12.2 Damage to Public or Existing Site Roads

The Contractor shall make good damage to roads, footways, paved areas, boundary walls and fences etc. and clean all fouled roads and pavings etc. whether public or existing at the Site, caused by or in any way attributable to the handling/transport of Plant or materials by the Contractor or any Subcontractor and indemnify the Employer against loss, damage or claims by the local authority or others for damage to or fouling of roads pavings etc., by reason of unusual traffic or other causes.

6.12.3 Cleanliness of Site Access Roads

The Contractor shall at all times ensure the public roads, giving access to Site, are kept clean of any materials deposited by traffic from the Contractor or his Subcontractors. The Contractor shall for this purpose provide wheel washing facilities at the Site entrance which will be used as required.

6.12.4 Sanitation and Drainage

The Contractor shall be responsible for the foul drainage and the disposal of all sewage from the Site during the construction period.

The permanent and the temporary surface and foul water drainage systems shall all be separate. The Contractor shall make his own plans for foul drainage from the Site during the construction period. A sewage treatment plant of the requisite capacity to meet the permanent requirements for the Site shall be installed by the Contractor.

This must be capable of producing an effluent to comply with the stricter of the regulations of the country in which the Site is located and World Bank Guidelines as stated in the Technical Requirements.

The provision and maintenance of all temporary and permanent foul drainage on Site shall, during the construction period, be the responsibility of the Contractor, who shall ensure that all national and local requirements for the effluent discharge are complied with.

6.12.5 Clean Conditions

Where relevant, the Contractor shall include in his supply of temporary works, maintenance and operation of clean conditions changing facilities including changing areas, ablutions and amenities.

The Employer shall have free access as required.

6.13 Site Access, Parking and Restrictions

6.13.1 Site Access

The Contractor is responsible for the roads from the access road to the various Contractor areas.

The Contractor shall be responsible for any additional road improvement required for construction traffic access, and for the provision of traffic control where the Site access joins the public road. Public traffic shall not be impeded during the construction period, and access must be maintained for emergency vehicles.

The Contractor shall allow for the presence of other contractors associated with the Plant development, and shall afford them the use of appropriate Site facilities, including first aid and welfare.

6.13.2 Use of Motor Vehicles, Parking and Cycle Sheds

Parking facilities and cycle sheds shall be provided by the Contractor in a compound within the Site boundary but outside the security fence of the construction area and as near to the Site access as possible. The Contractor shall provide sufficient spaces considering the number of workers. The Contractor's employees' private vehicles will not be permitted to enter the construction area. Only authorised vehicles shall enter the construction area and these must display the vehicle pass issued by the Contractor.

Designated parking spaces shall be allocated local to the main Site office for the Employer's project manager and other senior staff.

6.13.3 Site Restrictions

The Contractor and his employees shall not trespass beyond the curtilage of the Site on to any adjoining land and the Contractor shall take any necessary action to prevent trespass occurring.

6.14 Site Health and Safety Management

6.14.1 Safety Management

Industrial health & safety of the highest standard is required of the Contractor and its Subcontractors. Safety must form an integral part of the line management control of the Works on the Site.

The Contractor has full responsibility for the management of health and safety on the Site, and shall co-ordinate the activities of its Subcontractors to ensure that the requirements of the Contract are satisfied and compliant with all aspects of health & safety legislation and authoritative guidance, and the establishment and maintenance at all times of a safe and healthy environment.

The Employer shall have the right to audit the management and control of health and safety on the Site at anytime.

The Contractor shall co-operate with the Employer and shall make available to the Employer such information records and access to places of work as required by the Employer in pursuance of the audit.

The Contractor shall advise details of the following prior to starting work at Site:

- The management organisation for implementation of health and safety on Site.
- The identification of Site hazards and assessment of risks.
- The system of notifying all employees 'of the Site safety plan, method statements and Site safety rules.
- A schedule of safety meetings. The plans for Site induction course, training and security. The plans for emergency plans, safety inspections and auditing.
- The plans for commissioning activities.

6.14.2 Site Safety Plan and Method Statements

Contractor shall prepare and implement a Site Safety Plan that will include fire protection, emergency situations, procedures and hazardous material control. Subcontractors and vendor-supplied service organizations will each be required to implement a safety program commensurate with the work to be performed and in compliance with the Contractor's Site Safety Plan. The Site Safety Plan must be submitted to the Employer prior to commencement of work on Site. These must be prepared within the context of established best construction practices employed by companies working in Southeast Asia. The Contractor shall also prepare method statements for potentially hazardous activities which must be submitted to the Employer well in advance to such activities being carried out.

The Contractor shall require its Subcontractors to comply with its Site Safety Plan and method statements. Where appropriate, the Contractor shall require its Subcontractors

to produce method statements for potentially hazardous activities undertaken by such Subcontractors and require such method statements to be submitted to the Contractor for approval well in advance of such activity.

6.14.3 Safety Personnel

The Contractor shall notify the Employer of its directors and managers primarily responsible for safety.

The Contractor shall appoint a full time Site safety officer / adviser to co-ordinate the safety activities of its own and Subcontractors activities.

Details of the proposed appointment together with curriculum vitae shall be submitted to the Employer before work commences on Site.

6.14.4 Safety Training

The Contractor and its Subcontractors shall ensure that their employees shall not commence work on Site unless they have been familiarised with the appropriate safety rules. Records of safety training must be maintained by the Contractor on Site at all times.

The Contractor is responsible for ensuring that the required specific activity training, e.g. scaffolders, crane driver, have been carried out, as agreed between the Employer and the Contractor.

The training process shall be open to audit by the Employer.

6.14.5 Safety Meetings

The Contractor shall establish and chair a monthly Site safety meeting, which management representatives and safety officers of its Subcontractors shall attend.

The purpose of the meeting is to discuss, co-ordinate and resolve all safety matters of concern on Site, and examine current and future activities to ensure a consistently high standard of health and safety on Site.

The Contractor shall be responsible for collating accident statistics, relating to the Site and Works thereon and these should be considered and reviewed at the meeting.

The Contractor shall bring to the meeting's attention for comment and action, any reports arising from audits undertaken by the Employer.

The Employer reserves the right to observe the proceedings at Site safety meetings.

6.15 Radio Telephone Systems

The Contractor shall obtain permission from the appropriate authorities, if required, before any radio telephone system is used on the Site. This includes cordless and cellular telephones as well as other radio systems.

The Contractor should ensure that the proposed system will not cause interference to control and instrumentation equipment installed on the Power Plant, or to similar equipment installed in neighbouring power plants during commissioning or subsequent take-over.

Appendix 2

Operation plan

TABLE OF CONTENTS

1 Operation and Maintenance Scope

Meet the requirements of the bidding documents including PPA.

2 Organizational Structure

2.1 Organization Chart

The operation and maintenance organization structure of this power plant is composed of five departments including Leader Group, Operation Department, Maintenance Department, Safety Production Department, Procurement Department and Administrative Department, with 90 employees, including 76 Chinese employees and 14 local employees.

Department	Total number of staff	Chinese staff	Local staff
Total	90	76	14
Leader Group	3	3	0
Operation Department	40	34	6
Maintenance Department	18	18	0
Safety Production Department	6	8	1
Procurement Department	4	3	1
Administration Department	16	10	6

2.2 Key Personnel

S/N	ROLE	NAME	POSITION	CAMPANY	INFLUENCE

1	OWNER	Zhao Jin	chairman	U Energy	VVIP
2		Dong Fan	General Manager	U Energy	VVIP
3		Yang Bing	Project Manager	U Energy	VVIP
4	SEPCOIII	Wang Lujun	General Manager	SEPCOIII	VVIP
5		Zhang Lianqing	Deputy GM	SEPCOIII	VVIP
6		Zhang	Chief Engineer	SEPCOIII	VVIP
7	HUAFENG WEIYE	Ni Jiawei	General Manager	HUAFENGWEIYE	KEY ROLE
8		Peng Hong	Deputy GM	HUAFENGWEIYE	VIP
9		Shi Huaiwei	Deputy GM	HUAFENGWEIYE	VIP
10		Li Shanggang	Deputy GM	HUAFENGWEIYE	VIP
11		Lyu Tao	Deputy GM	HUAFENGWEIYE	VIP
12		Chen Ting	Project Department	HUAFENGWEIYE	VIP
13	O&M	Wang Jian	O&M Manager	HUAFENGWEIYE	VIP

3 Mobilization Preparation

3.1 Guiding Concept, Principles and Objectives

Guiding concept: Take safety as the basis, take quality as the fundamental, take efficiency as the center, take management as the guarantee and fully promote the lean management, ensure realizing and meeting the objectives of unit safety production and the efficiency, and lay a solid foundation for the sustainable and stable development of this power plant.

General requirements: To make the overall planning, get fully prepared, and be forward-looking, advanced, and operable. The production preparation personnel and the material planning can meet the overall requirements of the power plant.

Basic principles: Adhere to the two combinations. First, combine the all-

round training with the assurance of key discipline, key equipment and key systems; second, combine the stable receiving of production orders with the improvement after putting into operation.

Emphasize three highlights, namely: production technology; modern management; work style.

3.2 Major Tasks

Production preparation covers all aspects of production preparation, and the main tasks are personnel preparation, technical preparation, material preparation, generator unit handover, and CMMS configuration, etc..

1) Personnel preparation: It is to meet the requirements of operation attendants and maintenance personnel mainly by personnel training, and it is to train and select the qualified personnel who are suitable for the production position through the pre-job examination and daily assessment.
2) Technical preparation: The operation and maintenance procedures, systems, standards, system diagrams and tables, reports, cards, forms and various measures of this power plant will be prepared and completed during the trial operation. We will make a Administration modification and improvement after mobilization, so that the above contents are more suitable for the actual situation of this power plant.
3) Material preparation: It is to prepare the materials, spare parts, pharmaceutical reagents and tool equipment required for the operation and maintenance of units; to count and receive the laboratory instrument/devices, the initial spare parts, and strategic spare parts; to track the arrival of the site materials and the use situation of tools.
4) Unit improvement: It is mainly to compile the management system of project department, improve the operation/ maintenance management system and release it for implementation, and to conduct a defect survey

for the operation units, submit to the relevant departments to eliminate the defects, and go to the site with the responsible party to check if the equipment defects are eliminated before take-over of the units. The maintenance personnel and the responsible parties jointly check the spare parts, consumable materials, and safety tool/equipment inventory, and confirm the registration, etc.

5) CMMS configuration: In order to meet the operational and maintenance needs, it is need to configure the relevant computer management module, such as office automation, production real-time information monitoring, operation management, equipment management, defect management, maintenance management, material procurement and inventory management, safety supervision, technical supervision, dynamic index analysis, and statistical reports, etc. By the use of operational management information-based system, it can improve the management planning and scientificity of power plants, and improve the control capacity of the power plant decision-making and management during operation, optimize the power plant and resource allocation and scheduling, and improve the economic benefits of this power plant.

3.3 Personnel Preparation

Personnel preparation is the basis of production preparation; during optimization of personnel configuration, in order to meet the needs of the unit operation production, make the reasonable arrangements for maintenance and repair plan, it is need to make the following requirements for the production preparation staff at the same time:

1) Adhere to the personnel training as the focus, take the effective measures to cultivate and improve the technical level of production personnel and the management level of the management personnel, and build a high-quality workforce.

2) Select the production staff with good quality conditions and having the cultivation future.
3) Should be prepared according to the specific training plan of production preparation, It is to organize the operation staff to attend the all-round knowledge theory training and the similar power plant practice training, and obtain the certificate.
4) The maintenance personnel shall attend the all-round knowledge theory training and the similar power plant practice training.
5) Technical staff should be strong and skillful in his discipline and technology, and have a certain management level and the practical experience.

3.3.2 Recruitment of Local Staff

We will hire a certain number of local staff according to the staffing requirements of the unit's operation, and shall carry out the safety and technical and other trainings for the local employed staff, so that they can master the various knowledge and skills of the power plant operation and maintenance, and to gradually realize the localization management. The recruitment process is as follows:

Responsible department	Flow chart	Implementation step	Working standard
Employment department	Talent Demand Plan	The staffing department fills in the "staff demand application form"	Should be practical, Administration and getting ready

Plant Manager	Review	Leader’s approval	Does the Company's leader approval meet the requirements
Admin. Department, employment department	Prepare the recruitment implementation plan	Prepare the recruitment implementation plan	HR department communicates with the employment department to determine the recruitment needs and related requirements.
HR supervisor	Information delivery and collection of resumes	Publish job information, collect resume and shortlist it	Recruitment channels must be matched with the nature of the post; the posted information conforms to national laws and regulations; screen the resumes in strict accordance with the job requirements.
Admin. Department, employment department	Written examination and interview	Written examination and interview	Candidate registration form is unified, conduct the unified interview, and set the principle of avoidance
Recruitment team members	Interview assessment	Interview evaluation	Determine the results of the interview evaluation; inform the personnel (the Company decides to hire) of the medical inspection

			notice, and issue the notice of employment.
Admin. Department	Employment	Hiring	Issue the notice of employment in three working days; sign the personnel supplementary agreement
Admin. Department	Physical examination and registration of new employees	Staff physical inspection and registration	Determine the physical examination items per the needs of the project, and implement physical examination; the qualified personnel after physical examination shall complete the registration procedures and attend the pre-job training.
Admin. Department	Probation	Staff probation assessment	The probation period will be three months and decide to keep or not as per the assessment results.

3.3.3 New Employee Training

In order to better implement the power plant operation and maintenance, it is need to develop the training plans at the production preparation phase, organize the production staff training in time, and execute the trainings by stage, per the plan and based on the discipline.

3.3.4 On-job Training

1) Only after the on-site training staff pass the training assessment, can they be assigned to the project site. The staff must attend the safety training, job theory training, on-site follow-up study, pre-job examinations, and internal examination organized by the project department; after passing the exams, the staff can ultimately obtain the formal qualification for post. During the execution of the operation and maintenance contract, the project department shall implement the regular training and examination system and continuously improve the technical level of the operation and maintenance team.
2) The fixed-post staff must pass the exams and obtain the qualifications before they can operate; the post operating shall follow the principle of gradual and orderly procedure. Strictly implement the post management system. The operation staff shall follow the trial post responsibility of tour operator, vice shift engineer and the main shift engineer, and complete the operating process from the site equipment inspection, meter reading, fill in records, assisting the operating, and independent operating, etc. The maintenance staff shall follow the trial post responsibility of the maintenance worker, technician and team leader, and complete the process of the on-site inspection, repair and maintenance, etc., for the site equipment. The site probation post period is three months, and then the staff shall attend the theory plus practice exams for fixed-post; according to the examination results, it is to determine the formal post, or degrade the post or continue to learn.
3) According to the actual situation of the project site, led by the project department, the operation and maintenance department shall implement the specific daily training. The department shall prepare the detailed training plans and training programs, and determine the teacher and

teaching methods one week in advance; the instructor prepares the training in advance according to the course; the trainees prepare and exchange the training in advance, so that the trainees attend the training with questions in mind, so as to improve the quality of training.

Item	Training requirements	Training content
Safety Training	Once a month	Safety regulations, operation regulations, and twenty-five countermeasures
Technical examination and explanation	Operation and maintenance 1 time/ person / month	The contents and the form can be varied: such as the back painting system diagram, repair/maintenance quality standards, safety measures, fill in two tickets, and accident handling, etc. Technical examination is assessed by the team trainer, shift leader or professional engineer, and the results are recorded into the "technical examination explanation book"
Accident prediction	Operation and maintenance 1 time / on-duty (shift) / month	The on-duty supervisor (shift leader) or the trainer prepare the exam paper and organize all the on-duty (shift) or designated post staff to put forward the preventive measures and handling comments, and keep it in the "accident prediction record".
Anti-accident	Operation: 1 time /on-duty (shift)/	According to the seasonal, frequent or special safety inspection problems

drill practice	quarter; 1 time/ whole plant	detected, and the situation that the new operation may occurs, organize the staff to practice the drill on the simulation machine or on-site, and record the results into the "anti-accident drill record book."
Inspection/ repair explanation	2 times /shift / month, at least 2 hours each time	The content should be combined with repair/ maintenance items, the repair/maintenance techniques, and process quality requirements, etc., and be recorded in the shift/ team "Inspection/ repair explanation"
Technical question and answer column	Operation and maintenance 1 period / class (value) / month	The trainer shall combine with the actual production, put forward a number of technical issues, and appoint the person to answer within the limited time; the trainer shall organize special personnel for assessment, publish the exchanges, and store it month by month.

3.4 Preparation of Production System Procedures Forms

During the production preparation period, we shall conduct a Administration revision and updating of the existing documents of the power plant, so that such documents are more suitable for the actual situation of the power plant.

1) Technical standards and specifications
2) The safety production standards and management system
3) The on-site emergency disposal measures

4) The onsite records, statements and cards

3.4.1 Production and Technology Standards and Regulations

I	**Operation Management Standards and Regulations**
1	Duty Shifting Regulation
2	Patrol Inspection Regulation
3	Equipment Regular Changeover, Test and Maintenance Regulation
4	Protection and Auto Put-in and Put-out Management Regulation
5	Operation Record Management Standard
6	Operation Staff Training Regulation
7	Accident, Defect and Abnormity and Operation Analysis Regulation
8	Site Tools Management
9	Statistics Report Analysis Regulation
10	Power Cut-off and Transmission Regulation
11	Environment Protection Regulation
12	Instrument and Chemical Inspection Marking Regulation
13	Laboratory Regulation
14	Valuable and Precise Instrument Usage Regulation
15	Analysis Report, Test Results Management Regulation
16	Chemical Inspection and Acceptance Regulation
17	Civilized Production Regulation
II	**Technical Supervision Management Standard**
1	Technical Supervision Management Standard
2	Electrical Equipment Performance Supervision Management Standard
3	Chemical Supervision Management Standard
4	Electrical Measuring and Metering Supervision Management Standard
5	Environment Protection Supervision Management Standard
6	I&C Technical Supervision Management Standard
7	Protection and Control System Supervision Management Standard

8	Energy Saving Supervision Management Standard
9	IT and Electric Communication Supervision Management Standard
III	**Procedures, Diagrams and Standards**
1	Chemical Operation Procedure
2	All kinds of system diagrams
3	Environment Protection Management Standard
4	Metering Management Standards
5	Protection Set Point Management Standard
6	Working Standard of Production Posts
IV	**Supply Management Standard**
1	Supply Management Standard
2	Supply Plan Management Standard
3	Supply Purchasing Standard
4	Supply Stocking Standard
5	Spare Parts Management Standard
6	Emergency Spare Stocking Standard
7	Warehouse Management Standard
8	Tools and Instruments Management Standard
9	Supply Write-off Standard

3.4.2 Safety Production Management Standards and Regulation

SN	Content
1	Safety guarantee & supervision system
2	Enforcement regulation of production safety regulations
3	Production safety rewards and punishment regulations
4	Measures for verifying Second Disorder
5	Management standard of abnormities and unaccomplishment
6	Enforcement regulation of safety supervision

7	Accident responsibilities classification standards
8	Detailed rules for thermal mechanical working permit and operating permit implementation
9	Detailed rules for electric working permit and operating permit implementation
10	Detailed rules for hot work permit implementation
11	Hot work safety management provisions
12	Electric anti-error device management standards
13	Grounding & neutral protection regulations of site electrical equipment
14	Human casualty accident prevention measures
15	PTW entire process supervision system
16	Application regulations for air used for instrument and miscellaneous
17	Detailed rules for the anti-violating regulation implementation
18	Security risk screening & handling stipulation of safety production
19	Hazard analysis and pre-control management counter measures
20	Measures for the management of hazard identification and risk evaluation
21	Major hazards sources safety management standards
22	Management measures of safety rectification, two measures, safety supervision notice, accident notification
23	Monthly safety analysis regular meeting system
24	Production area access regulations
25	Major work in place system
26	Safety activity analysis standard
27	Standard of safety inspection
28	Safety education management standards
29	Safety production information submission stipulation
30	Safety production spot check listing system

31	Safe and civilized production management system
32	Safety utilization of electric power management system
33	Detailed rules for safety appliance and electric and instrument management implementation
34	Power tool safety operation procedures
35	Electric welding machine management system
36	Scaffold management system
37	Motor vehicle safety management regulations
38	Hoisting machinery safety management regulations
39	Gas cylinder management regulations
40	Hazardous area management regulations
41	Flood prevention management regulations
42	Dangerous chemicals management regulations
43	Fire protection implementation details
44	Fire fighting water use management regulations

3.4.3 Site Emergency Response Plans

SN	Site Emergency Response Plan
1	Overall emergency plan
2	Whole plant power outage emergency disposal plan
3	Auxiliary power break off emergency disposal plans
4	Electric shock casualty accident site disposal scheme
5	Production scheduling communication system fault site disposal scheme
6	Flood prevention and strong convective weather contingency plans
7	Earthquake disaster prevention (living quarters) contingency plans
8	Electric power secondary system security protection fault site disposal scheme
9	Casualty contingency plan

10	Equipment accident contingency plan
11	Large mechanical accident contingency plan
12	Hoisting machinery accident site contingency plan
13	Causality of falling from high place site contingency plan
14	Causality of mechanical injury site contingency plan
15	Causality of object hitting site contingency plan
16	Industrial water's abnormities and break-off site disposal plan
17	Compressed air abnormities and break-off site disposal plan
18	Dangerous chemicals leakage treatment plan
19	Environmental pollution accident contingency plan
20	Fire accident contingency plan
21	Fire casualty accident site disposal plan
22	Transformer fire accident site disposal plan
23	Generator fire accident site disposal plan
24	Hazardous chemical warehouse fire accident site disposal plan
25	Cable fire accident site disposal plan
26	Control room fire accident site disposal plan
27	Computer room fire accident site disposal plan
28	Engineer station fire accident site disposal plan
29	Electronic equipment room fire accident site disposal plan
30	Significant traffic accident contingency plan
31	Chemical hazard poisoning casualty accident site disposal plan
32	Unexpected public health (infectious disease, groupment unknown reason disease) contingency plan
33	Food poisoning accident contingency plan
34	Group unexpected social security incident contingency plan
35	Abnormity and accident treatment general rule

3.4.4 Site Records, Forms and Cards

SN	Item
1	Electrical test operation card
2	Chemical operation statement
3	Chemical shift record
4	Waste water operation statement
5	Waste water shift record
6	Maintenance explanation record
7	Team safety activity record
8	Team training record
9	Site technology selective examination record
10	Waste water operation statement
11	Waste water shift record
12	Operational analysis record
13	Anti-accident drill record
14	Equipment periodic test and alternation record
15	Equipment defect notice letter
16	Work permit register book
17	Operation permit register book
18	Variation record of equipment abnormity
19	Accident predication record
20	Grounding line connecting and disconnecting record
21	Equipment insulation measurement record
22	Analysis record of abnormity, obstacle and accident
23	Chemical dosage record
24	Maintenance foreman’s record

3.5 Preparation of Production Materials

3.5.1 Principles of Production Material Preparation

1) Understand and get familiar with the equipment wearing parts and commonly used spare parts; take full account of the accompanied spare parts, special tool/ instrument and other accompanied spare part's reserve.
2) With reference to the provisions of the material management reserve, combined with the actual situation of the power plant budget estimates, prepare the material preparation plan, and compile the fund plans and apply for implementation.
3) To develop the proper tool/ instrument plan, special tool plan, labor protection plan, maintenance materials, and consumption materials plan;
4) To purchase the chemicals in time.
5) To strengthen the material management work, establish the proper equipment account book, equipment list, and the various tools account, and strengthen the management of fixed assets.

3.6 Unit Handover

Unit handover should be comprehensively considered from the equipment status, spare parts, defect handling, completion information and other aspects.

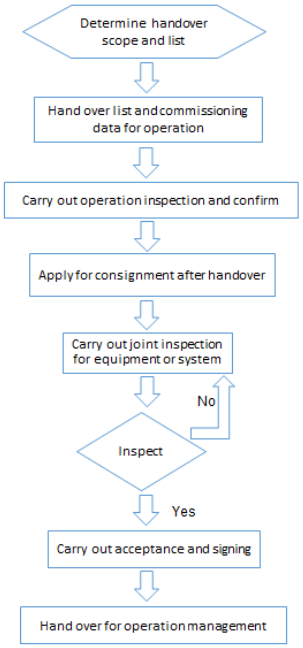
3.6.1 Handover Management

The operation/ maintenance project department shall be responsible to review and take over the commissioning information handed over by the commissioning personnel, participate in the acceptance/certificate issuance work of the equipment / system handover, and put forward the rectification opinions and check the rectification, and shall be responsible for the management of the equipment / systems handed over.

According to the operation procedures, the team shall operate, monitor and implement other work, prepare the records properly, and bear the responsibility for the operating performed by the operation personnel during

the operation; be responsible to handle the abnormal phenomena and accidents occurred in the operation of the equipment/ system handed over in accordance with the accident handling procedures.

Collect the various defects found during the operation, and put forward the corresponding improvement proposals, and submit to the EPC project department to handle; check the main plant, public systems and public facilities operating environment. The handover process is as follows:



3.6.2 Equipment Take-over

The EPC contractor shall prepare the equipment list according to the design documents (for equipment contract, prepare the equipment list per the system or discipline), and the content includes the equipment number, equipment name, model specification, quantity, installation location, manufacturer, date of ex-factory, and date of operation, etc. The operation/

maintenance project department shall take over the equipment per the equipment list on the site (including the accompanied spare parts, the accompanied tool/ instruments, and the accompanied documents), and sign and confirm it. If there is any shortage, damage or defect, the handling proposals should be clearly addressed and confirmed by the three parties.

3.6.3 Spare Parts Take-over

The operation/ maintenance project department shall, at least one month in advance, send special personnel to contact and communicate with the owner and EPC; the project department shall count the items per the list submitted by the owner and EPC, compile it into a book, and confirm that the spare parts are intact and undamaged. If there are any damaged or unqualified spare parts, the three parties shall discuss the treatment method and sign to confirm. The project department establishes a list of spare parts, so that the use is clear, and clarifies the responsible department and responsible person. The warehouse should ensure the environmental conditions that the spare parts are stored, so as to prevent that spare parts are not available due to rusting.

3.6.4 Defect Management

The operation/ maintenance project department should check with the EPC to confirm the PUNCH LIST, and clarify the processing mode of PUNCH LIST; the three parties shall discuss and confirm the processing way.

The operation/ maintenance project department should check the defects occurred in the trial operation, and should keep the complete records; the three parties shall discuss and confirm the handling way, clarify the responsible organization and determine the completion time.

3.6.5 Handover of Completion Data

The contents of the completion information include: the accompanied documents, technical inspection records, construction technology records,

quality inspection records, commissioning reports, supervision reports, as-built drawings and other construction documents.

EPC should prepare the list of data one month in advance; the operation/ maintenance project department assigns special personnel for contact and communication, check and verify it item by item, per category, set the detailed accounts, and ensure the completion file to meet the intact, accurate, systematic and regulatory requirements.

The document contents that should be mainly inspected: the main building, structures and large equipment foundation settlement observation records; the main and auxiliary equipment operation log at the unit trial production stage, technical records, defect records, and abnormal fault record; the protection set value list and the actual setting situation; the protection, program control and instrument input situation table; automatic regulating system form, data acquisition system switch, analog I/O list and analog precision calibration statistics table; the main operating parameters and economic indicators of unit trial production; the reasons analysis of the unit thermal and electrical protection action, the unit downtime and the reasons for the unit shutdown; trial operation summary report.

3.6.6 Participation in the Trial Operation of Individual System and Whole System

The operation/ maintenance project department shall, in accordance with the requirements of the *Specification for Start up and Acceptance of Basic Construction Projects of Thermal Power Plant*, under the leadership of the trial operation headquarters, participate in the discussion and review of the commissioning outline program (measures) of all unit professionals, the entire system start-up commissioning outline, and the entire system start-up measures of all professionals; implement the unit trial operation by sub-project and the unit trial operation/ acceptance by the whole system. After

passing the acceptance inspection, it is put into trial production. In the trial run, the project department shall operate to start/stop the equipment, for operation adjustment and, accident handling, and shall put forward the handling comments or proposals for the various issues detected in the operation;

3.7 CMMS Configuration

The CMMS is used by the plant's maintenance team to plan and manage all aspects of their work. The CMMS is thus central to the plant operation. The turn-key delivery of the CMMS, populated with all relevant plant data, before plant start-up, aims at ensuring smooth handover of plant data between the EPC and the owner's maintenance team. It also ensures real life-cycle management of all plants assets in order to truly optimize maintenance.

3.7.1 CMMS Equipment Management

Multi-level equipment structures, with no limitation of depth.

Equipment technical data sheets, with searchable technical specification.

Management of equipment criticality, categories, groups.

Record of spare parts used on the equipment (spare parts lists).

Record of drawings and manuals for easy access. All related document can be stored in the CMMS itself (alternatively a Document Management System shall be provided, interfaced to the CMMS).

Record of warranty and service contracts, with all details.

Record of equipment failures symptom, defects, causes and actions (SDCA). Standard SDCA codes can be defined in the CMMS either by equipment category or for all equipment.

Automatic calculation of equipment Mean Time Between Failure (MTBF) and Mean Time to Repair (MTTF) based on failure records.

3.7.2 CMMS Work Order Management

Management of job requests and related failure records by operation team

to maintenance department. Job requests after review by authorized personnel are transferred to work orders.

Management of incident reports, to report safety and other risk related issues or incidents. Incident reports after review by authorized personnel are transferred to job requests, work orders or purchase requests.

Preventive maintenance: definition of preventive maintenance instruction, either time-based or condition-based, with all related resource requirements (spare parts, labor – skills and hours, tools, subcontractors); calculation of related work order costs; planning of preventive maintenance over any period (yearly, monthly, etc.); forecast of costs and resources needed based on the plan.

Management of work orders, from creation to execution and final acceptance. Record of planned and actual resources (spare parts, labor – skills and hours, tools, subcontractors) and related costs.

Scheduling tool combining all work orders (corrective maintenance from job requests and incident reports, and preventive maintenance from plan), allowing the allocation of employees and execution time.

Project management, allowing to group relevant work orders under a project, with basic project management functionality.

Integrated tool to export of all work orders to Microsoft Project and Excel, for external planning purposes.

3.7.3 CMMS Inventory Management

Management of spare parts and consumables stocks, allowing multiple stock locations, bins, shelves.

Stock transactions: receipt, reservation, issue, counting, etc.

Link between spare parts, equipment and work orders.

Definition of minimum stock levels, with possibility to automatically trigger purchase requisitions.

3.7.4 CMMS Purchase Requisition Management

Management of suppliers and contracts.

Purchase requisitions process with multilevel approval process for release to quotation requests and purchase orders.

3.7.5 CMMS Analysis and Reporting

Key Performance Indicators (KPIs) for various user roles, allowing monitoring of performance indicators and ongoing activities directly from the users' CMMS homepage.

KPIs shall provide a color-coded graphical display (gauge or equivalent), current value, name of KPI and allow click-through to detailed reports.

Initial KPIs shall be defined based on relevant international standards, such as EN 15341 Maintenance Key Performance Indicators. The CMMS system administrator shall be able to setup new KPIs as required.

Full reporting facility, allowing the edition, printing, emailing of reports in PDF format.

Reports shall include graphs, tables and lists. Facility to automatically schedule and email reports from the CMMS, without manual intervention by users.

Initial CMMS reports shall be defined based on relevant international standards, such as EN 15341 Maintenance Key Performance Indicators. The CMMS system administrator shall be able to setup new reports as required.

4 Environmental, Health and Safety Management Conducting Plan

4.1 Management Policy

Resolutely implement the policy of "safety first, prevention first, Administration management", establish the thinking of "protection of personnel, power grid and equipment", strengthen management and implement the measures to protect the personal and equipment safety, health, environmental protection, and reduce the pollution and continuously

improve the working level of safety, health and environment management and culture management. Achieve the "legalization of safety management, standardization of safety facilities, fixed stacking of equipment and materials, methodization of production site, family-like team building" in order to guarantee the achievement of the requirements of the owner.

4.2 Management Objectives

4.2.1 Safety Management Objectives

"Five Ensure": Ensure that there is no extra serious and major equipment accidents, personal injuries and death accidents, malignant misoperation accidents, major fire accidents, major pollution causing the environmental events with adverse social impact all the year round.

"Four Control": Control the personal serious injuries at 0 times, Class 1 fault at no more than 1 time/year, Class 2 fault at no more than 2 times/year.

4.2.2 Work-Environment-Friendly Management Objectives of the Site

Implement modular management to achieve "standardization of operation, normalization of behavior, ordering of operation and cleanliness of environment", and establish the company's brand image project of safety and Work-Environment-Friendly Management.

4.2.3 Environmental Protection Objectives

Strictly implement the requirements related to the environmental protection, establish the concept of "green operation" to realize "construction site is cleaned and the residual material is disposed when the construction is completed", and keep the site clean, maintain the original ecology; do not affect the surrounding environment and discharge the excessive pollutants, the waste disposal shall comply with the regulations and there should be no environmental pollution accidents.

4.3 Assurance System and Organization of Safety and Work-Environment-Friendly Management

4.3.1 Assurance System of Safety and Work-Environment-Friendly Management

To ensure the continuous, effective and safe operation work, the Project Director is authorized to establish the appropriate safety management organization to implement the safety management in the operation and maintenance process. Establish the safety management organization which is fully responsible by the Project Director and deputy Project Director, and supervised by the HSE department and production & technical department in the whole process, and consists of Project Director, administration department and operation department and maintenance department, set up three-level safety management system and safety supervision system, and accept the supervision and inspection of the owner and the relevant departments on its safety management work.

4.3.2 General Requirements of Safety and Work-Environment-Friendly Management

Performing the standardized management in line with the requirements of the owner, and achieving the standardization of office facilities, team building and safety facilities at the site.

4.3.2.1 Visual image

1) Implementing the responsibility division management in the principle the person responsible for the area shall be responsible for the management. Ensure that the identification on site is clear, the safety warning is high-lighted, and the site area is standardized and orderly.
2) The operation personnel at the site shall wear uniforms which are clearly marked, and shall ware and use the standardized and unified safety helmets. Wearing of seriously oil-stained uniforms and dirty safety

helmets is prohibited regardless of any operation.

3) The machinery and equipment, industrial equipment, tool room, scaffold tubes entering the site shall be repaired, painted and identified in the same color to ensure that they are intact and clean.
4) Toolbox, container and others shall be placed and arranged in the unified manner, and identified with unified color.

4.3.2.2 Regional management

Project department office and living areas shall implement the regional enclosure and closed management.

4.3.2.3 Road, gully and transportation management

1) Section management shall be performed according to responsibility areas to ensure that the whole road and drainage channel are smooth and unblocked.
2) Each production vehicle shall be kept clean and driven as required as well as subject itself to uniform command and management.
3) Layout of smoking room and drinking water point.
4) According to site actuality, smoking room and drinking water point shall be placed in terms of uniform standard and kept clean under the management of specific personnel.

4.3.2.4 Equipment and materials pile-up management

Field equipment and materials shall be piled up by area for fixed location management. What to achieve is that various materials shall be in neat and orderly form with clear marks for safety and reliability.

4.4 Guarantee Basis and Measures for Safety Production

4.4.1 Management Standards and Implementation Basis for Safety Production.

Our company has passed the certification of OHSAS18001:2007 Occupational Health and Safety Management System and has perfect

occupational health and safety system architecture and management documents. The Project Department will establish management implementation measures and safety management account under the management system of the company according to practical situation.

4.4.2 Concrete Safety Guarantee Measures

4.4.2.1 Personnel training work

1) Arrange technical experts above foreman in advance for special training, arrive at the site in advance to understand in-depth equipment condition, and meanwhile develop pointed study of equipment operation and maintenance and maintenance specifications, and make spare parts plan.
2) Ensure the effectiveness of training work, update in time training content according to equipment operation situation and equipment upgrade and transformation situation, continuously improve the Administration quality of operating personnel and deepen the understanding and knowledge of the machine set.
3) Carry out Administration assessment when training completed to ensure that the members of operation maintenance team have met the requirements of three familiars and three capabilities. Three familiars: be familiar with system and equipment on structure and performance; be familiar with equipment on its assembly technology, working procedure and quality standard, and; be familiar with safety operation rules. Three capabilities: be capable of any one other craftsmanship closely relevant to their own profession; be capable of understanding drawings, and; be capable of making drawings.
4) Arrange technical experts above foreman in advance for special training, arrive at the site in advance to understand in-depth equipment condition, and meanwhile develop pointed study of equipment operation and

maintenance and maintenance specifications, and make spare parts plan.

5) Ensure the effectiveness of training work, update in time training content according to equipment operation situation and equipment upgrade and transformation situation, continuously improve the Administration quality of operating personnel and deepen the understanding and knowledge of the machine set.
6) Carry out Administration assessment when training completed to ensure that the members of operation maintenance team have met the requirements of three familiars and three capabilities. Three familiars: be familiar with system and equipment on structure and performance; be familiar with equipment on its assembly technology, working procedure and quality standard, and; be familiar with safety operation rules. Three capabilities: be capable of any one other craftsmanship closely relevant to their own profession; be capable of understanding drawings, and; be capable of making drawings.

4.4.2.2 Fire safety management measures

1) Implement by-level responsibility system of fire control, arrange in place by-level fire control safety responsibilities and post fire-control safety responsibilities, and establish complete fire control inspection system.
2) Strengthen fire control safety education for team members to ensure all of them to master the characteristics of flammable and explosive materials and basic firefighting knowledge and to clearly know about fire risk. Reaching THREE UNDERSTANDs, THREE CANs. (THREE UNDERSTANDs: understand the fire risk of the post of their own; understand the fire control measures of the post of their own, and; understand the firefighting methods for the post of their own. THREE CANs: can give an alarm; can use fire extinguisher of the post, and; can

fight fire at initial stage).

3) Establish accounts for the firefighting equipment in the scope of management and regularly carry out and finish maintenance of them.
4) According to relevant content in the fire inspection table, organize regular fire safety inspection to eliminate in time any fire hazard found, and before any fire hazard eliminated, implement corresponding prevention measures to ensure the safety during fire hazard rectification period. Any unqualified firefighting equipment shall be replaced and replenished timely according to relevant requirements.
5) Strictly prohibit piling up materials, equipment and other barriers that may influence evacuation at emergency exit or evacuation exit.
6) Set up by specification guide marks on fire safety evacuation and emergency lighting equipment conforming to the state regulations.
7) Organize regular inspection, maintenance and service against fireproof doors, guide marks of fire safety evacuation, emergency lighting equipment and fire accident alarms in the scope of management to ensure them to use reliably at any time.
8) Strictly enforce the approval system of hot work permit, eliminate any flammable and explosive hazardous substance near hot point as required before hot work starting or carry out proper safety isolation, and deploy ready-to-use firefighting equipment of proper types and quantity. If no approval procedure is performed, it is strictly forbidden to carry out any hot work without authorization.

4.4.2.3 Disciplines and regulations on safe and Work-Environment-Friendly Management

1) When entering the field, it is necessary to pay attention to any safety signboard and to obey the requirements on the board and the field rules voluntarily.

2) Any personnel entering the field must wear in correct way safety helmet and fasten hatband. It is strictly prohibited to sit on safety helmet (The color code and mark of safety helmet shall be determined uniformly).
3) Field personnel shall wear uniform work clothes that conform to safety requirements.
4) Any personnel engaged in toxic dust operation or special operation shall wear special protective clothing.
5) Every high-rise operator must wear a safety belt.
6) Any personnel on the field shall not wear any tie, ring or bracelet.
7) The personnel on the field is not allowed to let her back hair down, but long hair or pigtail shall be bundled into safety helmet.
8) Do wear safety goggle when using grinding machine, or performing abrading and correcting, fire welding and cutting, or touching hazardous chemicals.
9) It is strictly forbidden to enter the field after drinking.
10) It is strictly forbidden to smoke at any place out of the smoking room.
11) It is strictly forbidden to enter dangerous operation area without authorization.
12) It is strictly forbidden to scatter litter or stack items at will on the field.
13) The vehicles on the site shall be kept clean-up and in good condition and driven at limited speed along the signboards.
14) Any vehicle entering the field (including non-automatic vehicles) must be driven along the designated path and stopped in the designated area.

4.5 Emergency Guarantee Measures

4.5.1 Emergency Plan and Measure for Emergent Events

Special Emergency Plan for the Project is hereby established to effectively operate the machine set, to do well crisis prevention and control works, to establish crisis management thinking, to improve the ability to deal with

emergencies, to standardize the management of the emergency plan for safety production accidents, and to establish a crisis emergency mechanism of perfect organization, quick response and clearly-determined responsibility that tallies with practical project situation.

4.5.2 Emergency Organization Structure for Sudden Accidents

An emergency command center should be established, with the Project Director as commander-in-chief. The emergency command center is composed of persons in charge of the teams and related departments, including HSE department, Tech support department, maintenance department, operational department, general management department, etc. The center should hold regular meetings, carry out trainings, set up normative systems and procedures, etc.

4.5.2.1 Duty of the Emergency Command Center

Release the order for starting and terminating the emergency plan; Organize and command the rescue crew to carry out rescue operations; Be responsible for reporting to the company and the owner to seek help; Organize accident investigation and summarize emergency experience and lessons learned from the accident; Be responsible for formulating and revising the pre-plan; After the emergency rescue team being set up, organize drills and urge the personnel to prepare corresponding measures for major accident and all kinds of necessary preparations for emergency rescue(The emergency center should be set up in the HSE department).

4.5.2.2 Duty of the commander-in-chief

Take overall control of the emergency rescue for this project

4.5.2.3 Office of the Emergency Command Center

As a daily administrative body(the HSE department should take care of the office of emergency command center), its duties include: implement the guidelines and policies about the emergency operation of sudden accident

given by the superior officers, and carry out the emergency plan for sudden accidents; be responsible for the receiving, examining, processing, delivering, notification and reporting of emergency information about sudden accidents; coordinate with, supervise and urge all the team members in the emergency command center of sudden accidents to prepare for emergency rescue; organize emergency rescue training and drills regarding sudden accidents in accordance with the company's arrangement and deployment. During emergency response, collect information and come up with report and suggestions timely; Deliver and execute all the decisions and orders from both the leaders and emergency command center, then examine the executive condition and report; carry out any other related decisions made by the emergency command center after the emergency state being terminated. The emergency command center should carry out works by complying with the principle of dividing works according to the project and taking respective responsibilities. The person in charge should assure each person of their respective duties and obligations. Taking the crisis management principle as standard, the person in charge should reinforce management and treat all types of work in a serious and responsible way by adhering to the related management responsibilities.

4.5.3 Precaution and Early Warning

4.5.3.1 Monitoring of Dangerous Points

Staff of the emergency command center should keep their phones open 24 hours a day and ensure smooth communication; field management should be strengthened by operating in strict accordance with the safety management regulations and implementing the precautionary measures so as to reduce violations and avoid accidents. Field monitoring should also be strengthened. Besides the full-time safety guards, each of the operation and, maintenance team should also arrange some part-time safety guards to take

overall control during the productive process; implement the regulations about patrol inspection, regular inspection and maintenance on the productive machines and safety tools so as to ensure safe operation and completely wipe out the unsafe factors of production.

4.5.3.2 Precautionary Actions

Hold regular meetings monthly to conclude and analyze the safety operation and come up with instructions and requirements for the safety work of the next month. Report the related information collected recently to both the company and the owner. Inspect carefully to find out hidden danger and assure the processing rate of related problems. Discuss about how to deal with critical incidents.

4.5.3.3 Emergency Response

The first person who finds out or receives the information about a sudden accident should inform the emergency command center office or the commander-in-chief as soon as possible. After being informed, the office or the chief commander then should start the emergency measures. While organizing the early-stage processing, the person should inform the related departments immediately and find out details of the events. As for serious accidents, the emergency command center can decide to make an emergency call for help.

4.5.3.4 Submission of Information

At the beginning of the accident, self-rescue emergency measure is recommended to prevent the accident from getting worse. Meanwhile, the emergency command center should report the situation to the owner. Content of the report should include: basic information about the accident, including related equipment or name of the facilities; time, location, scale, brief course, persons involved, damage degree, casualties and measures taken etc.; cause analysis, judgment of the nature, assessment of the effect

degree and so on.

4.5.3.5 Information Passing

The emergency command center office will coordinate with other related departments to transfer the information about the sudden accident through phone call, fax, network and so on so as to pass the information to the emergency center of related departments.

4.5.3.6 Response Program

After receiving the alarm message, the emergency command center should start the emergency plan for production safety accident immediately. All the members in the emergency command center should get to the accident site without any delay and perform their own duties. At the early stage of the accident, self-rescue measures should be taken to prevent the accident from getting worse. According to the situation, the emergency command center decides whether to make the emergency call for social help and report to the group company as well as other related departments. Content of the report: general situation about the unit; time, location, situation on the site, brief course, casualties and measures taken, etc.

4.5.3.7 Rescue Activities

The emergency rescuing and maintaining staff should cut off the power supply and clear away other flammable and combustible things on the accident site so as to prevent the accident from spreading. While rescuing the wounded and the property, attention should be paid to protect the site of accident. If the accident site has to be changed because of rescuing the wounded and property, preventing the accident from spreading or evacuating the staff, etc., mark the site and take pictures. Keep the physical evidence from the accident site in good state. The emergency command center should make all efforts to organize rescuing work. And the rescuing workers should act by complying with the orders and keep calm during the rescuing process.

4.5.3.8 Measures for Emergency Support

Staff of the emergency command center should keep their phone open 24 hours a day to ensure the smooth communication and information. The emergency rescuing team should study further and enhance related trainings so as to improve their self-rescuing and mutual-helping abilities. Necessary expenditure should be set aside as guarantee for emergency supplies so as to assure the fund requirement for emergency rescue.

4.5.4 Training and Drill

4.5.4.1 Training

Train the staff about laws and regulations regarding the emergency rescue of sudden accidents through face-to-face instruction, notice and so on. The training should cover prevention of accident and disasters, avoiding risk and disaster, common sense about self-rescue and mutual-help; besides, the training should also include knowledge about basic treatment to equipment and facilities. In this way, safety awareness and awareness of public responsibility of all the staff will be heightened; and the staff's capability of emergency rescuing, risk avoiding as well as self-rescuing will also be largely improved.

4.5.4.2 Drill

According to the regulations, an emergency rescue drill with all staff involved should be organized once every year. Keep record of the drill and conclude about it. A written summary report should be formed.

4.6 Work-Environment-Friendly Management

4.6.1 System and Organization Structure of Work-Environment-Friendly Management

Establish a leading group for safe and Work-Environment-Friendly Management, which is under supervision and inspection of the owner. The project should implement the policy of Safety First, Prevention First,

Administration Treatment, set up all levels of management organizations and supervising systems, make sure of the responsibilities, formulate practical and feasible measures in accordance with the features of this project, increase investment, execute all the regulations strictly and achieve the set goal of Work-Environment-Friendly Management.

4.6.2 General Planning for Work-Environment-Friendly Management

4.6.2.1 Administrative Standard for Safe and Work-Environment-Friendly Management

Execute according to the company's administrative regulations about safe and Work-Environment-Friendly Management and related regulations and rules of the tenderer.

4.6.2.2 Administrative Measures for Safe and Work-Environment-Friendly Management

1) Carry out the work in strict accordance with related regulations. No uncultivated working behavior is allowed. The on-site arrangement should be reasonable and the site should be clean and in good order.
2) The staff should be organized in a reasonable way with clear division of work. No command or work which violates the rules and regulations is permitted.
3) Goods and materials shall be provided with clear identification and put in good orders to meet fire safety standards.
4) Materials and equipment on the working surface shall be stacked in a rational and orderly manner, surplus materials, scrap materials and wastes shall be cleared to reach the goal of the site shall be clean once construction is finished and materials are exhausted.
5) Gamble, drug taking and other misconducts are strictly prohibited.
6) Project department, dormitory, storeroom and mess hall shall be kept clean and neat and be equipped with corresponding fire-fighting

equipment.

7) During working, the site shall be kept clean and various works shall be conducted in an orderly manner without confusion so as to reach the goal of six-three-system:

a) One line: instruments shall be put in one line, components shall be put in one line, materials and spare parts shall be put in one line.

b) THREE CARELESSNESs: electric wire shall not be drawn at will, equipment shall not be dismantled at will and instruments shall not be used at will.

c) THREE CLEANLINESSEs: the site shall be kept clean before, during and after the construction.

d) THREE NOs: no pollution, no accumulation water and no dust formation.

e) Three STRICTNESSEs: cooperation and coordination, safety rules and worksite systems shall be strictly implemented.

f) Three not fall to ground: instruments, measuring implements, dismantled components, oil dirt and dirt shall not fall to the ground.

4.6.3 Scrap Management

4.6.3.1 Temporary junk box shall be provided according to practical conditions of worksite.

4.6.3.2 Conduct the construction in strict accordance with standard operating procedures and complete clean-up work as the last process of each day.

4.6.3.3 Clean wastes in the junk box in a timely manner without throwing about.

4.6.4 Equipment and Material Management

Equipment and materials on the site shall be put in good orders without obstructing traffic and keep the road unblocked.

4.6.5 Recycling Instruments Management

4.6.5.1 Unified standard bracket shall be provided for various gas bottles; the unused gas bottles shall be recycled and returned to storeroom in a timely manner to keep a clean worksite.

4.6.5.2 Various kinds of recycling instruments and apparatus shall be stored in good orders by specification and model.

4.6.5.3 Steel wire rope, snap ring, release clamp, hoist and other hoisting instruments and equipment shall be put in good orders and steel wire rope and hoist shall be put in one line.

4.6.6 Thermal Insulation and Paint Work Management

4.6.6.1 Quantity of thermal insulation materials and paints to enter the site shall be strictly controlled and opened package shall be recycled in a timely manner and provide fire prevention measures.

4.6.6.2 During painting, effective separation facilities shall be provided within the operation area to prevent secondary pollution and keep the original safety signs and device identification.

4.6.7 Small Machine Management

Electric welding machine, cutting machine and other small machines shall be put according to actual demand and be managed in a centralized way.

4.6.8 Temporary Electricity Utilization Management

4.6.8.1 Arrangement of temporary electricity utilization equipment and lines shall accord with Work-Environment-Friendly Management standards, the power supply shall be arranged in a safe and rational manner and line shall be neat and pleasant.

4.6.8.2 Single unified distribution box shall be used in a standardized way. Both inside and outside of box and plate shall be kept clean and housing shall be soundly earthed the pivot shall be flexible; switch cabinets of power or distribution cabinets and socket boxes shall be sealed.

4.6.8.3 If certain operations are certainly to damage or pollute the ground, greenbelts and walls, file an application in accordance with regulations. Written report shall be submitted to the Owner if reinstatement is impossible after the completion.

4.6.8.4 The worksite shall be free from oil stains, accumulation water, dust formation impurities; and safety cover, trench cover, device identification, lighting facilities shall be complete and equipment shall possess good thermal insulation properties, natural color as well as clear and correct identification.

4.7 Environmental Protection Management

4.7.1 Environmental Protection Management Organization

Set up a Leading group for environmental protection management which shall be subject to lead of company as well as supervision and inspection of the Owner, identify the responsibilities and formulate effective and feasible measures based on characteristics of the project, strictly implement various systems and realize set goals for environmental protection.

Environmental protection organization: see organizational chart of safety and Work-Environment-Friendly Management.

4.7.2 Environmental Protection Measures

4.7.2.1 Organize all staffs to learn the Environmental Protection Act and relevant laws and rule as well as regulation made by the Owner, strengthen environmental protection education and training for operators, strengthen environmental protection awareness and improve Work-Environment-Friendly Management awareness.

4.7.2.2 Wastes, scraps, materials, equipment and instruments shall be put in an orderly and clean manner according to the Owners requirements without being throwing about.

4.7.2.3 Spare parts, materials and dismantled device and spare

components on the site shall be categorized and put in good orders, waste oil and other waste liquor shall be soundly collected and recycled.

4.7.2.4 Wastes shall be recycled as much as possible so as to minimize quantity of unrecyclable waste.

4.7.2.5 Toxic and hazardous wastes shall be sealed and separately stored and dangerous and general wastes shall be separately stored and managed to prevent secondary pollution; combustible and explosive goods shall be placed away from each other; dangerous wastes of difference categories are forbidden to be put in one place.

4.7.2.6 Impact on the surrounding environments shall be taken into consideration for storing waste, especially dangerous waste which shall be safely stored in suitable containers to prevent accident leakage or spillage.

4.7.2.7 Dangerous wastes shall not be arbitrarily disposed or directly discharged into waste water pipe network, but be handled by organization with qualification on dangerous waste handling.

4.7.2.8 Sprinkling and leakage preventative measures for wastes shall be completed before transportation.

4.7.2.9 Establish energy conservation and consumption reduction system, the Commerce Department shall purchase and use equipment and products of energy conservation and consumption reduction and utilize various industrial effluent waste heat and other resources and complete works concerning fuel, electricity and water conservation so as to reduce energy, control and eliminate pollution and protect the environment.

Table 1:

Routine Inspection Process for Safety Production

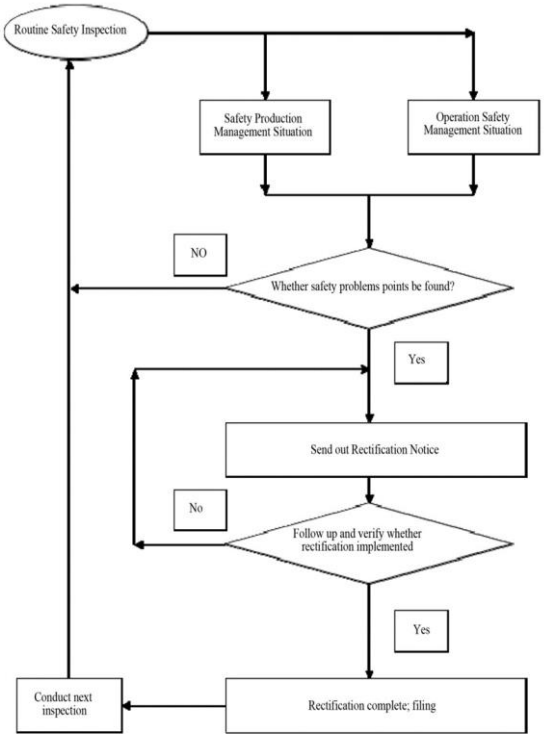
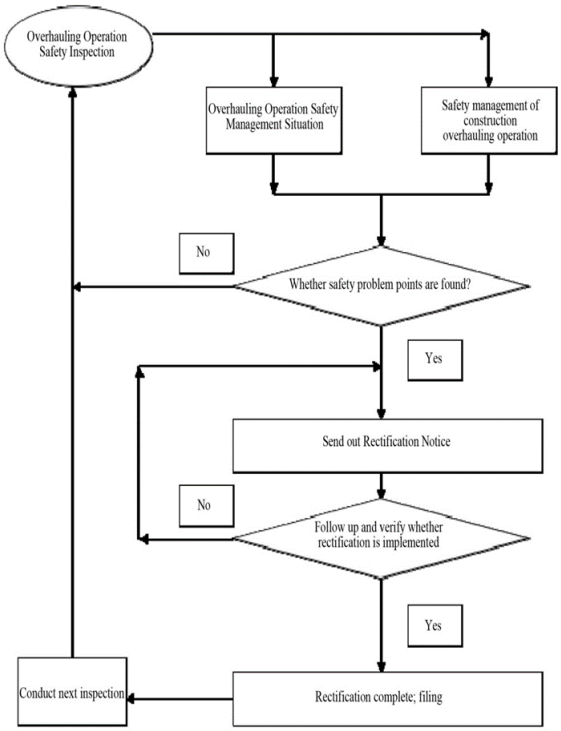


Table 2:

Supervision and inspection process for operation and maintenance of safety production



5 QA/QC System Conducting Plan

According to ISO 9001:2008: Quality Management Systems, combining with the characteristics of the plant and requirements of the owner, SEPCOIII will establish document, maintain and implement a quality management system and continually improves its effectiveness.

5.1 Overview of Quality System and Management

Our company will enact the quality management system what must be in accordance with the objective. In order to ensure the quality of maintenance, we will strictly according to the quality management system standard, ensure to complete the tenderer's contract requirements.

5.2 Implement Quality Management System

According to the SEPCOIII's "quality control handbook", combining with the

project and the owner's requirements to implement and control the production of the quality system documents. And shall be continuous improvement in the maintenance project.

1) Identify the quality activities in the process of the maintenance project.
2) Clear control method, cross sequence and interface relations of maintenance process. Manage the maintenance process through the identification, determination, supervision, inspection and analysis, etc.
3) The purpose of managing these processes is to accomplish the project quality goals according to the quality management system and company quality principle.
4) Process Control

   In order to achieve planned results, and shall be continuous improvement by supervision and inspection, test and analysis and adopt improvement measures, This system is to ensure the quality of the project under control, and meet the requirements of the owner's quality and expectations.
5) Planning and Resource

   We will establish systems for planning of maintenance activities and the allocation of sufficient and adequate resources. Verification activities shall be included on all plans and programme. The programme will be updated in response to unplanned breakdown and operating defects, faults or malfunctions.
6) Identification and traceability

   We will generate maintenance schedule, which shall comply with equipment manufacture’s recommendation frequency and type of maintenance.
7) We will make sure of that all the working process of the project department is always under control and leave the corresponding records

by implementing company quality management manual, program files and project planning book, etc.

8) Training

Training procedures will ensure all personnel are competent, effective and efficient execution of their defined responsibilities.

9) Documentation and Software

Maintenance information system will ensure the availability and appropriate distribution of all pertinent documentation of the facility. Including codes, standards, legislation and technical publications.

(1) Document control

a) Soft version: quality manual and program document; program support document; three-level documents (like technical management system document); regulated record form;

b) Hard version: documents of outside source (drawings, project mail and regulation and rules), record;

c) It is required to take soft version except the special required hard version by tenderer;

d) The documents made by project shall fully base on quality management system and confirm writer, verifier and date, or receive approval from owner side; it is required to fully consider and pay attention to the reconciliation of environment, safety and measurement management.

(2) Record control:

a) Record form includes soft version and hard version.

b) It is required to have clear writing and the record shall be complete, timely and correct; there shall be signature of in-charge staff, there shall be data and serial number; the record shall be kept in special document cabinet.

c) There shall be specially-arranged staff to manage these records to prevent damage and lost.

d) Project video record shall be included into record management, and it shall be managed according to special requirements.

e) Set up holding period limit and handling requirements according to importance degree.

10) Audits: Provide a recorded internal audit plan.

Improvement and corrective action

11) Achieve the purpose of continuous improvement and keep the company's quality management system continuous adaptability, adequacy and effectiveness through the unqualified things prevention, control and correct and the internal audit and management review.

5.3 Maintenance Quality Management

1) Maintenance quality management must be systematical, hierarchical, procedural, and responsible. Shall achieve the following 4 points: have reference for checking, have institution for following, have personnel for responsiblility, and have personnel for supervision. Strengthen whole process management. All level maintenance technical management personnel must participate in quality management, strengthen technical training for maintenance personnel, improve their quality awareness and prevent from occurring quality problem.

2) During equipment maintenance, once found important defects, shall timely report, analyze reasons, and establish treatment scheme. Quality of spare parts and material is very important for quality management during maintenance. Strictly control quality before entering to the storehouse as per drawing and technical agreement. It is forbidden to use unqualified spare parts and material into the equipment.

3) Maintenance technique can directly influence maintenance quality and

check the technical level of maintenance personnel. Shall strictly follow maintenance regulation and quality criteria. Strengthen all level check and acceptance work according to the institute. All level maintenance technical management personnel shall enter to the site, supervise and solve quality problem during maintenance. Project Director and field engineers shall strengthen process supervision of maintenance technique, timely rectify incorrect maintenance technique and discipline violation phenomenon. For those maintenance quality problems, due to careless criteria execution or inexactitude acceptance, the relevant personnel must be timely notified and given relevant punishment.

5.4 Management System Establishment

5.4.1 ISO 9001, ISO 14001 and OHSAS18001

Our company has passed the ISO 9001 , ISO 14001 and OHSAS18001 management system authentication which serves as the basis for standard management of our company for daily work of headquarter and operation and maintenance work of each project. We established scientific, regular and orderly integrated project management system and incorporated advanced international management mode in it, which contributes to enhancing management level and enterprise' sustainable development. We have very rich experience in project management. All in all, our company is very experienced and competent in establishing an integral management system and applying it for this project.

5. 4.2 Implementation Method:

1) Decide the standard to be adopted.
2) Establish the team and formulate the strategy.
3) Training (including seminar)
4) Select consultant.
5) Select authentication company (considering the factors: experience,

geographical scope, price and service level)

6) Present state investigation and analysis.
7) Arrange organization structure and allocate resource.
8) Organize and draft the plan.
9) Prepare manuals.
10) Prepare constructive documentation (for supporting manual preparation)
11) Try to operate the management system (the key point is to communicate and train. All executors should make a record during implementation period.)
12) Review service (generally, it starts 6 weeks after the management system is carried out.)
13) Get authentication
14) Maintain and improve it continuously , follow-up verification (the authentication agency will check the standard execution situation periodically. The system needs to be appraised again after it expires. If it passes the appraisal, the certificate will be replaced.)

6 Operation Management Conducting Plan

6.1 O&M Daily Management

Daily Production Meeting: the tech support department will hold the meeting attended by the project manager and relevant personnel from various departments; the production of the previous day will be reported in the meeting and the production arrangements of this day will be made; production problems will be dealt with under the cooperation of different departments.

Monthly Production Meeting: the vice project manager will hold the meeting monthly to analyze the production of the previous month including production indexes, equipment reliability, unit abnormity, defects and problems and arrange the production of next month.

Annual Production Plan: in August the project department is responsible for compiling annual production plan for the next year; at the beginning of every year, annual production index, safety control index and expense quota shall be given to every department and shift; at the end of the year every department and engineer shall summit Annual Department Report and Major Department Report to the project department and the project department shall summit Annual Report to the Owner according to the contract.

Safety Inspection: periodic safety inspections and anti-accident measure inspections shall be conducted every year; pertinent safety inspections shall be conducted to make sure the safe and stable production of the units according to the safety production conditions and the requirements of the Owner.

6.2 Operation Management

We will make sure the safe and stable operation of the units by operation plan management, panel monitoring management, equipment patrol inspection management, equipment regular test rotation management, operation record management, equipment fault management etc.

Build the production and maintenance indicator management system, construct energy saving inspection system, enhance benchmarking management, take benchmarking management as the method, find out the problem and the gap, make sure the measures, and build firm foundation for unit economic operation.

Manage the equipment and improve the equipment's health level. so the operators of the equipment should carefully find out the defect and hidden danger of the equipment, kill the defect, do the best on equipment maintenance with plan, implement the equipment managing principles of 'repair what should be repaired and get it repaired, and improve the equipment's health level.

Pay attention to abnormities analysis, analyze the abnormities in unit operation, find out the reasons with the raw data, parameters change and abnormities, try to solve the problem in primary period, and improve the economic efficiency of the unit.

Enhance the technical management, carry out the technical inspecting work, make the annual technical inspection plan as per professional inspection rules and regulations in order, and insure both safety production and economic operation.

Find out the hidden danger, make anti-accident measures, and kill the hidden danger in primary period.

Pay attention to adjustment, adjust the equipment carefully and frequently, master the operation characteristics, and improve the economic efficiency of the unit gradually.

Enhance the training, do more on-site practice for emergency, and improve the practical operating level and emergency treating ability of the operators. Make targeted training plan for new unit and new technology, and use the methods including technology lecture, questioning and on-site practice to improve the skill level of the staff.

6.3 Maintenance Management

Maintenance divided into schedule maintenance and routine daily maintenance. Maintenance plan include equipment minor repair, intermediate maintenance and major overhaul; Routine daily maintenance must be conduct properly and correctly, ensuring unit safety and stable operation.

6.4 Equipment Periodic Maintenance Management

Equipment periodic maintenance is an effective measure for improving the equipment working condition, making equipment to be in a good working state and standby state, eliminating the environmental factors that can

influence the safe operation of equipment, making passive eliminating defect to become active maintenance, decrease the happening probability of equipment defect, preventing accident, lowering shutdown time of unit, lengthening working life of equipment, improving work efficiency of equipment, reducing maintenance cost and insuring safety production.

The equipment master management system should be used for equipment maintenance. The master of equipment should do the tour and inspection at least once to the equipment every day and find out the problem.

When doing the maintenance for equipment, workers should strictly follow equipment oil-feeding management including the part, period and method of oil-feeding, oil type and standard. The following table is an example of standard form for equipment oil-feeding.

Equipment Name			Model Number	Date Code		Y-Year M-Month W-Week D-Day		
No.	Part Requires Lubrication	Type and Brand of Lub Oil	Lubricating Mode	Oil Change Standard		Standard of Topping Up Oil		Responsible Department
				Capacity of Oil	Oil Change Period	Capacity of Topping Up Oil	Oil Top Up Period	
1								
2								
3								

Make periodic maintenance manual for each equipment. The maintenance manual should cover the item, content, measure, period and standard of maintenance. The maintenance worker should do the periodic maintenance

as per the manual. The following table is an example of periodic maintenance log sheet.

Equipment (Device) Name		Spot Check Mark	○— Spot Check in Operation △— Spot Check in Stop	Stop Check Period Mark	D–Day W–Week M–Month Y–Year	
Standard Number	Version Number	Maker	Date	Check	Permit	
No.	Spot Check Position and Item	Spot Check Content	Standard	Spot Check Period	Spot Check Method	Spot Check State
1						
2						

6.5 No Leakage Management

No leakage management is for water, gas, air, and oil leakage of equipment, pipe system, and inside leakage of valve. Solve the leakage problem can effectively improve the economic efficiency and cleaning situation of the unit. The operation department and maintenance department should count the seal point of unit, make no leakage management regulation including counting regulation for seal point, checking standard for leakage point, calculating method for leakage point, and examining method for leakage point.

The operation department should organize a no leakage check every month for promoting the no leakage work.

6.6 Defect Management

The defect elimination ratio of main equipment should reach 98%, of auxiliary equipment should reach 100%.

The defect should be eliminated timely. If the defect could not be eliminated due to the reasons including operation mode, technical problem, spare and material, the safety technical measures should be made, and it also requires accident anticipation for preventing expanding defect.

Commented [M1]: 要不要换成 Precaution

The operation department and maintenance department should make defect management standard including defect register, treating, accepting, evaluation, counting and examining, and all departments should follow the standard. The defect management standard should also include relevant regulations about defect treating in night shift and holiday.

6.7 Instrument Management

The instrument includes individual instrument and public instrument. The instrument should be registered. The instrument should be charged by specific person. The machine account should be set.

The HSE engineer should make instrument management regulation and list the instrument name, checking period, checking item, acceptable quality level and treating method for unqualified instrument.

The HSE engineer should take charge of periodic checking work for the instrument in all groups. The checking work should follow the safety regulation and regulations made by manufacture. There should be a certification on the qualified instrument, and the Date Due should be on the certification. Scrap the unusable instrument by following the scraping procedure.

6.8 Expendable Material Management

The operation department and maintenance department should make plan for expendable material reserve quota. The list of quota should include OEM,

installed amount, time of putting into use, spare amount of single equipment, model number and specification of spares, drawing number, changing period, reserve quota, etc. The reserve quota of expendable material should be enough. The operation department and maintenance department should make management regulation for expendable material including plan, quota, procurement, storage and using.

6.9 Technology Machine Account Management

Each specialty should build the equipment machine account, and the machine account should include the following items:

Basic information of equipment: equipment number, equipment name, model number, serial number, specification, OEM name, manufacturing number and date, installation number.

Maintenance information of equipment: record the maintenance situation of equipment including the date, character, content of main maintenance and parts changing, and the accepting evaluation and problem after maintenance.

6.10 Overhaul Management

6.10.1 Preparation Before Starting Work

Make sure of the project manager; build maintenance quality inspection and management system; make quality inspection plan; and finish the preparation work; collect materials, spares, special tools and safety appliance; finish work sheet; do the safety work.

6.10.2 Maintenance Process Management

The maintenance should strictly follow the safety rules, quality standard, technical proposal, technical measure, and insure the maintenance quality. Pay attention to the processes of disassembly, repair and installation.

The equipment disassembly check should be detailed, early and Administration; do the cleaning work well; meter and record the technical data. The technical record should be in table or diagram, should be finished

timely, correctly and comprehensively. Arrange the items that need tests timely.

After maintenance, the equipment should be qualified to the technological requirements and quality standard; the equipment only could be installed after being eliminated the defect and accepted. When installing the equipment, do not damage the equipment, do not install the component to wrong place, and do not leave any other things in the equipment. The maintenance shift leader and manager of relevant specialty should be on site for inspecting important process.

The Maintenance Department should coordinate all specialty for knowing the materials and spares situation, the maintenance safety and quality situation, the problems of maintenance and the key points of maintenance, and insuring the maintenance work could be carried out well. The managers of each specialty should pay attention to the construction quality, progress and safe state and coordinate the labor between groups.

6.10.3 Maintenance Quality Management

The Maintenance Department should inspect the defect elimination work, especially the technological standard, quality requirements, technical measures and quality management system, put forward treating method and suggestion for unqualified matters, make the accepting ratio of H point and W point to reach the standard, and insure the maintenance quality.

The maintenance items should be checked and accepted by following the three-level acceptance system (from specialty to Maintenance Department and to Safety and Production Department).

6.10.4 Maintenance Technology Record and Technology Machine Account Management

The specialties in Maintenance Department should record the technology correctly, comprehensively, timely, clearly and actually. The record should

include the equipment technology situation, system or structure change and metering and testing data, etc. The original record should be checked and signed by maintenance worker and project manager, and the important record should have signature from specialty manager.

Pay attention to accumulating original record and checking technology record, prevent to fault, analyze the situation according to data, and deal with abnormities timely.

7 Technical Supervision Program Plan

This plan is formulated to standardize and guide the power plant technology supervision and management, and further improve the overall quality and technical management performance to ensure the safe and economical operation of equipment with focus on technical supervision covering metal, electrical insulation, chemical, thermal engineering, electrical measurement, relay protection, gas and steam turbine, excitation, pressure vessel supervision, as well as for technical supervision on important parameters and performance indicators of safe and economical operation of all systems and equipment of power plant.

7.1 Requirements of Supervision

1) Technical supervision must be carried out strictly in accordance with the standards and conducted regularly by assigned staff at fixed time with guaranteed quality and in certain quantity. Any special situation must be recorded in written form to indicate the reasons and propose further rectification plan.

2)Project department should develop detailed technical supervision scheme according to the needs of the project.

3)Technical supervision work requires an improved and complete technical supervision organization for performing the responsibility and establishing and improving the technical supervision system, as well as

conducting internal self-examination to realize closed-loop management according to the requirements of the responsibility system.

4) Previously recorded and Administration comparison and analysis must be carried out by all disciplines on supervising, test and experimental data. Through process supervision of technical monitoring and control, the hidden danger or hazard should be spotted and found out and to be solved to avoid any accident.

5) Project department should carry out technical supervision strictly following the specification, standards and anti-accident measures.

6) Establish and improve a variety of completed technical supervision equipment records.

7.2 Supervision Process

1) Three-level technical supervision network, led by the project manager or chief engineer, should be established to implement the operation maintenance and technology supervision and management system.

2) According to the actual conditions of the project, the specialist engineers should make operation, maintenance and technology supervision and management plans.

3) Maintenance manager of the Operation and Maintenance Department is responsible for examining operation, maintenance and technology supervision and management plan.

4) Project manager of the Operation and Maintenance Department is responsible for checking and approving operation maintenance technology supervision and management plan.

5) The technical engineers should carry out supervision work according to the approved operation and maintenance technical supervision plans and strictly implement of the issued and circulated Ratification and Correction Sheet of Operation, Maintenance and technical Supervision.

6) Should guide the work according to supervision plans and requirements to follow , check the rectifications and corrective actions implementation of the spotted issues that need to be solved.

7) Technical engineer should make the Annual Report on Technical Supervision Work to summarize the achievements and deficiencies of the technical supervision work of previous year.

8) According to the standards for operation and maintenance technology supervision, maintenance manager is responsible for checking if the Annual Report on Technical Supervision Work is consistent with relevant requirements or not.

9) Project manager is responsible for checking and approving the Annual Report on Technical Supervision Work.

10) Operation and Maintenance Business Department should take experience and lessons from the Annual Report On Operation, Maintenance and Technical Supervision Work as a feedback to better guide the operation and maintenance technical supervision work in the future and to share and exchange this experience within and among all project offices.

7.3 Supervision System and Contents

7.3.1 Specification for Metal Technical Supervision

Main points of technical supervision:

1) Supervision of metal parts.

2) Supervision of metal materials.

3) Supervision of welding quality.

4) Metal supervision of steam pipes , reheating steam pipes and steam lead pipes.

5) Metal supervision of high temperature auxiliary.

6) Technical supervision of metal parts of gas turbine.

7) Metal supervision of pipes with heating surface.

8) Metal supervision of drums.

9) Metal supervision of feedwater pipes.

10) Metal supervision of of steam turbine components.

11) Metal supervision of power generator components.

12) Metal supervision of fasteners.

13) Metal supervision of heavy castings.

7.3.2 Supervision and Management System of Chemical Technology

Main points of technical supervision:

1) Supervision of steam and water

2) Supervision of oil quality.

3) Supervision of gas quality.

4) Supervision of fuel quality.

7.3.3 Supervision and Management System of Insulation Technology

Main points of technical supervision:

1) High-voltage electrical equipment of power plant.

2) Overhead lines

3) Power cables.

4) Insulating oil.

7.3.4 Supervision and Management System of Thermal Technology

Main points of technical supervision:

1) Detecting components of thermodynamic instrumentation and control system.

2) Secondary lines of thermodynamic instrumentation and control system.

3) Pulsed pipelines of thermodynamic instrumentation and control system.

4) Control equipment of thermodynamic instrumentation and control systems

5) Standard measuring instruments and device, and thermal technology management

7.3.5 Supervision and Management System of Electrical Measurement Technology

Main points of technical supervision:

1) Electrical measurement instruments and devices.

2) Indicating instruments of electric measurement.

3) Digital instruments for electric measurement.

4) Recording instruments for electric measurement.

5) Power meters (including meters with maximum demand indicator and maltii-tariff meters).

6) Current and voltage transformers.

7) Power Transducers.

8) Secondary circuits of electric measurement systems.

9) Standard devices for electric measurement.

10) AC sampling devices (NCS system).

7.3.6 Supervision and Management System of Relay Protection Technology

Main points of technical supervision:

1) Generator and transformer unit protection;

2) Start / standby transformer protection;

3) Protection for power plant transformer with voltage of 6 KV and above;

4) Lines protection with voltage of 110 KV and above;

5) Protection for buses, feeders, power switches and interconnection power cords with voltage of 400 V and above;

6) Protection for electric motors with voltage of 6 KV and above;

7) Automatic re-closing devices;

8) Automatic switching control auxiliary power (backup power automatic switching device);

9) Automatic excitation regulators of generators;

10) Wave recorders of generator and transformer units and line fault;

11) Automatic synchronized systems;

12) Security and stability control equipment.

7.3.7 Supervision and Management System of Gas and Steam Turbine Technology

Main points of steam turbine:

1) In each A-class check and maintenance after the commissioning of the turbine units, surface check should be conducted for the big shaft of rotor, particularly the R part of variable cross-section at the foot of rotor speed impeller and the front seal groove, for the impeller, small - angle flange and impeller balance holes, as well as parts like injector, baffle plate, diaphragm sleeve. There should not be any crack, severe scratch or impact mark. Surface inspection is required when doubt arises.

2) In the first A-class check and maintenance after the commissioning of the turbine units, hardness and metallographic examination should be conducted for high and medium pressure rotor shaft. The hardness examination part is the large shaft end surface and the impeller wheel plane (mark the record check point position) while the metallographic inspection part the impeller wheel side plane. After the metallographic structure examination, the inspection points should be cleaned several times.

3) If abnormal conditions occur in the operation of the units such as severe over-speed, over-temperature, rotor water bending and so on, then hardness and nondestructive testing should be carried out based on the damage to the rotor.

4) Quality inspection and nondestructive testing should be performed considering the results of A-class or B-class maintenance based on the equipment condition.

Main points of gas turbine:

1) Appearance inspection, dimensional measurement, thickness measurement, hardness test, and selective examination for penetrating inspection should be carried out for compressor blade, stator blade, inlet and outlet guide vanes, cylinder.
2) Appearance inspection, dimensional measurement, thickness measurement and selective examination for penetrating inspection should be carried out for fuel nozzle of combustion chamber, flame tube, transition section, cross-flame tube, guide bushing and cylinder block.
3) Scale analysis, appearance inspection, dimensional measurement, thickness measurement, hardness test, selective examination for penetrating inspection and ultrasonic inspection should be carried out for turbine blade, nozzle (including stator blade), nozzle support ring, nozzle diaphragm seal ring, double ring, cylinder, exhaust diffuser and rotor.
4) Acceptance work should be conducted for repair and replacement parts of compressor, combustion chamber and turbine. Sampling ratio should be fixed with reference to the approach adopted for non-replacements.

7.3.8 Supervision and Management System of Excitation Technology

Main points:

AC / DC exciter (including secondary exciter), excitation transformer, excitation converter and series transformer, power rectifier and its operating cabinet; automatic and manual excitation regulator and back-up excitation equipment; power system stabilizer (PSS); demagnetization switch, demagnetization resistance and over-voltage protection device; special voltage transformer for excitation system; excitation equipment and related AC and DC power supply (from the power supply switch fuse); generator rotor slip ring and brush; control and signal related secondary circuit and components (relays, control switches, buttons, etc.) connected to the

excitation system; monitoring system (DCS, ECS, etc.) and the control parts of AVC device excitation system.

7.3.9 Supervision and Management System of Boiler Pressure Vessel Technology

Main points:

Supervision, management, design, manufacturing and order of metal materials must be safe. Welding of pressure components, safety protection devices and instruments should be periodically inspected. Chemical supervision and shutdown protection of boiler, as well as operation, management, maintenance and modification of oiler is also part of the work.

8 Document Management Program Plan

8.1 Document Archiving Management

8.1.1 Document Archiving

1) The documents handed over to the Owner shall be handed over in accordance with the requirements of the contract. And the original documents handed over to the Owner shall be scanned into electronic format. The original documents shall be handed over to the Owner. While electronic version of the original documents and the original document, with signatures of hand-over procedures for document handed over to the Owner, shall be handed over to the Administration Department.

2) Documents Handed over to the Administration Department

List of archiving scope	Responsible department for archiving
Equipment maintenance account	Maintenance Department
Contract for procurement of office supplies by project department	Administration Department
Equipment defect sheet	Maintenance Department
Periodic maintenance and laboratory	Maintenance Department

records of equipment	
Acceptance documents on maintenance quality	Maintenance Department
Summary of maintenance	Maintenance Department
Photography and video files for project maintenance and other activities	Maintenance Department
Letters between project site and various parties	Administration Department
Accident analysis report	Technical Department
Project Contract	Company headquarter
Operation & Maintenance Manual, system diagrams	Operation Department
Letters between headquarter and project parties	Project Management Department
Project summary	Maintenance Department
Operation and maintenance documents (operation and maintenance plan, duty book, running form, assigned record, patrolling inspection record, equipment defect list, work slip, operation slip, Accident handling and analysis record, equipment daily and periodic inspection record, defect elimination record, training record, technical record, technical recording book and reliability evaluation record, etc.)	Operation Department

8.1.2 Time Requirement for Document Archiving

(1) The documents handed over to the Owner shall be handed over

according to the time required by the contract.

(2) Documents handed over to the Administration Department

a) One week after the signing of the contract, project contract and the corresponding bidding documents shall be handed over to the Administration Department.

b) The Administration Department should sort and archive the received operation and maintenance manual, system diagram and equipment document at any time.

c) Project maintenance document should be handed over to the Administration Department with one and a half month since the completion of the project

d) Operating documents should be handed over annually. Unit operation documents of the previous year should be submitted to the Administration Department by the end of January every year.

e) Handover time of other project documents shall be determined by the department manager of the corresponding documents

8.2 Management of Operation & Maintenance Manual and System Diagrams

8.2.1 Recording of Management of Operation & Maintenance Manual and System Diagrams

The Administration Department should receive the electronic version of the Operation & Maintenance Manual and system diagram documents sent by the headquarter and record them in the recording book, of which reception dates, names and plan demand date should all be included with statistics function.

8.2.2 Distribution of Operation & Maintenance Manual and System Diagrams

The Administration Department should distribute the Management of

Operation & Maintenance Manual and system diagrams to site offices as due requirement.

8.2.3 Updating of Operation & Maintenance Manual and System Diagrams

Operation and Maintenance Manual, as well as the system diagrams should be updated every 2 years. The Administration Department may print the approved Operation and Maintenance Manual and the system diagrams. Updated Operation and Maintenance Manual and the system diagrams received by the Administration Department should be distributed first and then archived.

Upon receiving the updated Operation and Maintenance Manual and the system diagrams, the Administration Department should mark the reception date. The distribution work should be carried out, based on the list for distributing the old-version documents, in the way of same quantity for different divisions, departments and personnel while taking back the old-version Operation and Maintenance Manual and the system diagrams. Cancellation mark should be stamped on the collected old-version Operation and Maintenance Manual and the system diagrams by the Administration Department.

8.2.4 Archiving of Operation & Maintenance Manual and System Diagrams

After being distributed as required, the rest Operation and Maintenance Manual and the system diagrams should be archived for further reference.

8.2.5 Handover of Operation & Maintenance Manual and System Diagrams

The Administration Department is responsible for sorting and list-making of daily-used Management of Operation & Maintenance Manual and system diagrams. After the completion of operation and maintenance project, the

plant should be handed over to the Owner, as important part of the completion documents, of all site documents of Management of Operation & Maintenance Manual and System Diagrams.

8.3 Management of Laboratory Certificates

All the spare parts bought by the Owner will be transported to the operation site. The OM team will, jointly with the Owner, conduct equipment unpacking and collect delivery documentation attached. The equipment acceptance discipline will be responsible for supervising the process while the documents need to be double checked by both parties. The Administration Department is responsible for checking if the text format of the delivery attached documentation is consistent with the requirement of English version or Chinese-English bilingual version. The equipment acceptance discipline will be responsible for examining whether the delivery attached documentation is up to the technical and performance requirements or not. Recording should be conducted and the equipment documents should be handed over to the relevant disciplines for use.

8.4 Management of Maintenance Documents

Operation data, including operation and plan manuals, duty books, operation forms, special records, inspection records, equipment defect lists, PTW tickets, operation tickets, accident handling and analysis records, etc., should be prepared, collected, sorted, handed over and archived led by the Operation Department. Documents that need to be handed over to the Owner shall be submitted according to the contract's requirements under coordination of the Operation Department with operation units. The original operation documents should be handed over to the Owner while the scanned version should be transferred to the Administration Department for archiving.

9 Social Responsibility Of Enterprises

SEPCOIII is enthusiastically involved in nurturing the local educational,

cultural and developmental resources at its global construction locations and has been taking great efforts to integrate itself with local communities. These humanitarian activities have won praise from SPECOIII stakeholders at every level in many countries.

SPECOIII's underlying operating philosophy for international projects is based on utilizing the best local resources available and providing thousands of new jobs and technical training for the indigenous residents. SPECOIII's primary contribution of efficient power generation thereby has two very direct and secondary benefits on local human welfare: an indelible positive impact on the community's vocational human resources and, accordingly, brighter prospects for its residents for future economic prosperity.

THE DEVELOPMENT, OPERATION AND TRANSFER OF THAKETA COMBINED CYCLE POWER PLANT PROJECT

BUSINESS PLAN FOR PHASE II

I. Summary

The Government of the Republic of the Union of Myanmar has announced the policy of encouraging and promoting the development of independent power producers for generating electricity to meet electricity demands in the Republic of the Union of Myanmar.

To advance such Governmental policy, UREC and DEPP entered into a Memorandum of Understanding dated January 2nd 2013 (the "MOU") in connection with a 500 MW gas-fired combined cycle power plant to be constructed and operated in the region of Thaketa, Yangon, Myanmar, in order for the MOEP of Myanmar to upgrade the base load of power generation in the region of Yangon.

After singing the MOU, UREC have conducted feasibility studies and environmental and social impact assessments of the Power Plant (collectively, hereinafter referred to as the "FSR"). The project is to be developed in two phases:

Phase I: 109MW

Phase II: 380MW

On November 14 of 2014, DEPP and UREC-EI have entered into a Memorandum of Agreement for the Build, Operate and Transfer of the 500 MW Combined Cycle Power Plant in Yangon (Thaketa), Myanmar.

DEPP and UREC-EI, pursuant to the MOA, entered into a Joint Venture

Agreement to incorporate a private limited liability company named *U-Energy Thaketa Power Company Limited* in accordance with the Myanmar Companies Act, 1914 and the Special Company Act, 1950 for the purpose of jointly developing the Project.

The Project Phase I is planned to be put into commercial operation at the beginning of 2018. Up to December of 2015, the development Phase I Project is keeping going. However, the gas supply can just meet the gas consumption requirement of the 109MW unit of Phase I Project. Yangon General Station of Natural Gas presently has no margin to supply natural gas for the 380MW unit of Project Phase II. Therefore, the Phase I Project should be developed firstly. When there is enough natural gas can be supplied to Project Phase II, it will be developed at once.

II. Plan for Project Phase II

(1) Construction scale: A capacity of 380 MW is designed for Project Phase II, two 190 MW gas and steam turbines will form a "one on one" combined cycle double - shaft arrangement.

(2) Natural gas source: Pending.

(3) Connection system of the power plant: Phase II (2×126.1+2×67) MW “π” is connected to Thaketa–Thanlyin line.

(4) Plant site: This project is to be constructed on the site specified by the Ministry of Electric Power of Myanmar. Therefore, no site selection is

involved in this project.

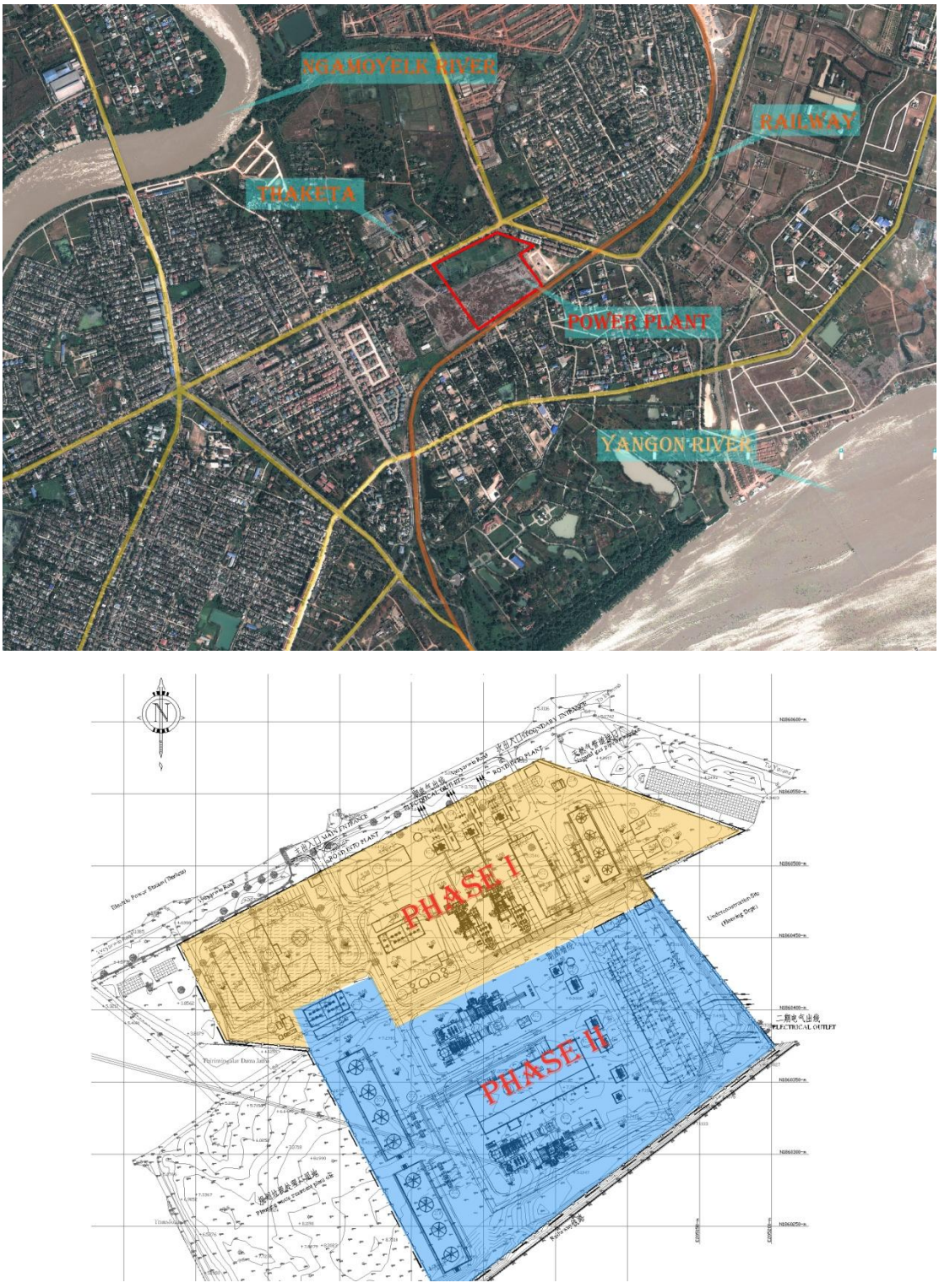
(5) Water resource of the plant: water intake for phase II is 536m^3/h (0.15m^3/s).Water source of the Project is the municipal water supply network of Yangon city.

(6) Overall layout of the plant area: with prerequisites of unified planning, reasonable process flows, phase I is separated from phase II in the production area. Various production facilities and system function shall be integrated to achieve clear zoning. Existing site shall be fully used to achieve optimal land utilization.

The plant site can be divided into north land and south land. The latter is dominated by refuse landfills; while the former is made of farmlands and wastelands with a few trees and crops as well as ponds partially at present.

As the 109MW of phase I will be put into operation firstly, its main and auxiliary production facilities shall be laid out on the north land, and the Project Phase II will be arranged on the south land.

Up to December of 2015, the land of Phase I already could meet requirement of the Project development, the land for Phase II still could not be utilized for development.



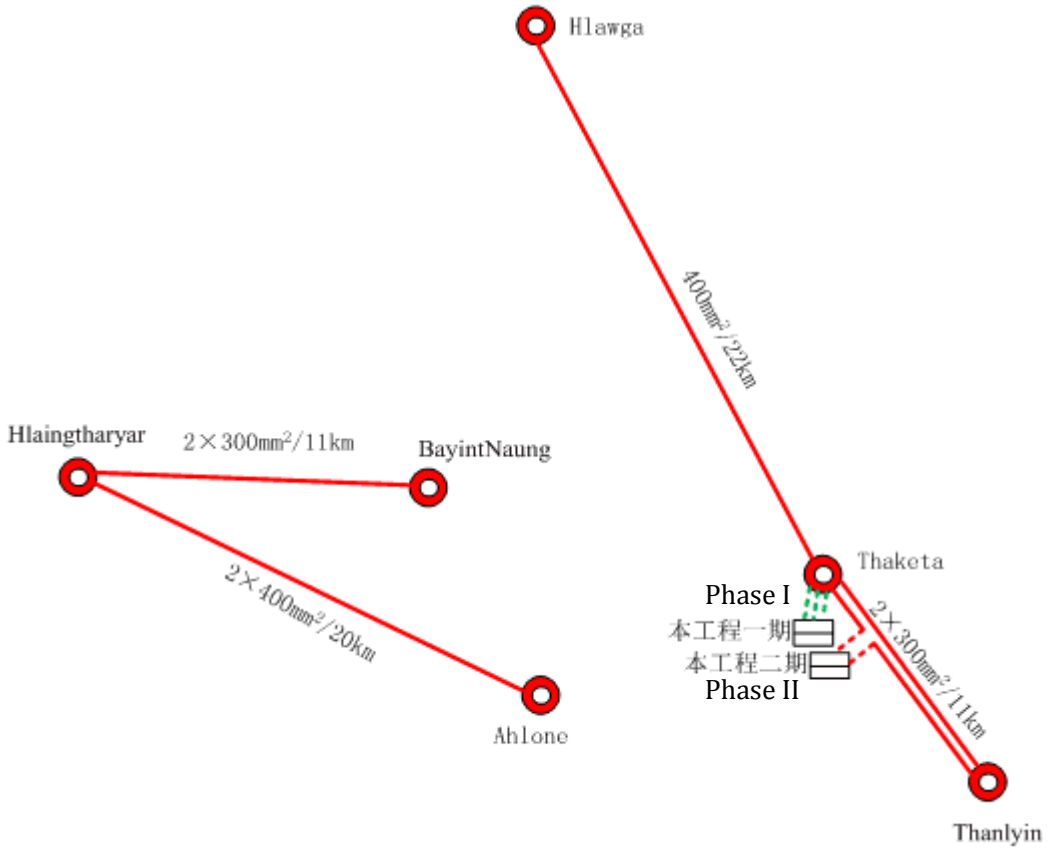
Site Location and general plan of Project Phase I & Phase II

(7) Type Selection for Main Machine Equipment of This Project: 190MW combined cycle units of Class “E” are proposed to be adopted in Project Phase II. Installation scheme shall be "one on one" multiple-shaft

scheme, namely, two Class “E" gas turbines + two waste heat boilers + two condensing steam turbine +two generators.

(8) Layout of the Main Power Building: For phase II, the cooling tower, turbine room, and step-up substation are laid out from west to east. The two sets of gas turbine and waste heat boiler group are respectively arranged in the south and north of the turbine room. The two sets of gas turbine and waste heat boiler group are arranged outdoors, and the two turbine generator units are laid out indoors.

(9) Main Electrical Connection: Project Phase II shall be connected to 230kV outdoor step-up substation of the power plant in generator-transformer form. Double-busbar connection shall be adopted for the 230kV substation and main four-circuit transformer incoming line and 230kV two-circuit outgoing line shall be provided. 230kV two‐circuit outgoing line "∏" shall be connected to the transmission line between Thaketa substation and Thanlyin substation.



Power access system plan of Project Phase I & Phase II

(10) Centralized control adopted for Project Phase II: One centralized control room is set up for the cycle unit consisting of two gas turbines and one steam turbine of phase II.

(11) Make-up water treatment system for the waste heat boiler: Project Phase II will continue to use the demineralized water tank used in Phase I Project with ultrafiltration and second-stage reverse osmosis treatment to be provided.

(12) Steel structure is proposed to be adopted for the main power building, and the ground treatment scheme depends on engineering geology of each section. Natural foundation or pile foundation is partially

backfilled.

(13) Construction organization: Highway-waterway-highway combined transport plan is adopted for large equipment transport. Construction site plan is coordinated with the general layout, and permanent and temporary combination shall be considered.

(14) Environmental protection: Laws and regulations on environmental protection of Myanmar shall be met.

(15) Investment estimation and economic evaluation shall be prepared as per the price level of May 2015 and the new budget regulations and budget quota of the year, and new quota, and cost of local labor, construction materials, and transport in Myanmar shall be considered.

(16) Operation progress plan: Project Phase II needs a 20-month construction period and commencement date will depends on natural gas source and construction condition of the gas supply pipelines.

(17) Key technical economic index (USD1 = RMB6.2)

S/N	Item	Unit	Phase II
1	Level of installed capacity	MW	380
2	Unit output under the ISO conditions	MW	386.2
3	Rated output under the average annual conditions at the local environment	MW	375.44
4	Static investment	(USD 10,000)	32734.04
5	Dynamic investment	(USD 10,000)	33916.06
6	Static unit investment	USD/kW	871.42

7	Dynamic unit investment	USD/kW	902.89
8	Annual consumption of natural gas	m^3/a	$5.26x10^8$
		mmcf/a	18585.04
9	Thermal efficiency of power plant LHV Gross Electric Eff	%	51.17
10	Gas consumption of combined cycle generator set for power generation	Nm^3/kW ћ	0.2869
		cf/ kW ћ	10.132
11	Station service power consumption rate	%	2.5
12	Water consumption index per GW	$m^3/s.GW$	0.397
13	Total land area	ha	4.45
14	Earthwork volume of the whole plant area		
	Excavation	m^3	250000
	Filling	m^3	215000
15	Personnel index of the whole plant	Person	100

Appendix 4

List of Plant Species and Cultivated Plant Species

List of Plant Species in the Study Area

No.	Scientific Name	Family Name	Myanmar Name	Habit
1	*Abelmoschus ficulneus* (L.) Wight & Arn. ex Wight	Malvaceae	Taw-yonpade	S
2	*Abrus precatorius* L.	Fabaceae	Yway-new	Cl
3	*Acacia auriculiformis* A. Cunn.	Mimosaceae	Malaysia-padauk	ST
4	*Acanthus ilicifolius* L.	Acanthaceae	Khaya	S
5	*Achyranthes aspera* L.	Amaranthaceae	Kyet-mauk-pyan, Kyet-mauk-sue-pyan, Naukpo	H
6	*Acmella calva* (DC.) R.K. Jansen	Asteraceae	Shadon-po, Sein-nagat	H
7	*Aeschynomene indica* L.	Fabaceae	Nay-bin	H
8	*Ageratum conyzoides* L.	Asteraceae	Khwe-thay-pan	H
9	*Albizia procera* (Roxb.) Benth.	Mimosaceae	Sit	T
10	*Alternanthera nodiflora* R. Br.	Amaranthaceae	Kanaphaw	H
11	*Alternanthera sessilis* (L.) R. Br.	Amaranthaceae	Pazun-sar	H
12	*Alternanthera* sp.	Amaranthaceae	Bo-taung	H
13	*Alysicarpus vaginalis* (L.) DC.	Fabaceae	Than-ma-naing-kyauk-ma-naing	S
14	*Anthocephalus cadamba* Miq.	Rubiaceae	Ma-u	T
15	*Avicennia officinalis* L.	Avicenniaceae	Thame	S/T
16	*Bambusa bambos* (L.) Voss	Poaceae	Kyakat-wa, Spiny bamboo	B
17	*Barleria prionitis* L.	Acanthaceae	Leik-su-ywe	S
18	*Bidens alba* DC.	Asteraceae	Ta-sae-ark, Ta-sae-ut	H
19	*Blumea* sp.	Asteraceae	Kadu	S
20	*Borassus flabellifer* L.	Arecaceae	Htan	T
21	*Bougainvillea* sp.	Nyctaginaceae	Sekku-pan	S/Cl
22	*Bridelia* sp.	Euphorbiaceae	Seik-chi	ST
23	*Butea parviflora* Roxb.	Fabaceae	Pauk-nwe	Cl

24	*Caesalpinia crista* L.	Caesalpiniaceae	Alo-lay	Cl
25	*Canavalia lineata* (Thunb.) DC.	Fabaceae	Pe-new	Cl/Cr
26	*Capparis tenera* Dalzell	Capparaceae	Alo-lay	S
27	*Carallia brachiata* (Lour.) Merr.	Rhizophoraceae	Mani-awga	T
28	*Cassia alata* L.	Caesalpiniaceae	Pwe-se-mezali	S/ST
29	*Cassia fistula* L.	Caesalpiniaceae	Ngu	T
30	*Cayratia trifolia* (L.) Domin	Vitaceae	Taw-sabyit	Cl
31	*Ceiba pentandra* (L.) Gaertn.	Bombacaceae	Hmo-pin	T
32	*Centella asiatica* (L.) Urb.	Apiaceae	Myin-khwa	H
33	*Cephalandra indica* Naud.	Cucurbitaceae	Kinmon	Cl/Cr
34	*Chromolaena odorata* (L.) R. M. King & H. Robinson	Asteraceae	Bizat	S
35	*Clerodendrum indicum* (L.) Kuntze	Verbenaceae	Ngayan-padu	S
36	*Clerodendrum inerme* Gaertn.	Verbenaceae	Pinle-kyauk-pan	T
37	*Clerodendrum serratum* Spreng.	Verbenaceae	Yinbya-net	S
38	*Clitoria macrophylla* Wall.	Fabaceae	Taw-pe	Cl/Cr
39	*Clitoria ternatea* L.	Fabaceae	Aung-me-nyo, Aung-me-phyu	Cl/Cr
40	*Coix lacryma-jobi* L.	Poaceae	Kyeik	G
41	*Colocasia esculenta* (L.) Schott	Araceae	Pein-pin	H
42	*Commelina diffusa* Burm. F.	Commlinaceae	Myet-kyut	H
43	*Cordia dichotoma* Forst.	Boraginaceae	Thanat	T
44	*Costus speciosus* Sm.	Costaceae	Phalan-taunghmwe	H
45	*Crateva nurvala* Buch.-Ham.	Capparaceae	Kadat	T
46	*Crotalaria burhia* Buch.-Ham.	Fabaceae	Pikesan-thein	S
47	*Cynodon dactylon* (L.) Pers.	Poaceae	Mye-sa	G
48	*Cyperus* sp. (1)	Cyperaceae	Wet-la	G

49	*Cyperus* sp. (2)	Cyperaceae	Thone-daunk-myet	G
50	*Dalbergia* sp.	Fabaceae	Sauk-kala	ST
51	*Dalbergia spinosa* Roxb.	Fabaceae	Byaik-su	S
52	*Derris* sp.	Fabaceae	-	Cl
53	*Derris trifoliata* Lour.	Fabaceae	New-net	Cl
54	*Desmodium heterophyllum* (Willd.) DC.	Fabaceae	-	S
55	*Desmodium triflorum* (L.) DC.	Fabaceae	Pe-yaing	H
56	*Dichanthium caricosum* (L.) A. Camus	Poaceae	Padaw-ni, Padaw-nyo	G
57	*Digitaria* sp.	Poaceae	-	G
58	*Dillenia indica* L.	Dilleniaceae	Tha-byu	T
59	*Dipterocarpus alatus* Roxb.	Dipterocarpaceae	Kanyin-byu	T
60	*Dolichandrone spathacea* Schum	Bignoniaceae	Thakhut	T
61	*Dracaena sanderiana* Hort. Sander ex M. T. Masters	Dracaenaceae	Zaw sein, Zaw kya	H
62	*Dregea volubilis* (L. f.) Benth. ex. Hook. f.	Asclepiadaceae	Gwe-dauk-nwe	Cl
63	*Echinochloa* sp.	Poaceae	Wun-be-sar	G
64	*Eclipta alba* (L.) Hassk.	Asteraceae	Kyeik-hman	H
65	*Eriochloa procera* (Retz.) C.E. Hubb.	Poaceae	Myet-kyein	G
66	*Erythrina stricta* Roxb.	Fabaceae	Kathit	T
67	*Euphorbia hirta* L.	Euphorbiaceae	Kywekyaung hmin say	H
68	*Excoecaria agallocha* L.	Euphorbiaceae	Tayaw, Kyikan	S/T
69	*Ficus benjamina* L.	Moraceae	Nyaung thabye	T
70	*Ficus hispida* L.	Moraceae	Kha-aung	T
71	*Ficus microcarpa*	Moraceae	Nyaung	T
72	*Ficus religiosa* L.	Moraceae	Bawdi-nyaung	T
73	*Ficus rumphii* Blume	Moraceae	Nyaung	T

74	*Flagellaria indica* L.	Flagellariaceae	Myauk kyein	Cl
75	*Flemingia* sp.	Fabaceae	Kye-mi	S
76	*Flueggea leucopyrus* Willd.	Euphorbiaceae	Chinya-pyu, Kon-chinya	S
77	*Geissaspis cristata* Wight & Arn.	Fabaceae	-	H
78	*Glochidion fagifolium* Miq.	Euphorbiaceae	Htamasok gyi	ST
79	*Grangea maderaspatana* (L.) Poir.	Asteraceae	Taw-ma-hnyo-lon, Ye-tazwet	H
80	*Heliotropium indicum* L.	Boraginaceae	Sin hna maung gyi	H
81	*Hibiscus sabdariffa* L.	Malvaceae	Chinbaung ni	S
82	*Hibiscus tiliaceus* L.	Malvaceae	Thinban, Ye-ngan-shaw	ST
83	*Hopea odorata* Roxb.	Dipterocarpaceae	Thin-gan	T
84	*Hygrophila phlomoides* Nees	Acanthaceae	Migyaung kunbat	H
85	*Hyptis rhomboidea* Marts & Gal	Lamiaceae	-	S
86	*Ichnocarpus frutescens* (L.) W.T. Aiton	Ichnocarpaceae	New-ni, Twin-net	Cl
87	*Indigofera* sp.	Fabaceae	Me-yaing	S
88	*Ipomoea aquatica* Forssk.	Convolvulaceae	Kazun-ywet	Cl/Cr
89	*Ipomoea sagittata* Poir	Convolvulaceae	Kone-kazun	Cl
90	*Ixora* sp.	Rubiaceae	Taw-sagwe	S
91	*Jasminum pubescens* Willd	Oleaceae	Taw-sabe	S/Cl
92	*Lagerstroemia macrocarpa* Kurz	Lythraceae	Pyinma-ywet-kyi	T
93	*Lagerstroemia speciosa* (L.) Pers.	Lythraceae	Pyinma	T
94	*Lannea coromandelica* (Houtt.) Merr.	Anacardiaceae	Nabe	T
95	*Lawsonia inermis* L.	Lythraceae	Dan, Henna	S
96	*Leea indica* Merr.	Leeaceae	Naga-mauk	S
97	*Leucaena leucocephala* (Lam.) De Wit	Mimosaceae	Baw-sa-gaing	T
98	*Lindernia antipoda* (L.) Alston	Scrophulariaceae	-	H

99	*Ludwigia octovalvis* (Jacq.) Raven	Onagraceae	Lay-hnin-gyi	S
100	*Ludwigia* sp.	Onagraceae	-	S
101	*Luffa aegyptiaca* Mill.	Cucurbitaceae	Thabut nwe	Cl
102	*Mangifera indica* L.	Anacardiaceae	Thayet	T
103	*Markhamia stipulata* (Wall.) Seem. ex K. Schum.	Bignoniaceae	Ma-hlwa, Mayu-de	T
104	*Melochia corchorifolia* L.	Sterculiaceae	Pilaw-akyi	S
105	*Mikania micrantha* HBK	Asteraceae	Bizat-nwe	Cl
106	*Mimosa pudica* L.	Mimosaceae	Hti-ka-yone	H
107	*Mimosa rubicaulis* Lam.	Mimosaceae	Bilat-hti-ka-yone	H
108	*Mucuna pruriens* (L.) DC.	Fabaceae	Khwe-la-ya	Cl/Cr
109	*Nauclea* sp.	Rubiaceae	Ma-u	T
110	*Nypa fruticans* Wurmb	Arecaceae	Dani	ST
111	*Oroxylum indicum* (L.) Kurz	Bignoniaceae	Kyaung-sha	T
112	*Panicum* sp.	Poaceae	-	G
113	*Passiflora foetida* L.	Passifloraceae	Taw suka	Cl
114	*Pennisetum pedicellatum* Trin.	Poaceae	Bottle-brush	G
115	*Phyllanthus* sp.	Euphorbiaceae	Chiya	S
116	*Physalis minima* L.	Solanaceae	Bauk-pin	S
117	*Pithecellobium dulce* (Roxb) Benth.	Mimosaceae	Kala-magyi	T
118	*Pluchea indica* (L.) Less.	Asteraceae	Khayu, Wabalu	S
119	*Polyscias fruticosa* (L.) Harms	Araliaceae	Kalon-letthe	S
120	*Pterocarpus macrocarpus* Kurz.	Fabaceae	Padauk	T
121	*Pueraria phaseoloides* Benth.	Fabaceae	Taw-pe	Cl/Cr
122	*Rungia pectinata* (L.) Nees	Acanthaceae	-	H
123	*Saccharum spontaneum* L.	Poaceae	Kaing	G

124	*Samanea saman* (Jacq.) Merr.	Mimosaceae	Kokko	T
125	*Schoenoplectus articulatus* (L.) Palla	Cyperaceae	Ye-kyet-thon	G
126	*Scoparia dulcis* L.	Scorphulariaceae	Darna-thu-kha	S
127	*Senna siamea* (Lam.) Irwin & Barneby	Caesalpiniaceae	Mazali	T
128	*Sesbania bispinosa* (Jacq.) Fawcett & Rendle	Fabaceae	Nyan	S
129	*Sida acuta* Burm. f.	Malvaceae	Wet-chay-pane	S
130	*Solanum indicum* L.	Solanaceae	Khayan-kazaw	S
131	*Sonneratia caseolaris* (L.) Engl.	Sonneratiaceae	Lamu	T
132	*Sphaeranthus indicus* L.	Asteraceae	Mwe soke	H
133	*Streblus asper* Lour.	Moraceae	Ohnne	T
134	*Streptocaulon tomentosum* Wight & Arn.	Asclepiadaceae	Myinsa-gonni	Cl/Cr
135	*Syzygium cumini* (L.) Skeels	Myrtaceae	Thabye-kyettet	T
136	*Syzygium kurzii* (Duthie) N.P.Balakr.	Myrtaceae	Thabye-nyo	ST
137	*Tamarindus indica* L.	Caesalpiniaceae	Magyi	T
138	*Tinospora cordifolia* Miers	Menispermaceae	Sindon-manwe	Cl
139	*Urena lobata* L.	Malvaceae	Kat-si-ne	S
140	*Vernonia cinerea* Less.	Asteraceae	Ka-do-pyan	H
141	*Vigna* sp.	Fabaceae	-	Cl
142	*Vitis japonica* Thunb.	Vitaceae	Yin-naung	Cl/Cr
143	*Ziziphus jujuba* Lam.	Rhamnaceae	Zee-pin	ST

T- Tree
ST- Small tree
S- Shrub
H- Herb

Cl- Climber
Cr- Creeper
G- Grass

List of Cultivated Plant Species in the Study Area				
No.	Scientific Name	Family Name	Myanmar Name	Habit
1	*Abelmoschus esculentus* (L.) Moench	Malvaceae	Yonpade	S
2	*Aglaia odorata* Lour.	Meliaceae	Thanatka-wa, Thanatkha-pan	ST
3	*Aloe vera* L	Aloaceae	Shazaung-let-pat	H
4	*Angelonia grandiflora* C. Morr.	Scrophulariaceae	Yehmwe-pan	H
5	*Anthurium* sp.	Araceae	Pein-pan	H
6	*Areca catechu* L.	Arecaceae	Kun-thi-pin	T
7	*Artocarpus heterophyllus* Lam.	Moraceae	Pein -hne	T
8	*Bulbophyllum* sp.	Orchidaceae	-	Epiphyte
9	*Cajanus cajan* (L.) Mills	Fabaceae	Pe-sin-ngone	S
10	*Canna* sp.	Cannaceae	Botdan-tharanan	S
11	*Carica papaya* L.	Caricaceae	Thin baw	ST
12	*Catharanthus roseus* (L.) G. Don	Apocynaceae	Thinbaw-ma-hnyo-pan	S
13	*Cocos nucifera* L.	Arecaceae	Ohn-pin	T
14	*Codiaeum variegatum* (L.) Blume	Euphorbiaceae	Ywet-hla	S
15	*Cordyline fruticosa* (L.) A. Chev.	Agavaceae	Kone-linne, Kun-linne, Zaw-ma	H
16	*Cymbidium aloifolium* (L.) Sw.	Orchidaceae	Thit-tetlin-nay	Epiphyte
17	*Cymbopogon citratus* (DC.) Stapf	Poaceae	Sabalin	G
18	*Dendrobium aphyllum* (Rchb.) C.E.C. Fisher	Orchidaceae	Phayaung-pan	Epiphyte
19	*Dracaena sanderiana* Hort. Sander ex M.T. Masters	Dracaenaceae	Zaw-sein	S
20	*Duranta repens* L.	Verbenaceae	Bokadaw-myethkon	S
21	*Gardenia jasminoides* Ellis	Rubiaceae	Zizawa	S

22	*Hibiscus rosa-sinensis* L.	Malvaceae	Khaung yan	S
23	*Hippeastrum* sp.	Amaryllidaceae	Lay-kyun-kya-gaing	H
24	*Lablab niger* Medik	Fabaceae	Pe-pazun	S
25	*Lagenaria siceraria* (Molina) Standl.	Cucurbitaceae	Bu	Cr
26	*Mangifera indica* L.	Anacardiaceae	Thayet	T
27	*Manihot esculenta* Crantz	Euphorbiaceae	Pilaw-pinan	T
28	*Mirabilis jalapa* L.	Nyctaginaceae	Mye-su	S
29	*Morinda citrifolia* L.	Rubiaceae	Yeyo	ST
30	*Moringa oleifera* Lam.	Moringaceae	Dantalon	T
31	*Musa* sp.	Musaceae	Nget pyaw	T
32	*Nerium oleander* L.	Apocynaceae	New-thagee	S
33	*Ocimum basilicum* L.	Lamiaceae	Pin-sein	S
34	*Phyllanthus acidus* (L.) Skeels	Euphorbiaceae	Thinbaw-zibyu	ST
35	*Solanum melongena* L.	Solanaceae	Khayan	S
36	*Syzygium kurzii* (Duthie) N.P.Balakr.	Myrtaceae	Thabye-nyo	ST
37	*Tabernaemontana divaricata* (L.) R.Br. ex Roem.& Schult.	Apocynaceae	Zalat-setkya, Taw-zalat	S
38	*Vigna catjang* Walp.	Fabaceae	Bo-cate-pe	S

T- Tree
ST- Small tree
S- Shrub
H- Herb
Cr- Creeper

Appendix- 5

Laboratory Results

Analytical Laboratory Section
Reg: No. 002
Date 26.5.2013
Department of Fisheries

THE REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF LIVESTOCK & FISHERIES
DEPARTMENT OF FISHERIES
FISH INSPECTION AND QUALITY CONTROL DIVISION
YANGON, MYANMAR
ANALYTICAL LABORATORY SECTION

ORIGINAL

TEST REPORT

Our Reference: 1305002

Report Date : 26.5.2013
Company's Name : Resource And Environment Myanmar Co.,Ltd.
Address : Yangon
Attention : Tharkata Gas Turbine, Yangon, Myanmar
Date Received : 14.5.2013
Sample Description : Water Sample
Date Analyzed : 15.5.2013 to 21.5.2013
RESULTS : On analysis, the following result was obtained:

No.	Sample (Code)No	Test Parameter, mg/l(ppm)				Remark
		Cadmium	Lead	Mercury	Arsenic	
1.	SW – 1	0.0004	0.0079	0.0003	ND	
2.	SW – 3	0.0010	0.0006	0.0002	0.0444	

NOTE : *AAS- Graphite Furnace Method for Pb, Cd & As
LOD of Pb = 0.0008 ppm
LOD of Cd = 0.0005 ppm
LOD of As = 0.0015 ppm
*AAS- Hydride Method for Hg
LOD of Hg = 0.0002 ppm
* ND = Not Detected

Tested By:

Nwe Ni Aung
Deputy Assistant Fisheries Officer
Contaminant Lab
Chemical Laboratory

Approved By :

Thet Naing
Head of Chemical Laboratory
Analytical Laboratory Section
Department of Fisheries

Analytical Laboratory Section
Reg: No. 003
Date 26.5.13
Department of Fisheries

ORIGINAL

THE REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF LIVESTOCK & FISHERIES
DEPARTMENT OF FISHERIES
FISH INSPECTION AND QUALITY CONTROL DIVISION
YANGON, MYANMAR
ANALYTICAL LABORATORY SECTION

TEST REPORT

Report Date : 26.5.2013
Company's Name : Resource And Environment Myanmar Co.,Ltd.
Address : Yangon.
Attention : Tharkata Gas Turbine
Date Received : 14 .5.2013
Sample Description : Water Sample
Date Analyzed : 14 .5.2013
RESULTS : On analysis, the following result was obtained:

No.	Sample (Code)No	Total Nitrogen (mg/ml)	Remark
1	SW1	7.7	
2	SW3	6.4	

NOTE : Kjeldahl Distillation Method for Total Nitrogen

Tested By :

Moe Thu Zar
Deputy Fisheries Officer
Chemical Laboratory
Analytical Laboratory Section

Approved By

Thet Naing
Head of Chemical Laboratory
Analytical Laboratory Section
Department of Fisheries

Analytical Laboratory Section
Reg: No.....
Date .....
Department of Fisheries

THE REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF LIVESTOCK & FISHERIES
DEPARTMENT OF FISHERIES
FISH INSPECTION AND QUALITY CONTROL DIVISION
YANGON, MYANMAR
ANALYTICAL LABORATORY SECTION

DEPARTMENT OF FISHERIES MYANMAR

ORIGINAL

Test Report for Microbiological Analysis

Name of Project : Tharkata Gas Turbine

Name of Company : Resource And Environment Myanmar Co., Ltd.

Date of Received :14.5.2013

Date of Analysis :14.5.2013

Test Method : AOAC Petrifilm Method

No	Date of Analysis	Detail of Samples (Water)	Total Coliforms cfu/100ml	Fecal Coliforms cfu/100ml	*E.coli* cfu/100ml	Remarks
1	14.5.13	SW 1	0	0	0	
2	14.5.13	SW 3	0	0	0	

Reference : The International Commission on Microbiological Specification for foods (ICMSF,1986) , 98/93 EC , Guidelines for drinking water quality WHO 1997 (2nd Edition) .

Analyzed by :

(Than Than Myint)
Micro Lab

Evaluated by:

(Dr.Su Myo Thwe)
Ph.D Japan
TM, Head of Micro Lab

Approved by :

(Zaw Win)
B.V.S (Ygn),D.F.T(Y.I.T),QMR
Deputy Director
Analytical Laboratory Section
Department of Fisheries

Remarks: This result is responsible for the sample in the lab.

ORIGINAL

Analytical Laboratory Section
Reg: No. 004
Date 26.5.13
Department of Fisheries

THE REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF LIVESTOCK & FISHERIES
DEPARTMENT OF FISHERIES
FISH INSPECTION AND QUALITY CONTROL DIVISION
YANGON, MYANMAR
ANALYTICAL LABORATORY SECTION

TEST REPORT

Report Date : 26.5.2013
Company's Name : Resource And Environment Myanmar Co.,Ltd.
Address : Yangon.
Attention : Tharkata Gas Turbine
Date Received : 14 .5.2013
Sample Description : Water Sample
Date Analyzed : 14 .5.2013
RESULTS : On analysis, the following result was obtained:

No.	Sample (Code)No	Total Nitrogen (mg/ml)	Remark
1	GW 1	10.3	
2	GW 2	11.1	

NOTE : Kjeldahl Distillation Method for Total Nitrogen

Tested By :

Moe Thu Zar
Deputy Fisheries Officer
Chemical Laboratory
Analytical Laboratory Section

Approved By

Thet Naing
Head of Chemical Laboratory
Analytical Laboratory Section
Department of Fisheries

Analytical Laboratory Section
Reg: No. 001
Date 26.5.2013
Department of Fisheries

THE REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF LIVESTOCK & FISHERIES
DEPARTMENT OF FISHERIES
FISH INSPECTION AND QUALITY CONTROL DIVISION
YANGON, MYANMAR
ANALYTICAL LABORATORY SECTION

ORIGINAL

TEST REPORT

Our Reference: 7305001

Report Date	: 26.5.2013
Company's Name	: Resource And Environment Myanmar Co.,Ltd.
Address	: Yangon
Attention	: Tharkata Gas Turbine, Yangon, Myanmar
Date Received	: 14.5.2013
Sample Description	: Water Sample
Date Analyzed	: 15.5.2013 to 21.5.2013
RESULTS	: On analysis, the following result was obtained:

No.	Sample (Code)No	Test Parameter, mg/l(ppm)				Remark
		Cadmium	Lead	Mercury	Arsenic	
1.	GW – 1	0.0001	0.0130	0.0063	0.0173	
2.	GW – 2	0.0002	0.0083	0.0038	0.0090	

NOTE : *AAS- Graphite Furnace Method for Pb, Cd & As
LOD of Pb = 0.0008 ppm
LOD of Cd = 0.0005 ppm
LOD of As = 0.0015 ppm
*AAS- Hydride Method for Hg
LOD of Hg = 0.0002 ppm
* ND = Not Detected

Tested By:

Nwe Ni Aung
Deputy Assistant Fisheries Officer
Contaminant Lab
Chemical Laboratory

Approved By :

Thet Naing
Head of Chemical Laboratory
Analytical Laboratory Section
Department of Fisheries

Analytical Laboratory Section
Regt No.
Date 14.5.2013
Department of Fisheries

THE REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF LIVESTOCK & FISHERIES
DEPARTMENT OF FISHERIES
FISH INSPECTION AND QUALITY CONTROL DIVISION
YANGON, MYANMAR
ANALYTICAL LABORATORY SECTION

ORIGINAL

Test Report for Microbiological Analysis

Name of Project : Tharkata Gas Turbine

Name of Company : Resource And Environment Myanmar Co., Ltd.

Date of Received :5.5.2013

Date of Analysis :6.5.2013

Test Method : AOAC Petrifilm Method

No	Date of Analysis	Detail of Samples (Water)	Total Coliforms cfu/100ml	Fecal Coliforms cfu/100ml	*E.coli* cfu/100ml	Remarks
1	6.5.13	GW 1	0	0	0	
2	6.5.13	GW 2	0	0	0	

Reference : The International Commission on Microbiological Specification for foods (ICMSF,1986) , 98/93 EC , Guidelines for drinking water quality WHO 1997 (2nd Edition) .

Analyzed by :

(Than Than Myint)
Micro Lab

Evaluated by:

(Dr.Su Myo Thwe)
Ph.D Japan
TM, Head of Micro Lab

Approved by :

(Zaw Win)
B.V.S (Ygn),D.F.T(Y.I.T),QMR
Deputy Director
Analytical Laboratory Section
Department of Fisheries

Remarks: This result is responsible for the sample in the lab.

MINISTRY OF LIVESTOCK AND FISHERIES
DEPARTMENT OF FISHERIES
AQUACULTURE DIVISION
FRESHWATER AQUACULTURE RESEARCH
WATER AND SOIL EXAMINATION LABORATORY

RESULT ON CHEMICAL EXAMINATION OF WATER

Sender's reference : Resources & Environment
Myanmar Co.,Ltd.

Location : Tharkata

Arrival Date & Time : 10.4.2013 & 2:00

Sample No	SS (mg/l)	COD (mg/l)	BOD (mg/l)	NH4-N (mg/l)	NO3-N (mg/l)	PO_4 (mg/l)	P (mg/l)	CU (mg/l)	Zn (mg/l)	Turbidity (FTU)
SW(1)	1051	0.736	2.5	nil	0.08	0.052	0.01716	0.04	1.02	1536
SW(3)	1481	0.368	3.0	nil	0.010	1.0	0.33	0.17	1.25	954

Analysed by - Htay Htay Kyi
- San San Soe
- Khaing Khaing Oo
- Thuya win

Approved by

(Aye Aye Thein)

Head of Water & Soil Examination Laboratory

MINISTRY OF LIVESTOCK AND FISHERIES
DEPARTMENT OF FISHERIES
AQUACULTURE DIVISION
FRESHWATER AQUACULTURE RESEARCH
WATER AND SOIL EXAMINATION LABORATORY

RESULT ON CHEMICAL EXAMINATION OF WATER

Sender's reference : Resources & Environment
Myanmar Co.,Ltd.

Location : Tharkata Arrival Date & Time : 3.5.2013 & 2:30

Sample No	COD (mg/l)	BOD (mg/l)	NH4-N (mg/l)	NO3-N (mg/l)	PO_4 (mg/l)	P (mg/l)	CU (mg/l)	Zn (mg/l)	Salinity (ppt)
GW(1) TKT	0.736	1.5	nil	0.019	nil	nil	0.06	0.94	nil
GW(2) TKT	3.68	2	nil	1.10	0.58	0.1914	0.09	1.20	nil

Analysed by - Htay Htay Kyi
- San San Soe
- Khaing Khaing Oo
- Thuya win

Approved by

(Aye Aye Thein)

Head of Water & Soil Examination Laboratory

APPLIED GEOLOGY DEPARTMENT

GEOCHEMISTRY LABORATORY

Project : Therketa Gas Turbine Project

Technician : Dr. Han Sein

Sample Type : River Bed Sediment

Requested by : Resource & Environment Myanmar Co., Ltd.

Method : Atomic Absorption Spectrophotometer

Digestion : Aqua-regia

Date : 24.4.2013

No.	Parameter/Sample No.	SB 1	SB 2
1	Mercury	0.005	0.005
2	Arsenic	0.004	0.003
3	Lead	125	130
4	Chromium	12	10
5	Cadmium	0.009	0.008
6	Copper	110	115
7	Nickel	15	9
8	Zinc	130	138

Note - Data Unit in ppm

ND means Not Detected.

Dr. Han Sein
Associate Professor
Applied Geology Department

Report No. : 2013-00454/001-2 (Page 1 of 1) Issued date : May 7, 2013

CLIENT : **RESOURCE AND ENVIRONMENT MYANMAR CO., LTD.**
CONTACT : Mr. Thura Aung
ADDRESS : B702 Delta Plaza, Shwegondaing Rd., Bahan, Yangon, Myanmar
Tel. +959-73013448 Fax. +951-552901
E-mail : thura@enviromyanmar.net

Analysis Report

PROJECT NAME : Thaketa Gas Turbine Project, Yangon, Myanmar
SAMPLE DESIGNATED AS : Water Quality **SAMPLING DATE** : April 9, 2013
SAMPLING LOCATION : Yangon, Myanmar **SAMPLING BY** : Client

Stations	Unit	Results of Oil and Grease
1. SW-1 TKT	mg/L	1
2. SW-3 TKT	mg/L	<1
Detection limit	mg/L	<1

Remark : - Analysis Methods followed to Standard Methods for the Examination of Water and Wastewater, recommended by APHA-AWWA-WEF.

(Siriporn Imwilaiwan)
License ID : ๖-010-๓-1793

SGS (THAILAND) LIMITED

(Thepson Yommana)
License ID : ๖-010-๓-333

TY/VN/PI

Appendix 6

CHEMICAL WATER TREATMENT SYSTEM

FOR

THAKETA POWER PLANT

CONTENTS

1 General

1.1 General Unit

1.1.1 Gas Turbine

Type:	6F.03
Output(ISO)	75.14MW
Rated speed	3000r / min
Exhaust Temperature	620.5℃
Quantity:	1 set
Manufactory:	GE Energy Products France snc

1.1.2 Gas Turbine Generator

Quantity	1 set
Manufactory	GE Energy Products France snc
Rated speed	3000r / min
Cooling mode	TEWAC

1.1.3 Heat Recovery Boiler

Type:	double pressure, unfired, horizontal natural circulation, integrated deaerator
Manufactory	Hangzhou Boiler group Co., Ltd
Quantity	1 set
HP Steam Temp	514.5℃

HP Steam Pressure	6.726MPa(g)
HP Steam Flow	122.3t/h
LP Steam Temp	201.8℃
LP Steam Pressure	0.76MPa(g)
LP Steam Flow	11.21t/h

1.1.4 Turbine

Type: sub-high pressure, single cylinder, double pressure, uniaxial, condensing

Manufactory:	Hangzhou Steam turbine Co., Ltd
Quantity:	1 set
Output(TMCR):	39.49MW
HP/LP Steam Temp:	513/ 199.7℃
HP/LP steam pressure :	6.53/0.69MPa(a)
HP/LP steam flow:	122.3/11.21 t/h

1.1.5 Generator

Normal power	39.49MW
Cooling mode	Air cooling

1.2 Water Source and Design Water Quality

Water source of boiler make-up water treatment system is the Nga Moe Yeik Creek, and the water analysis report refer to table 1.2-1. But the water quality data is not complete, we are waiting for finial report.

Table 1.2-1

Project name	Unit	Content	Project name	Unit	Content
Total solid	mg/l	2575.8	pH		7.26
Dissolved solid	mg/l	2370.4	Free CO_2	mg/l	-
Suspended solid	mg/l	205.4	Total SiO_2	mg/l	65.78
Total hardness	mmol/l	9.08	Colloid SiO_2	mg/l	20.27
Carbonate hardness	mmol/l	1.25	Total alkalinity	mg/l	-
Non-carbonate hardness	mg/l	-	Methyl orange alkalinity	mg/l	2.28
Conductivity	25 °C, us/cm	7690	Phenolphthalein alkalinity	mg/l	0.00
Ba^{++}		-	COD ($KMnO_4$)	mg/l	11
Sr^{++}		-			
K^+	mg/l	-	Cl^-	mg/l	1277.26
Na^+	mg/l	779	SO_4^{--}	mg/l	162.3
Ca^{+++}	mg/l	50.7	HCO_3^-	mg/l	139.12
Mg^{++}	mg/l	79.58	CO_3^{--}	mg/l	0.00
Fe^{++}	mg/l	0.069	OH^-	mg/l	-
Fe^{+++}	mg/l	-	NO_3^-	mg/l	4.67
Al^{+++}	mg/l	0.0125	NO_2^-	mg/l	-
NH_4^+	mg/l	0.23	PO_4^{3-}		0.68
SUM K	mg/l	909.59	SUM A	mg/l	1584.03

1.3 Water and Steam Quality Standard of Unit

1.3.1 Feed water quality standard:

	Standard value	Expected value
Sodium	-	-
Iron	≤30 μg/L	-
Copper	≤5 μg/L	-
Dissolved oxygen	≤7 μg/L	

Hydrogen conductivity (25℃)	≤0.30 μs/cm	-
pH	8.8-9.3 Water supply system containing copper；9.2-9.6 Water supply system no copper	
SiO_2	Shall ensure that the silica to meet standards	
TOC	Standard value≤500 μg/L	
Hydrazine	≤30 μg/L	

1.3.2 Steam quality standard:

	Standard value	Expected value
Sodium	≤5 μg/kg	≤2 μg/kg
SiO_2	≤20 μg/kg	≤10 μg/kg
Iron	≤15 μg/kg	≤10 μg/kg
Copper	≤3 μg/kg	≤2 μg/kg
Hydrogen conductivity (25℃)	≤0.15μs/cm	≤0.10μs/cm

1.3.3 Boiler water quality standard:

SiO_2	≤2.0 mg/L	Boiler water Solid alkali treatment
Cl^-	-	
conductivity (25℃)	＜150μs/cm	
Hydrogen conductivity (25℃)	-	
pH	Standard value：9.0-10.5 ， Expected value 9.5-10.0	
Phosphate（mg/L）	2-10	

1.3.4 Boiler make-up water standard:

	Demineralized water tank inlet conductivity (25℃)μs/cm	Demineralized water tank outlet conductivity (25℃)μs/cm	SiO_2 μg/L	TOC μg/L
Standard value	≤0.20	≤0.40	-	-

1.3.5 condensate water standard:

	conductivity (25℃)μs/cm	hardness μmol/L	Dissolved oxygen μg/L
Standard value	≤0.30	≤1.0	≤20

2 Boiler Make-Up Water Treatment System

2.1 System Design Description

According to the raw water analysis data and the steam & water quality requirement of unit, the boiler make-up water treatment system process is as follows:

Clarified water from water supply→ Clear water tank→ Clear water pump→ Dual Media Filter→ Self-cleaning filter → Ultrafiltration (UF) unit → UF water tank → UF water pump → Primary RO safety filer → Primary RO high pressure pump → Primary RO unit→ Primary RO water tank→ Primary RO water pump→Secondary RO safety filer→Secondary RO high pressure pump→Secondary RO unit→ Secondary RO water tank→ Secondary water pump →EDI unit→Demineralized water tank → Demineralized water pump→Plant user

2.2 Boiler make up water treatment capacity

2.2.1 Water & Steam losses of the plant are listed in the following table:2.2-1

Table 2.2-1

Item	Loss（t/h）
Water & steam circle loss and Boiler blow-down	5
Closed Cycle Cooling Water loss	2.5
other	0.5
Total(demineralized water)	～8

2.2.2 Water treatment capacity

According to the above table, the normal demineralized water loss of the

plant is 8t/h，the capacity of the water treatment equipment is 8t/h.

Potable & service water and Industrial water is 5t/h, according to the required water quality，Potable water comes from product water of primary RO.

The capacity of the water treatment equipment (EDI capacity) is 2×8t/h, Secondary RO Capacity is 2×9t/h, Primary RO Capacity is 2×16t/h, UF Capacity is 2×241t/h, dual media filter 2×30t/h.

2.4 Connection Mode and Operation Mode of the Boiler Make-up Water Treatment System

2.4.1 Connection mode of the system

Dual Media Filter are connecting in parallel, one running and one stand by.

Self-cleaning filters, UF units, primary RO units, secondary RO units and EDI units are connecting in series, and all of them are two trains 100% with one running or all running simultaneity.

2×150m^3 demineralized water tanks will be provided to satisfy the demineralized water demand in the condition of unit start-up, accident, boiler acid clean, flush and so on.

2.4.2 Operation mode of the system

(1) DM water treatment system will be monitored and controlled by DCS.DCS operator station will be laid in CCR for monitoring and control of DM water treatment system. One local operator station/engineer station will be laid in water treatment workshop for testing and maintaining the control system.

(2) Operation conditions for dual media filter: value of pressure difference of the filter inlet and outlet or the water volume excess limit.

(3) Operation conditions for UF system: product water rate, recovery rate of system, differential pressure of system, turbidity of product water, SDI etc.

are in prescribed limit.

(4) Operation conditions for RO system: product water rate, recovery rate of system, differential pressure of system, salt rejection ration of system, conductivity of product water, removal of silica rate etc. are in prescribed limit.

(5) Operation conditions for EDI: product water rate, recovery rate of system, differential pressure of system, salt rejection ration of system, conductivity of product water, SiO2 of product water etc. are in prescribed limit.

(6) instrument configuration

location	P	T	F	NTU	pH	L	rem arks
Clear water tank						●○	
Clear water pump	●						
dual media filter inlet main pipe		○	○				
dual media filter inlet	●		○				
dual media filter outlet	●			main pipe○			
Backwash water pump of filter inlet	●		main pipe○				
Self-cleaning filter inlet	○		○				
Self-cleaning filter outlet	○						
UF inlet	○						
UF outlet	○		○	○			
UF water tank						●○	
UF backwash pump outlet	○		main pipe○		main pipe○		

location	P	T	F	NTU	pH	L	remarks
UF water pump outlet	○						
All kinds of tank						●○	
All kinds of pump & blower	●						

location	P	T	F	C	pH	SiO_2	ORP	L	remarks
Primary RO filter inlet	○	main pipe○	○	main pipe○			○		
Primary RO filter outlet	○								
Primary RO high pressure pump inlet	○								Low pressure alarm
Primary RO high pressure pump outlet	○								high pressure alarm
Primary RO feed water	stage○								
Primary RO product water	○		○	○					
Primary RO concentrated water	○		○						
Primary RO water tank								●○	
Secondary RO filter inlet	○		○	main pipe○	○				
Secondary RO filter outlet	○								

location	P	T	F	C	pH	SiO_2	ORP	L	remarks
Secondary RO high pressure pump inlet	○								Low pressure alarm
Secondary RO high pressure pump outlet	○								high pressure alarm
Secondary RO feed water	stage○								
Secondary RO product water	○		○	○					
Secondary RO concentrated water	○		○						
Secondary RO water tank								●○	
Secondary RO water pump outlet	○								
EDI feed water	○			○					high pressure alarm
EDI product water	○		○	○		○			
EDI concentrated water inlet/outlet）	○/○		/○	○					
EDI electrode water（ inlet/outlet）	○/○		/○						
Demineralized water tank								●○	

location	P	T	F	C	pH	SiO_2	ORP	L	remarks
Demineralized water pump	●/ main pipe○		main pipe○	main pipe○		main pipe○			

NOTE:

1. ●: local instruments ○: instruments with remote transmitter

2. P: pressure T: temperature F: flowmeter L: liquid lever meter C: conductometer

2.5 Arrangement for Boiler Make-up Water Treatment Equipment

The boiler make-up water treatment plant and chemical laboratory form one building. The building consists of water treatment equipment room, chemical dosing room, water pump room, laboratory, control room, MCC room and so on.

Water treatment equipment room is 32m(length)×10m(width)×6m(headroom), in which dual media filter, self-cleaning filters, UF unit, primary RO units, secondary RO units and EDI units are arranged. Against the plant is a penthouse, 32m(length)×6m(width)×4m(headroom), and the penthouse consists of chemical dosing room and water pump room. Neighboring water treatment plant is the chemical laboratory , 38.5m(length)×8m(width)×4m(headroom) and forming a “L” type building with the water treatment plant, which consists of the laboratory rooms for water and oil, control room and MCC room. Water tanks, compressed air tanks, acid & caustic storage tanks are outdoor.

Refer to the drawing No. FA09082C-H-04 for equipment arrangement for boiler make-up water treatment.

2.6 The main equipment List

Table2. 6-1

NO.	NAME	UNIT	SPECIFICATION AND TYPE	Q'TY	Remark
1	CLEAR WATER TANK	SET	V=30m^3	1	
2	CLEAR WATER PUMP	SET	Q=30m^3/h H=32mH_2O	2	SC
3	Dual Media Filter	SET	Q=30m^3/h DN=2000	2	
4	SELF-CLEANING FILTER	SET	Q=30m^3/h	2	
5	Ultrafiltration (UF) unit	SET	Q=24m^3/h	2	
6	UF water tank	SET	V=30m^3	1	
7	UF water pump	SET	Q=24m^3/h H=30mH_2O	2	
8	Primary RO high pressure	SET	Q=24m^3/h H=200mH_2O	2	

NO.	NAME	UNIT	SPECIFICATION AND TYPE	Q'TY	Remark
	pump				
9	Primary RO safety filer	SET	Q=24m^3/h	2	
10	Primary RO unit	SET	Q=16m^3/h	2	
11	Primary RO water tank	SET	V=10m^3	1	
12	Primary RO water pump	SET	Q=12m^3/h H=25mH_2O	2	
13	Secondary RO high pressure pump	SET	Q=12m^3/h H=170mH_2O	2	
14	Secondary RO safety filer	SET	Q=12m^3/h	2	
15	Secondary RO unit	SET	Q=9m^3/h	2	
16	Secondary RO water tank	SET	V=10m^3	1	
17	Secondary RO water pump	SET	Q=9m^3/h H=25mH_2O	2	
18	RO CLEANNING PUMP	SET	Q=16m^3/h H=25mH_2O	2	
19	WASTE WATER POND	SET	V=200m^3	2	
20	EDI unit	SET	Q=8m^3/h	2	
21	Demineralized water tank	SET	V=150m^3	2	
22	Demineralized water pump	SET	Q=8m^3/h H=50mH_2O	2	SC
23	REUSED WATER PUMP	SET	Q=20m^3/h H=50mH_2O	2	
24	CONSENTRATED WATER PUMP	SET	Q=20m^3/h H=50mH_2O	2	
25	WASTE WATER PUMP	SET	Q=30m^3/h H=50mH_2O	4	
26	BACKWASH WATER PUMP OF FILTER	SET	Q=50m^3/h H=30mH_2O	2	
27	ROOTS BLOWER	SET	Q=2.8m^3/min, P=0.06MPa	2	
28	ACID/ CAUSTIC TANK	SET		1/1	
29	ACID/ CAUSTIC DOSING PUMP	SET	Q=10m^3/h H=20mH_2O	2/2	
30	CHEMICAL CLEANING DEVICE	SET		1	
31	UF BACKWASH PUMP	SET	Q=40m^3/h H=25mH_2O	2	SC

NO.	NAME	UNIT	SPECIFICATION AND TYPE	Q'TY	Remark
32	UF BACKWASH FILTER	SET	Q=40m^3/h	1	
33	SCALE INHIBITOR DOSING DEVICE	SET		1	
34	REDUCER DOSING DEVICE	SET		1	
35	ACID DOSING DEVICE	SET		1	
36	CAUSTIC DOSING DEVICE	SET		1	
37	BIOCIDE DOSING DEVICE	SET		1	
38	EYEWASH SHOWER	SET		2	
39	RECYCLE WATER POND	SET	V=75m^3	1	
40	CONSENTRATED WATER POND	SET	V=75m^3	1	

2.7 Integrate data of the main equipment

2. 7−1

ITEM	UNIT	Dual Media Filter	UF	Primary RO	Secondary RO	EDI
Number	SET	2	2	2	2	2
Equipment diameter	mm	2000				
Sectional area	m^2	3.14				
Normal flow rate	m/h	10				
Normal capacity	m^3/h.	30	24	16	9	8
Filing layer	mm	1200				
Filing volume	m^3	4				
Recovery rate	%	≥90	≥90	65	≥75	≥90

ITEM	UNIT	Dual Media Filter	UF	Primary RO	Secondary RO	EDI
Operational cycle	d	1				

2.8 Chemical Storage Transportation and Wastewater Treatment

Acid and caustic will be transported by transfer vehicle and pumped to the acid and caustic storage tanks by acid and caustic unloading pumps. Acid is 31% Hydrochloric acid (HCl). Caustic is 40% Sodium Hydroxide (NaOH). There is one acid storage tank of 4m^3 and one caustic storage tank of 4m^3 outside the water treatment plant.

The chemical cleaning waste water of UF system, RO system and EDI system will be discharged to waste water pit of the neighboring industry waste water pond for treatment. The backwash effluent from self-cleaning filters and UF units will be drained into the recycle water pond, and then pumped into raw water per-treatment system. The concentrated water from primary RO system will be discharged to concentrated water pond, and then pumped into circulating water drainage system.

Boiler cleaning wastewater will be transported to the wastewater storage basin, discharged or output by truck after been treated.

2.9 Compressed Air for the System

The oil-free compressed air from the compressor room in steam turbine hall will be used for the instruments, valves. 2×6m3 compressed air storage tanks are arranged outside.

3 Circulating Water Treatment Dosing System

3.1 System Description

The total circulating water flow in summer is 9640m3/h， concentration ratio of 2 is considered

To control the breeding of micro-organisms and prevent scale formation in the circulating water system and to save water, chlorination (Sodium hypochlorite dosing) and scale inhibitor dosing treatments are designed for circulating cooling water system.

3.2 Scale Inhibitor Dosing Equipment

One set of scale inhibitor dosing equipment will be provided, including two (2) tanks and two (2) metering pumps.

Main equipment：

Solution Tank	$V = 0.5m^3$		2 Set
Dosing Pump	Q = 30L/h	P=1.0MPa	2 Set

3.3 C.W Sodium Hypochlorite Dosing System

One set of Sodium Hypochlorite Dosing device will be provided for preventing the microorganism growth in the circulation cooling water.

Main equipment：

Solution Tank	$V = 4.5m^3$		2 Set
Dosing Pump	Q = 0-300L/h	P=1.0MPa	2 Set
Unloading pump	$Q = 10m^3/h$	P=0.2MPa	2 Set

The chemical will be fed periodically at an interval of once of every 8 hours. During chemical injection, the chemical feeding will last for one ~ two hour at 1~3 ppm. The feed point is at circulating water channel.

3.4 Arrangement for Circulating Water Treatment Equipment

The equipment of C.W. treatment dosing system is arranged nearby the combination water pump house.

4 Chemical Dosing System and Water & Steam Sampling System

4.1 condensate water and Closed Cycle Cooling Water Ammonia Dosing Treatment

One (1) ammonia dosing device is set for one (1) combined cycle unit, one (1) dosing device in total. Ammonia will be injected into common header outlet of the condensate water pump and Closed Cycle Cooling Water pump. Condensate water ammonia dosing adopts automatic control mode, and ammonia dosing pumps will be interlocked with signals sent by condensate water specific conductivity and feed water flow meter. Closed Cycle Cooling Water Ammonia dosing adopts manual control mode. Dosing equipment arranged in zero (0) lay of center control room.

Main equipment:

Solution Tanks V = 1.0m^3		2 Sets
Metering Pumps Q = 20L/h	P=4MPa	2 Sets

4.2 Oxygen scavenger Dosing System

One (1) Oxygen scavenger dosing device is set for one (1) combined cycle unit, one (1) dosing device in total. Oxygen scavenger will be injected into common header outlet of the condensate water pump. Condensate water Oxygen scavenger dosing adopts automatic control mode, and Oxygen scavenger dosing pumps will be interlocked with signals sent by feed water flow meter. Dosing equipment arranged in zero (0) layer of Center control room.

Main equipment:

Solution Tanks V = 1.0m^3 2 Sets

Metering Pumps Q = 20L/h P=4MPa 2 Sets

4.3 Phosphate Dosing System

One (1) Phosphate dosing device is set for one (1) combined cycle unit, one (1) dosing device in total. Phosphate will be injected into the boiler high pressure drum directly.

Boiler drum phosphate dosing is manual control mode. Dosing equipment arranged in zero (0) layer of center control room.

Main equipment:

Dissolving tank V = 1.0m^3 2 Sets

HP Metering Pumps Q = 10L/h P=12MPa 2 Sets

4.4 Water & Steam Sampling System

Water & steam sampling system monitors the chemistry of water and steam in cycle, including feed water, condensate, boiler water, superheated steam and so on in order to control the chemical dosing to the water cycles to ensure correct water and steam quality.

One set of sampling equipment will be provided for one combined cycle unit, one set in total. The sampling equipment shall be arranged into two parts: instrument skid and sampling rack.

The cooling water will come from the closed circle cooling water system.

Sampling Locations and Analysers:

Item	Sample Points	Analyser	Remarks
Condensate	Condensate pump outlet	CC pH O_2 M	

Item	Sample Points	Analyser	Remarks
	Condensate pump outlet（After dosing）	SC pH M	
Feed water	Economizer inlet	CC pH M	
Boiler water	HP drum boiler water	SC pH M	
	LP drum boiler water	CC pH O_2 M	
Steam	LP Superheated steam	CC M	
	HP Superheated steam	CC M	
Cooling water	Generator inner cooling water	SC pH M	
	Closed cycle cooling water for GT	SC pH M	
	Closed cycle cooling water for Steam turbine	SC pH M	

Note: CC—Cation Conductivity Meter; O_2—Dissolved Oxygen meter; pH—pH Meter; SC—Specific Conductivity Meter; M—Manual Sampling

The water & steam sampling signal will send to DCS.

Refer to the drawing No. FA09082C-H-06, for water & steam sampling system diagram. The chemical dosing equipment and water & steam sampling equipment are arranged in zero(0) layer of center control room and electric control room. Refer to the drawing No. FA09082C-H-08.

5 Laboratory

A laboratory with one set of instruments and equipment will be provided for the water and oil analyze. The laboratory is closely next to water treatment plant, totally two floors. The first floor has MCC room, chemical storage room, working lab. The second floor has water analysis room, oil analysis room, spectrometer room etc.

Appendix 7

CHEMICAL LIST

CHEMICAL LIST		
No	**Chemicals**	**Formula**
Boiler Feed Water System		
1	hydrochloric acid	HCl
2	sodium hydroxide	NaOH
4	sodium hypochlorite	NaClO
5	sodium hydrogen sulfite	NaHSO3
6	antisludging agent	FLCON135
Chemical Dosing System		
1	ammonium hydroxide	NH3.H2O
2	oxidizing agent (hydrazine)	N2H4
3	phosphate	Na3PO4. 12H2O
Raw Water Pre-treatment System		
1	coagulant	PAC
2	coagulant aids	PAM
3	sodium hypochlorite	NaClO
Circulating Water Treatment System		
1	sodium hypochlorite	NaClO
2	water quality stabilizer	corrosion inhibitor of antisludging agent
Live Water System		
1	hydrochloric acid	HCl
2	sodium chlorite	NaClO2
Industrial Waste Water Treatment System		
1	hydrochloric acid	HCl
2	sodium hydroxide	NaOH
3	coagulant	PAC
4	bactericide	NaClO
5	coagulant aids	PAM
Living Sewage Water System		
1	sterilizing Chlorine Tablet	

Appendix 8

FIRE FIGHTING SYSTEM

FOR

THAKETA POWER PLANT

CONTENTS

1 GENERAL

1.1 Design Scope

The System covers the Fire Detection and Protection System for “THAKETA Gas-Fired Combined Cycle Power Plant”

The fire protection concept design will consider the entire power plant area, includes the following risk area:

- Steam turbine hall, include steam turbine generator and associated equipment.
- Central Control Room, Administration Office Building
- Gas turbine area, include gas turbine generator, and HRSG, and associated equipment.
- Transformers
- CW pump house, Cooling tower and associated equipment
- Chemical water treatment plant
- Auxiliary building area
- Sanitary waste water treatment station area
- Natural gas treatment station

1.2 System Function

The structural and process-related fire protection measures serve both to protect the plant operating personnel and the fire brigade, and to reduce/minimize the potential for damage by fire. This safety goals are achieved by means of provisions implemented in the process design as well as through structural fire protection provisions incorporated into the civil engineering. The risk of fire is significantly reduced by minimizing the fire loads through use of non-combustible materials as

well as by reducing the quantities of combustible material required for operation.

Fire Protection System (FPS) described herein for the power plant will include the following:

- Fuel fired at the plant: natural gas;
- Lubricating oil, seal oil;
- Material used for electrical equipment: primarily cable sheathing and insulating materials in switchgear and electronic equipment cabinets.

All combustible materials are given due consideration and suitable measure to:

- Prevent fire form starting (fire prevention)
- Detect fires at an early stage (fire detection)
- Prevent fire from spreading over a wide area (fire confinement)
- Actively fight fires (fire suppression)

1.3 Codes and Standards

NFPA-850 Electric Generating Plants & High Voltage Direct Current Converter Stations Fire Protection for Fossil Fueled Steam & Combustion Turbine

NFPA-10 Standard for Portable Fire Extinguishers

NFPA-13 Standard for the Installation of Sprinkler Systems

NFPA-14 Standard for the Installation of Standpipe & Hose Systems

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 2001 Standard on Clean Agent Fire Extinguishing Systems

2 FIRE-PROTECTION DEMAND OF ENERALLAYOUT

2.1 The Fire-Protection Distance of Buildings and Structures

The distance of buildings and structures will designed refer to the NFPA-850 fire protection standards requirements. If the distance for fire-protection of the buildings and structures can't meet the requirement of the codes, the particular processing method will be adopt, e.g. the fire-protection wall will be built between the unit step-up transformer and station service transformer for gas turbine.

2.2 Fire-Protection Road

The ring roads around the power house area and fuel oil tank area will be planned. The road is 6m width. The clear height is no less than 5m under the buildings and the structures that bridging the road for the fire fighting trucks can pass the road quickly.

3 REQUIREMENTS OF BUILDINGS AND STRUCTURES

3.1 Main Architectural Construction and Arrangement

Fire risks are minimized where practical by the use of non-combustible materials, by separation and/or compartment of individual fire hazards and by their separation from sources of ignition.

Fire-stops are provided for all penetrations in walls, floors and ceilings of enclosed or separated fire risks including (but not limited to) switchgear rooms, cable floors, cable tunnels and the control room.

Emergency access ways and exits are provided to allow easy passage of persons to areas of safety in event of fire or other emergency.

In general, routes of access leads to areas of lower fire risk incorporating two or more further exit routes and are on a level or downward path. Where practical, two or more exit routes are made available from any one location. Dead ends are avoided. Emergency lighting are installed. Exit routes are clearly marked, painted and provided with emergency lighting.

3.2 Portable Fire Extinguisher Dispose

According to the different fire hazards and whether fire hydrants or water sprinkler system and other fixed fire system are be installed, fire extinguishers including portable and wheel type will be disposed in the Main building area, gas turbine area, circulating water pump house, and other auxiliary workshop and for some equipment to extinguish the early fire hazard.

4 FIRE FIGHTING WATER SUPPLY AND FIRE FIGHTING MEASURES OF THE POWER PLANT

4.1 Fire Fighting Water Supply

a) Fire fighting water supply system

In order to ensure fire fighting water supply system credibility and test convenience, independent fire fighting water supply system will be designed to provide enough quantity and pressure for Indoor and outdoor firefighting of Steam Turbine Hall, gas turbine, Central Control Building, Transformer and other auxiliary workshop. The standard is NPFA-850.

The fire fighting water supply system is consist of one set of 100% motor driven fire pumps, two sets of jockey pumps(1W+1S, include a water/air-pressure vessel), one sets of 100% diesel fire pump and network. All the fire fighting pumps are installed near the fire fighting water tank. The capacity of firefighting water is 2×500m^3 and be stored in the fire fighting water tank.

Two sets of jockey pumps (one use one stand-by) will be installed to keep the pressure at constant level. Pressure of the fire fighting water system is

normally at 0.9MPa. The jockey pump will automatically start up when the pressure of the network drops to 0.75MPa. And it will automatically stop when the pressure resumes to 0.9MPa and keeps running 30 seconds.When fire happens, the pressure of the network drops to 0.6MPa, the motor driven fire pumps will be automatically in sequence or manually start up. If motor driven fire pump fails to start, the pressure of the network drops to 0.5MPa, the diesel driven fire pump will be automatically come into operation up to the fire quench.

A hydrant and hose station system is located at various positions of the plant, outdoor and indoor. The outdoor hydrant will set firefighting box. The outdoor hydrant will be installed on plant underground piping. The distance between two outdoor hydrants around Natural Gas Treatment Plant, gas turbine area and transformer area not exceed 80 m and other areas not exceed 120 m.

Indoor hydrant is set for Central Control Room, Electric Control Room, Administration Office Building, Steam Turbine Hall, Chemical Water Treatment Plant. The distance between two indoor hydrants will not exceed 30 m.

The fire hydrant is coupling type of relevant standard. Outdoor locations are protected by pillar hydrants, each with two 65 mm bib-nosed landing valve outlets and a one 100mm bib-nosed landing valve outlets and a main operating hand wheel. Max. main underground pipe is 300mm nominal bore. The plant's indoor locations are protected by 65/40 mm gunmetal bib-nosed landing valves. These are of either open or recessed type as appropriate to the location.

Sectional valves are installed in the system to facilitate maintenance of individual sections without the need to isolate the whole system.

Each pillar hydrant and landing valve are completed with a red fire service cabinet with steel hinges and bolts containing appropriate and adequate fire-fighting equipment.

Outdoor main underground pipeline aresteel pipe. Max. main pipe is DN200. The antisepsis will be designed and will be the coating antisepsis and cathodic protection.

b) Calculation of fire fighting water quantity and pressure

Because the plant area is less than 100 hectares and residential area is not in the plant, the fires happen at the same time consider as one time.

The main protection object of water fire fighting system is gas station area, Steam Turbine Hall, gas Turbine Unit, Control Room， transformer and other auxiliary workshop and equipment.

Main building fire fighting water quantity calculation see the table 4.1-1，the max. water quantity is 59.65l/s(214.74m^3/h).

Main building fire fighting water pressure calculation see the table 4.1-2，the max. water pressure is 87.6m.

Table 4.1-1 Fire Water Consumption

No.	Protect Object		F.F Standards	Consumption (l/s)	Consumption Total (l/s)	Fire time (h)	Total demand water (m^3)	Remarks
1	Transformer	Fixed Water spray system（The surface area of transform is 210 ㎡ and the oil dike is 80 ㎡）	Supply intensity 10.2 l/min.m^2 and oil dike supply intensity 6.1 l/min.m^2	43.9	59.65	1	214.74	
		Hydrant		15.75		1		

2	steam turbine hall	Water spray system（The surface area of oil tank is 128㎡）	Supply intensity 10.2 l/min.m^2	21.8	53.3	2	383.76	
		Hydrant		31.5		2		
3	Auxiliary building	Fully sprinkler	Supply intensity 10.2 l/min.m^2	23.7	55.2	2	397.44	
		Hydrant		31.5		2		

Table 4.1-2 Calculation Results of Fire Water Pressure

No.	Item		Main block	Transformer	Auxiliary Building		Remark
			Outdoor	Area	Outdoor	Indoor	
1	Height of Build or Structures (m)		9.1	7	10	12	
2	Low level in water tank (m)		0.5	0.5	0.5	0.5	
3	Water gun	Diameter (mm)	19	19	19	19	
		Head at outlet (m)	69	-	69	69	
4	Hose reel	Diameter (mm)	65	65	65	65	
		Length (m)	25	80	25	80	
5	Head for fixed nozzle (m)			35			
6	Head loss in networks (m)		10	15	8	6	
7	F.F. equipment Head loss (m)		-	5			
8	Total (m)		87.6	61.5	86.5	86.5	

c) Fire fighting water supply equipment select

The make-up water of fire fighting water is come from make-up water.

Fire fighting pump selection: One set of 100% diesel driven fire pumps, two jockey pumps, one set of 100% motor driven fire pump will be installed nearby the firefighting water tank. The motor driven fire pumps will automatically or manually start up in fire case. If motor driven fire pump fails to start, the diesel driven fire pump will automatically put into operation. If motor driven fire pump will be maintained, the diesel driven fire pump will automatically act main fire pump.

Fire-fighting pump and jockey pump can start up on the specified pressure spot or in center control room and fire-fighting pump don't stop but on the spot. Show the state on the fire-fighting control pan in center control room, set up alarm bell and give alarm setting in center control room.

Fire fighting pump's performance parameters see table4.1-3:

Table 4.1-3 Fire fighting pump's performance parameters

Name	Flow (t/h)	Head (m)	Quantity (set)	Motor		
				Power (kW)	Voltage (V)	Quantity (set)
Diesel driven fire pumps	216	90	1	80		1
Motor driven fire pump	216	90	1	80	400	1
Jockey pump	18	95	2	15	400	2

d) Fire fighting pipe mains

Completed hydrant mains will be designed encircle the power plant area.

The underground fire water supply pipe mains will be loop at steam turbine hall, gas turbine area and natural gas treatment station area; and mains diameter is DN200 and pipe material is steel pipe. All underground pipes will be buried at least 1m below ground level.

Outdoor hydrant will provided at the fire water supply pipe mains. The hydrant will be spaced around the ring mains at approximately 80m spacing with the overall requirements that all hazards can be reached hose from a hydrant. Hydrants will be readily accessible from roads and located so that they cannot be damaged by road or rail traffic.

Each outdoor hydrant set will includes:

- 1×∅100mm pump connection
- 2 ×∅65mm hose connections,
- One standard hose house (Hose with length of 80m &∅65mm, one ∅19mm water nozzle, special wrench etc.)

Outdoor hydrants will of the free-standing dry barrel pillar type and be made of cast iron, and all connections will satisfy local standard, and each outlet will be provided with its own detachable brass cap secured by a chain to the body of the hydrant.

Each hydrant will be painted red with the word 'FIRE HYDRANT' in white characters in English.Sectional valves are installed in the system to facilitate maintenance of individual sections without the need to isolate the whole system.

4.2 Fire Fighting Measures of Power Plant

4.2.1 General

The type of fire protection and detection system for the power plant are listed in table 4.2-1

Table 4.2-1 Type of Fire Protection and Detection for

Main Buildings and Equipment

No.	Building/ Area	Type of Detection	Control Mode	Type of Fire Fighting	Combustible Material	Remakes
A.	steam turbine hall			Hydrant & extinguishers& Water spray		
1	ST main lube oil tank	Heat or flame	Auto alarm and auto extinguish	Water spray	Lube oil	
2	ST lube oil purifier	Heat or flame	Auto alarm and auto extinguish	Water spray	Lube oil	
3	ST lube oil cooler	Heat or flame	Auto alarm and auto extinguish	Water spray	Lube oil	
4	Steam turbine/generator bearing	Heat or flame	Auto alarm	Mobile 50kg dry-power extinguisher		
B	Central Control Room			Hydrant & extinguishers		
1	6.6kV distribution room	Heat and Smoke	Auto alarm	FM200	Cable	
2	400/230V distribution room	Heat and Smoke	Auto alarm	FM200	Cable	
3	Dc Ups Room	Heat and Smoke	Auto alarm	FM200	Cable	
4	Battery Room	Heat and Smoke	Auto alarm	FM200		

No.	Building/ Area	Type of Detection	Control Mode	Type of Fire Fighting	Combustible Material	Remakes
5	Central Control Room	Heat and Smoke	Auto alarm	FM200		
6	I&CEngineering Station	Heat and Smoke	Auto alarm	FM200		
7	Cable Layer	Heat and Smoke	Auto alarm	FM200		
8	Electrical Engineering Station	Heat and Smoke	Auto alarm	FM200		
9	AC Electrical Relay Room	Heat and Smoke	Auto alarm	FM200		
C	Circulating water pump house			Outdoor Hydrant & extinguishers		
D	Gas Turbine Aera			Hydrant & extinguishers		
E	Transformer Area					
1	unit step-up transformer	Heat	Auto alarm and auto extinguish	Fixed water spray	Oil	
2	station service transformer	Heat	Auto alarm and auto extinguish	Fixed water spray	Oil	
F	Natural Gas Treatment Stationn	Fuel gas leak	Auto alarm	hydrant and extinguishers	Gas	
G	Emergency diesel generator room	Heat or Smoke	Auto alarm and auto extinguish	Auto sprinkler and extinguishers	Oil	
H	Administration Office Building,	Heat or Smoke	Auto alarm	Hydrant, extinguishers and auto sprinkler		
I	Pump house	Heat or Smoke	Auto alarm	Outdoor Hydrant & extinguishers		

No.	Building/ Area	Type of Detection	Control Mode	Type of Fire Fighting	Combustible Material	Remakes
J	Supercharged transducer room	Heat and Smoke	Auto alarm	FM200		
K	Chemical water treatment plant	Heat and Smoke	Auto alarm	Hydrant & extinguishers		
L	Material storage and workshop	Heat and Smoke	Auto alarm	Hydrant & extinguishers		
M	Dormitory	Heat or Smoke	Auto alarm	Outdoor Hydrant & extinguishers		
N	Guard house	Heat or Smoke	Auto alarm	Hydrant & extinguishers		

For different area or equipment, and different types of fire fighting system will be provided. Generally, it includes the following systems:

- Hydrant system, includes indoor and outdoor hydrants and hose reel system.
- Water spray system
- Automatic sprinkler system
- Portable and mobile extinguishers
- Fire alarm and detection system (refer to electrical parts).

4.2.2 Fire fighting measure of gas turbine

The high pressure CO_2 extinguishing system is provided in the gas turbine accessory and load compartment enclosure and is supplied by the gas turbine vendor. It is completed with high pressure steel cylinders, pipeline and extinguishing nozzles.

A residual gas escape facility on the pipeline between the carbon dioxide storage tank and the protected risk for purposes of isolation is supplied.

The distance between two outdoor hydrants around gas turbine area not exceeds 80m.

Portable fire extinguisher protected by extinguisher box set for gas turbine.

4.2.3 Water Indoor Hydrant System and Hose Reel

Water The indoor hydrant system will be designed to provide fire fighting at each floor of buildings in plant. The standard are NFPA-850 and NFPA-14.

Main pipe of indoor hydrant system will be not less than DN100, and water-stream of hydrant will designed as 13 meter. The arrangement of hydrant can ensure two water-streams reach any place simultaneous. Location of hydrant should allow for ease of access to operate. Isolating valve will be provided at each hydrant indoor standpipe to allow for ease of maintenance.

The indoor hydrant and assembles will be mounted in standard hose cabinet. Each unit will include but not limited to the following:

a. One 65 mm hydrant connection and wheel handle. The hydrant connection will have 65 mm female pipe thread inlet and 65 mm male outlet.

b. 25 m of DN65 mm single jacket hose with neoprene tube and brass pin lug coupling.

c. Ø19 mm water nozzle.

d. A standard hose-reel cabinet with red finish.

e. Ø24 mm save oneself type fire-fighting plate roll

All piping will be standard size carbon steel pipe with threadconnection.

4.2.4 Water spray system

The Water spray system include fixed water spray system and high velocity water spray system, will be designed according to NFPA-850, NFPA-15, to provide fire fighting for generator transformers, transformers, ST lube oil tanks, filters, coolers,

purifiers and associated equipment, and gas lube oil tanks, emergency diesel generator room.

The density rate of application for the system is 10.2 L/min.m^2 of the protected area, The density rate of application for the unoccupied oil pond is 6.1L/min.m^2 . Each system will includes but not limited to the following:

a. A manual control gate valve (OS & Y) installed in the upstream of each deluge valve in locked open position. The signal of the valve's position (open or closed) can be indicated at the control panel.

b. A deluge valve will be designed for electrical actuation (by fire detector) and manual reset, equipped with the manufacturers standard integral manual release, valve trim, strainer, gauges and releasing mechanism. The deluge valve is normally held in closed position and will open to allow the water to flow to the spray nozzles. The deluge valve will be operated at 24V DC power and with enclosure of IP65, and the deluge valve will be installed outdoor.

c. Pressure switch assemblies will be provided having DPDT contacts. The pressure switch will provide local annunciation to the local strobe bell and the Main Fire Control Panel. Pressure switch assemblies, solenoid valves and any other devices requiring external wiring connections will be mounted in a trim box enclosure or wired to terminal blocks in NEMA 4 watertight junction box.

d. Strobe Bell for water flow alarm will be located adjacent to each deluge valve or outside the valve enclosure and will be provided with identification placard.

e. Spray nozzles will be the directional solid-cone open head type, capable of delivering spray patterns to completely cover the protected equipment or area.

f. Fire detectors will be thermal actuated or flame actuated.

g. Y-strainer will be provided to each water spray system and installed in the upstream of the manual control valve (OS & Y). The mesh of the strainer can be cleaned and reused without removal the strainer.

h. All piping will be galvanized type and standard size

4.2.5 Clean agent FM200extinguishing system

One automatic FM200 gas fire extinguishing system will be set respectively in the central control building and other electrical rooms.

Protection zones include :6.6kv distribution room, cable layer, Electric equipment room, Battery Room, Central Control Room, Engineering Station , etc. The system design will follow the NFPA 2001 and NFPA-850 requirements.

Safety precautions:In system design , full account extinguishing system safe and reliable interlocking design . With automatic and manual detection, alarm control system and set up complete a variety of sound and light alarm display device and a blow lamp ; the delay is set at 30s when the gas spout, so that all personnel evacuated , to prevent causing harm, while air-conditioning outage, close doors and windows and other external openings ; fans and ventilation ducts in the damper automatically closes. Extinguishing agent release, the release signal is fed back to the control room fire master disk, and start the set up at the door outside the audible and visual alarms and blow lamp.

Protection zone of the channel remain unobstructed and have emergency lighting in the direction signs to ensure rapid and safe evacuation . Protection zone at the entrance to the warnings and instructions marked and fitted with continuous alarm . After the fire is extinguished , the set forced ventilation facilities open until normal atmosphere ; exit in a fire danger zone settings can only open outwards door.

Main and backup systems can be implemented on the main switch on the control panel . When the main system when maintenance release is completed or is in the standby system can be manually switched to a working state.

After extinguishing system protection zone should ventilation, without adequate ventilation before protected area staff should not enter. Protection zone with oxygen respirator. Gas emissions as soon as possible after the cylinders refilled , the system returned to normal.

4.2.6 Portable & moveable fire extinguishers

Hand operated portable extinguishers, of types suitable for various categories of equipment and classes of fires will be provided. Portable dry power fire extinguishers will be installed in all buildings. In addition, portable CO_2-extinguisdher will be adopted in the control, computer, electronic and switchgear room. The standard is NFPA-10.

4.2.7 Fire detection & alarm system

The fire alarm and control system will be allocated in accordance with EPC Exhibition. The system will comprise central processing unit modules, intelligent photoelectric smoke detector, intelligent heat detector, linear heat detector, manual push button, input modules, control relay modules etc. The fire detector will be arranged in main block, electrical/control building, oil storage tanks and transformers etc. When the fire detectors detect the fire, the system will alarm and close the air condition and fan, open the deluge valve.

5 F.F.VENTILATION

Distribution rooms in plant area will be served with air conditioning for cooling in summer, also ventilation will be provided for emergency with air changes not less than 12 times per hour. The fans and motors for ventilation for diesel generator room, and battery room etc will be of explosion proof type and the motor will be directly connected with the fan. All air conditioning and ventilation equipment in the rooms mentioned above will be shut off in the case of fire.

Air ducts and their insulation materials, adhesive materials used in ventilation systems will be made of incombustible materials.

Appendix 9

List of Participants, Questionnaire Form and Power Point Presentation

List of Participants who attend the meeting and household based interview

No.	Date/ Time	Office/ Ward	Name of Head	Participants
1	29.4.2013, 10:00AM	Thaketa Township Administrative Office	U Aye Han	U Hla Aung
2				U Kyaw Thein Han
3				U Thanzin
4				U Ye Nyunt
5				U Han Tin
6				U Myo Nyunt
7				U Aye Han
8				U Zaw Naing Oo
9				U Kyaw Zin Win
10				Daw Khin Ohnmar Htwe
11				DawKatta Soe
12				Daw Aye Aye Soe
13				U Kyaw Kyaw
14				U Nay Miin Aung
15				U Kyaw Zin Oo
1	10.4.2013	No.10 (North) Ward	U Thint Lwin	Ma Thein Thein Lwin
2	9:00Am to 3:00PM			Daw Mark Gyi
3				Ma Thin Thin Oo
4				Ma Win Than
5				Ma Nyo
6				Ma Aye Maw
7				Ma Myint Myint Khaing
8				U Maung Eain
9				U Aye Cho
10				Ma Khin San Yi
11				Ma Myint Myint Soe
12				U Zaw Htet
13				U Thein Tun
14				Ko Ye Naing
15				Daw Khin Htwe Oo
16				U Pauk
17				Ma Paing Su Su Aung
18				Daw Gyi Win
19				Daw Kyin Ohn
20				Daw Zar Zar Wai
21				Daw Tin Nilar Win
22				Daw Toe Toe Yee
23				U Than Aye

24				Daw Win Maw
25				Daw Ohn Mar Wai
26				Daw Mya Nawe
27				Daw Htwe Gyi
28				Daw Sein Sein May
29				Ko Nyunt Win
30				U Myint Soe
31				Daw Khaing
32				U Win Hlaing
33				U Soe Aung
34				U Win Myint
35				U Sein Win
36				Daw Aye San
37				Ma Yu Yu Hlaing
38				U Ngwe Thein
39				Ma San San
40				Ko Zaw Lwin
41				Ma Cho Mar
42				Ko Soe Naing
43				Daw San Aye
44				Ma Aye Maw
45				Ko Soe Naing
46				Ma Htay Htay Win
47				Ma Lay Mon
48				Daw Myat Myat Soe
49				Ma Lwin Cho
50				Daw Sein
51	11.4.2013	N0.10(North) Ward	U Thint Lwin	Ma May Thazin Moe
52	9:00AM to 3:00 PM			U Thein Aye
53				Daw Lwin Lwin Soe
54				U Soe Naing
55				Ma Khin Mar Myint
56				U Thein Zaw
57				Daw Thidar Moe
58				Daw Yin Yin Nawe
59				U Tin Saw
60				Daw San Yin
61				U Kyaw Thura
62				Daw Tin Tin Myint
63				Ko Kyaw SwarThein
64				Daw Than Sine

65				Daw Khin Win Kyi
66				Daw Khin San New
67				U Aung San Oo
68				Daw Maw Maw
69				Daw Saw Kyu
70				U Thant Zin
71				Ma San San Aye
72				Ma Win Pa Pa Htwe
73				Ma Mar Mar Oo
74				Daw San San
75				Ma San San Htay
76				Daw Yee Yee Thint
77				DawToe
78				Ma Khaing Mar Lar
79				Daw Than Than Sine
80				Daw Moe Moe Kyu
81	11.4.2013	No.9 Ward	U Han Tin	U Myo Nyunt
82	9:00 to 11:00 AM			U Aye Han
83				Ma Nilar Win
84				U Zaw Win
85				U That Oo
86				U Kyaw Zaw Khaing
87				U Kyaw Shew
88				U Khin Kyaing
89				U Hla Shew
90				Ma Win Win Myint
91				U Thura Myo Naing
92				U Myint Thein
93				Ma That That Lwin
94				U Win Tun Aung
95				U Ba Khin
96				U Hla Thein
97				U Kyaw Mya
98				U Aye kyu
99				U Kaung Nyunt
100				U Han Tin

Questionnaire

Social Impacts Assessment Questionnaire for Thaketa Gas Turbine Project

Sr. No. .....
Interviewer .....
Date .....
Time .....

1. Name of Interviewee ----------
2. Gender/ Age ---------- ( ) Years
3. Race/ Religion ----------
4. Education ----------
5. Occupation ----------
6. Monthly income ----------
7. No.of family members ----------

8. Places for social lives

No.	Aim	
1	School	
2	Festivals	
3	Communication	
4	Recreation	
5	Ceremony, special occasions	
6	Religious affairs	

9. Places of Commercial Lives before and after the Project

No.	Aim	
1	Place of Work	
2	Market	

10. Household Properties

No.	Type		No.	Type	
1	House		5	Bathroom	
2	Furniture		6	Electrical Appliance	
3	Television				
4	Kitchen				

11. Other Data of Project's Concern

A. Do you know about Nature Gas-Combined Cycle Power Plant, Thaketa Project?

B Yes 0 No

B. If yes, will there be apparent changes? ----------

If yes, what will be the changes? ----------

12.What would be possible noise problems related to Gas Turbine Project?

Because of the possible noise problems concerning the project, do you expect the followings? Why?

1.Can there be disturbances in your feeling) ----------

2.Can there be change your health) ----------

3.Can there be distribute your job ----------

4.Can there be change your social affairs) ----------

5.Can there be change your education ----------

6.Can there be change your business) ----------

7.Can there be change your religion) ----------

12. View on the Project

No.	Comments for	Very satisfied	Satisfied	Neutral	No Comments	Dissatisfied
1	Overview					
2	Business					
3	Social welfare					
4	Environment					
5	social status					
6	socioeconomics					

13. Please give any suggestion ----------

14. Is there under 5 child (+) or not ----------

If (+) how many of them ----------

15.Is there old age person (> 60 yrs) ----------

If (+) how many of them ----------

16.No of working persons at home ----------

Total amount of family income per day ----------kyats

17.House (owned / rented) ----------

- Type of housing
    1. Pucca(Brick)
    2. Semi-pucca
    3. Wooden
    4. Hut
    5. Others ----------
- Length of house ----------
- Width of house ----------
- No of rooms in the house ----------
- Kitchen (indoor or outdoor) ----------

18.Source of water supply

1. River or stream
2. Well or lake
3. Tube well
4. Dam
5. Manual well
6. Others ----------

- Water stored at home or not
- If water is taken from far away
- How far it is ---------- (minutes for walk)?
- What type of carried system?

19.Where do you dispose your house waste products?

1. In your house area
2. Public disposal area
3. In river

20.How do you dispose it ?

1. Pile at place
2. Buried in the soil
3. Throw away at public rubbish
4. Burning

21.Type of latrine

1. Sanitary pit latrine
2. Non sanitary pit latrine

3. Latrine at river side
4. In bush

22. Any diseases that occur in your family

1. Disability
2. Debility due to chronic diseases
3. Persons with chronic diseases but can do daily activities
4. Chronic communicable diseases
    a) Tuberculosis
    b) Hepatitis B
    c) Hepatitis C
    d) HIV
5. Severe infectious diseases
    a) Malaria
    b) Syphilis
6. Non communicable diseases(Chronic)
    a) Hypertension
    b) Diabetes
    c) Heart diseases

If (+), how many ? ----------

22.If someone in your family become ill who do you consult

1. Traditional medicines
2. Nurse
3. Health administrator
4. Doctor
5. Private clinic
6. Hospital
7. Others ----------

23. What is the nearest clinic from your home?

a) Private clinic
b) Hospital

- How far it is? ----------(minutes for walking)

24.Transportation

1. By bus
2. Home made vehicles
3. By Bullock cart

4. By walking
5. By boat
6. By ship or motor boat
7. Motor cycle

25.Is there any school at your village? If (+)

How many?

- Types of school?
    1. Monastery
    2. Primary school
    3. Over primary school
    4. Middle school
    5. High school
    6. Others ----------

26. Do you use following things?

1. Smoking/betel chewing
2. Da ni/htan yee/beer/ alcohol
3. Narcotic drugs(eg; yarma, ganger)

27.Is there any flooding at your village? If (+)

What season?

a) Summer
b) Rainy
c) Winter
d) Any time

28.Vectors in your place?

a) Mosquitoes
b) Flies
c) Mice

THAKETA POWER PLANT PROJECT

STAKEHOLDER MEETING

သာကေတသဘာဝဓါတ်ငွေ့သုံး ဓါတ်အားပေးစက်ရုံစီမံကိန်း

လူထု တွေ့ဆုံရှင်းလင်းပွဲ

ပတ်ဝန်းကျင်ဆိုင်ရာအကြံပေး - **Resource & Environment Myanmar**

OBJECTIVE OF PUBLIC CONSULTATION

(ပြည်သူများနှင့်တွေ့ဆုံဆွေးနွေးရခြင်းရည်ရွယ်ချက်)

Keep more information of the project to the public
(စီမံကိန်းမှသတင်းအချက်အလက်များကို ပြည်သူများပိုမိုသိရှိစေရန်)

To receive concern and worriness to design the effective project and reduce environmental impact.
(စီမံကိန်းကြောင့် သဘာဝ ပတ်ဝန်းကျင် ထိခိုက် ပျက်စီးစေခြင်းများ လျော့နည်းစေရန်)

GENERAL PROJECT DESCRIPTION

(စီမံကိန်း ဆိုင်ရာ အချက်အလက်များ)

FIGURE 1. Proposed (Thaketa) Thaketa Gas –combined Cycle Power Plant

Location map of Thaketa Nature Gas Combine Cycle Power Plant

Project Background

Existing Power Plant and Environmental Setting

Project Background

1. In order to generate electric power to add Myanmar's National Grid, the project has planned in an approximately 0.12 square km (29.65 Acres) area in sub-urban of the Yangon City. The proposed generator and associated facilities covers some shrub land and disposal site.

Project Background

The basic information about the project is stated as follows;
Total Installation Capacity: 500MW to be developed in two phases;
Phase I: about 100~120MW
Phase II: about 380~400MW

Type of Plant
Nature Gas-Combined Cycle Power Plant
(သဘာဝဓါတ်ငွေ့သုံးဓါတ်အားပေးစက်ရုံ)

Objective

Yangon is an economic center, an industrial center and a transportation hub in the Union of Myanmar.

Currently, the industrial parks near Yangon are constantly developing, the power supply and demand are also continuously growing and the gap between power supply and demand can be filled through the construction of power plant near Yangon, so UREC Ltd. suggests to construct a gas-steam combined cycle power plant near Yangon Industrial Park.

Project

With a planned capacity of 118.4 MW, the first phase project of Yangon Gas-steam Combined Cycle Power Plant consists of two gas turbine generator units of 37.85 MW each and one steam turbine generator unit of 42.7MW.
In other words, two gas turbines are equipped with one steam turbine through combined cycle (2+1).

It is predicted that the electricity generated by this power plant will alleviate the imbalance between supply and demand of the developing Industrial Park and Yangon City.

Project

It is suggested to implement the power plant project plan on the basis of BOT (Built Operate Transfer).

This power plant will operate and will be delivered to the Government of Myanmar according to the contract of BOT and the requirements of the given technical specifications and conditions.

This power plant will be brand-new and its design life will be at least 30 years from start of its commercial operation.

Environmental and Social Impact Assessment for Proposed 500MW Nature Gas-Combined Cycle Power Plant in Yangon, Myanmar

UREC 云南联合外经股份有限公司 Union Resources & Engineering Co.,Ltd.

Resource & Environment Myanmar Ltd.

- to collect the baseline data of social and natural environment condition before implementation the project
- to document various environmental and social related field activities that are being planned and or being undertaken by the developer for laying of the gas turbine and associated power-generating facilities

Environmental and Social Impact Assessment for Proposed 500MW Nature Gas-Combined Cycle Power Plant in Yangon, Myanmar

UREC 云南联合外经股份有限公司 Union Resources & Engineering Co.,Ltd.

Resource & Environment Myanmar Ltd.

- to highlight the environmental and social impact, and to support the documents for environmental management plan, strategies, styles and produce being employed in the Gas Turbine area and to meet the expectation of the International Finance Corporation, ADB guidelines, world Bank Guidelines, Myanmar's existing law, and the international conventions/ protocols/ agreements signed by Myanmar.

Scope of EIA

Resource & Environment Myanmar Ltd.

Scope of Study

- Identification of the legal and policy framework applicable to the project;
- Description of the principal project features and technical specifications including preconstruction, testing and commissioning operation and maintenance
- Description of the environmental and social baseline of the project in terms of key sensitivities and potential constraints on the construction and operation and maintenance of the power plant;

Scope of EIA

Resource & Environment Myanmar Ltd.

Scope of Study

- Assessment of the air, land, noise, water, and the natural (biological) environment including parameters of human interest (social issues) based on primary surveys and available secondary data; Geology of the area including earthquake risk will be considered for the safety of the Gas Turbine Plant.
- Identification of potential adverse environmental and social impacts during construction and operation of the generator and mitigation measures to be adopted by developer;

Scope of EIA

Resource & Environment Myanmar Ltd.

Scope of Study

To undertake preliminary ESIA study based on this base line data and to develop Environmental Management Plan (EMP) outlining preventive and control strategies for minimizing adverse impacts during construction and operation phase of the project.

Benefit of project
(စီမံကိန်းမှရရှိမည့်အကျိုးရလဒ်များ)

To improve community economic by increasing electric power supply under the good environmental management plan

RECOMMENDATION အကြံပြုချက်များ

To mitigate the Environmental Impacts by this development project, Environmental & Social Impact Assessment will be done inline with international and local guidelines and standards.

စီမံကိန်း ကြောင့် ဒေသဖွံ့ဖြိုး တိုးတက်စေမှု၊ လူမှုရေးအကျိုးများ ပူးပေါင်း ပါဝင်မှုနှင့်အတူ ပတ်ဝန်းကျင် ထိခိုက်မှု လျော့နည်းစေရေး၊ ဘေးအန္တရာယ် ကင်းရှင်းရေး အစီအမံများ ချမှတ်လုပ်ဆောင်ပါမည်။

Question မေးခွန်းများ
Recommendation အကြံပြုချက်များ
Concern/woriness စိုးရိမ်ပူပန်မှုများ

106 MW Tharketa Combine Cycle Power Plant နှင့်ပတ်သက်သော ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာအတွက် လိုအပ်သော စီမံကိန်းနှင့် သက်ဆိုင်သူများနှင့်တွေ့ဆုံဆွေးနွေးခြင်း အခမ်းအနား

ဖိတ်ကြားခြင်း

မြန်မာ့အလင်း
Myanma Alinn Daily

ဖိတ်ကြားလွှာ

106 MW Tharketa Combine Cycle Power Plant နှင့်ပတ်သက်သော ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာအတွက်လိုအပ်သော စီမံကိန်းနှင့်သက်ဆိုင်သူများနှင့် တွေ့ဆုံဆွေးနွေးခြင်း အခမ်းအနား

U Energy Thaketa Power Co.,Ltd.မှ JV/BOT စနစ်ဖြင့် အကောင်အထည်ဖော်ဆောင်ရွက်လျက်ရှိသည့် သဘာဝဓာတ်ငွေ့နှင့် ဒွန်ဒုစ်အပူသုံးဓာတ်အားပေးစက်ရုံ စီမံကိန်းအတွက် ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း (EIA)အစီရင်ခံစာကို U Energy Thaketa Power Co.,Ltd. နှင့် ပတ်ဝန်းကျင်ထိခိုက်သိမ်းရေးဦးစီးဌာနမှ တာဝန်ရှိ စိစစ်ရေးအဖွဲ့သည် ညှိနှိုင်းဆွေးနွေးမှုများပြုလုပ်ခဲ့ပြီး အစီရင်ခံစာကို ၂၀၁၈ခုနှစ်၊ ဧပြီလတွင် ပြန်လည်ပြင်ဆင်တင်သွင်းခဲ့ပါသည်။

သို့ဖြစ်ပါ၍ စီမံကိန်းနှင့်သက်ဆိုင်သူများအား တွေ့ဆုံဆွေးနွေးခြင်း (Stakeholder Consultation Meetig) အခမ်းအနားကို အောက်ဖော်ပြပါအစီအစဉ်အတိုင်း ဆောင်ရွက်မည်ဖြစ်ပါသဖြင့် စိတ်ပါဝင်စားသူများ တက်ရောက်နိုင်ပါရန် လေးစားစွာ ဖိတ်ကြားအပ်ပါသည်။

အစည်းအဝေးအစီအစဉ်

ရက်စွဲ - ၂၀၁၉ ရက် ဇွန် ၂၅ ရက် (အင်္ဂါနေ့)
အချိန် - နံနက် ၉ နာရီမှ မွန်းတည့် ၁၂ နာရီအထိ
နေရာ - Thaketa Power Plant Compound ၊ သာကေတမြို့နယ်။
U Energy Thaketa Power Co.,Ltd.

ကြေးမုံ
The Mirror Daily
Tuesday, 18 June 2019

ဖိတ်ကြားလွှာ

106 MW Tharketa Combine Cycle Power Plant နှင့်ပတ်သက်သော ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း အစီရင်ခံစာအတွက် လိုအပ်သော စီမံကိန်းနှင့် သက်ဆိုင်သူများနှင့် တွေ့ဆုံဆွေးနွေးခြင်း အခမ်းအနား

U Energy Thaketa Power Co.,Ltd မှ JV/BOT စနစ်ဖြင့် အကောင်အထည် ဆောင်ရွက်လျက်ရှိသည့် သဘာဝဓာတ်ငွေ့နှင့် ဒွန်ဒုစ်အပူသုံး ဓာတ်အားပေးစက်ရုံ စီမံကိန်း အတွက် ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း (EIA) အစီရင်ခံစာကို U Energy Thaketa Power Co.,Ltd နှင့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာနမှ တာဝန်ရှိ စိစစ်ရေးအဖွဲ့သည် ညှိနှိုင်းဆွေးနွေးမှုများ ပြုလုပ်ခဲ့ပြီး အစီရင်ခံစာကို ၂၀၁၈ ခုနှစ်၊ ဧပြီလတွင် ပြန်လည်ပြင်ဆင် တင်သွင်းခဲ့ပါသည်။

သို့ဖြစ်၍ စီမံကိန်းနှင့် သက်ဆိုင်သူများအား တွေ့ဆုံဆွေးနွေးခြင်း (Stakeholder Consultation Meeting) အခမ်းအနားကို အောက်ဖော်ပြပါအစီအစဉ်အတိုင်း ဆောင်ရွက် မည်ဖြစ်ပါသဖြင့် စိတ်ပါဝင်စားသူများ တက်ရောက်နိုင်ပါရန် လေးစားစွာ ဖိတ်ကြားအပ်ပါသည်။

အစည်းအဝေးအစီအစဉ်

ရက်စွဲ။ ။ ၂၀၁၉ ခုနှစ်၊ ဇွန်လ ၂၅ရက် (အင်္ဂါနေ့)
အချိန်။ ။ နံနက် (၉း၀၀) နာရီမှ (၁၂း၀၀) နာရီထိ
နေရာ။ ။ Thaketa Power Plant Compound သာကေတမြို့နယ်။
U Energy Thaketa Power Co.,Ltd.

Source: REM Study Team

MOEE

U ENERGY
U ENERGY THAKETA POWER CO.,LTD

ဖိတ်ကြားလွှာ

“လူထု ပူးပေါင်းပါဝင်ဆွေးနွေးပွဲ”

ရန်ကုန်တိုင်းဒေသကြီး၊ U Energy သာကေတလျှပ်စစ်ဓာတ်အားပေး စက်ရုံဝင်းအတွင်း၊ လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန MOEE နှင့် U Energy Thaketa Power Co.,Ltd တို့မှ အကောင်အထည်ဖော်မည့် သဘာဝဓာတ်ငွေ့နှင့်ဒွန်ဒုစ်အပူသုံး လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ စီမံကိန်းနှင့်စပ်လျဉ်း၍ သဘာဝပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင် သက်ရောက်မှု ဆန်းစစ်ခြင်း (ESIA) လုပ်ငန်းစဉ်များအား ဒေသခံပြည်သူလူထုသို့ ရှင်းလင်းတင်ပြခြင်း အခမ်းအနားကို အောက်ပါအစီအစဉ်အတိုင်း ကျင်းပပြုလုပ်မည်ဖြစ်ပါသဖြင့် တက်ရောက်လေ့လာ ဆွေးနွေးပေးပါရန် လေးစားစွာ ဖိတ်ကြားအပ်ပါသည်။

အခမ်းအနားအစီအစဉ်

နေ့ရက် ➢ ၂၅-၆-၂၀၁၉ (အင်္ဂါနေ့)
အချိန် ➢ နံနက် (၉း၀၀)နာရီမှ နေ့လည် (၁၁း၀၀)နာရီထိ
နေရာ ➢ U Energy ဓာတ်အားပေးစက်ရုံ၊ ၁၀/မြောက်ရပ်ကွက်၊ ရောဝတ်လမ်း၊ သာကေတမြို့နယ်။

Source: REM Study Team

အခမ်းအနားအစီအစဉ်

နေ့စွဲ။ ။ဇွန် ၂၅. ၂၀၁၉ (အင်္ဂါနေ့)
နေရာ။ ။Thaketa Power Plant Compound၊ သာကေတမြို့နယ်။
အချိန်။ ။နံနက် ၉း၀၀ နာရီ မှ ၁၂း၀၀ နာရီထိ။
၉း၀၀ - ၉း၁၀ တက်ရောက်သူများစာရင်းကို မှတ်ပုံတင်ခြင်း။
၉း၁၀ - ၉း၃၀ အခမ်းအနားဖွင့်လှစ်ခြင်း။

တက်ရောက်သူများစာရင်း

No.	Name	Position	Department/ Address	Phone No.
1	U Aung Thu Kyaw	Deputy Director	ECD	09 250155729
2	U Thet Lwin Oo	Staff Officer	ECD	09 42812849
3	Daw Hsaung Hine Phyu		IPRD Co., Ltd.	09 767818692
4	U Kyaw Hein		IPRD Co., Ltd.	09 458217746
5	Daw Aye Aye Myint	Township Education Officer	Education	09 452988734
6	U Ye Win	Hight School Head	Education	09 4306942
7	U Ye Min Tun	Plant Manager	Thaketa Power Plant	09 8601919
8	U Mg Mg Than	EO	YCDC	09 977275127
9	U Htin Paw Win	Repoter	Myanma Ahlin	09 420159113
10	U Ye Min Htun	Township Supervisor	YCDC	09 453891838
11	U Aung Myo Han	Township Supervisor	YCDC	09 694193230
12	U Win Hlaing	Platoon Commander	Fire Service Department	09 763176882
13	U Yin Htun Lwin	Deputy General Manager	YESC	09 444804450
14	U Zaw Zaw Win Htun	EE	YESC	09 456880096
15	Daw Su Su Khaing	Hight School Head	Education	09 5093414
16	U Aye Thiha	Vice Chairman	MEAA	09 2042233
17	U Thein Htike Aung	Clerk	General Administration Dept.	
18	U Myint Wai	10 Households leader	10 Myauk Ward	09 5181734
19	U Ye Nyunt	Town's Elder Person	10 Myauk Ward	09 25079374
20	U Tint Lwin	Administrator	2 Myauk Ward	09 5097144
21	Daw Khin Ohnmar Htwe	Director	REM	09 402305886
22	U Maung Maung		Orphange Co., Ltd.	
23	Mr. Yang Bing	Deputy Managing Director	U Energy	09 972016198
24	Mis. Yang Zisuy	Repersentative	UREC	09 766971268
25	U Sai Aike Htun	Translator	U Energy	09 788465866
26	U Aung Nyein Kyaw	Chairman	YCDC (Thakata)	09 255290081
27	U Soe Lin Htike	Township Administrator	General Administration Department	09 43060329
28	U Kyaw Htwe	Parliament Member	Upper House	09 5002018
29	Daw May Thandar Hlaing	Member(2)	YCDC	09 783511069
30	U Thura Zaw	Member(1)	YCDC	09 420082127
31	Daw Nyein Nyein Aye	100 Households Leader	10 Myauk Ward	09 210495256

32	U Than Swe	10 Households leader	10 Myauk Ward	09 895251335
33	Daw Thin Yati Htet	Chemical Analyst	Chemical	09 428100226
34	U Soe Myint	Administrator	Shu Khin Thar Ward	09 421085251
35	U Win Naung	Electric Engineering	Kwema Housing	09 450033110
36	Daw Nu Nu Aung	Proprietor	Kyaw Hotel	09 2043332
37	U Tin Win		2 Taung Ward	09 402358835
38	U Myo Min Lat	Administrator	1 Htuparyon Ward	09 777746255
39	U Aye Myint	10 Households leader	1 Htuparyon Ward	09 699469105
40	U Lwin Min Oo	Administrator	1/Anawmar Ward	09 59055299
41	U Htay Aung	Administrator	Satmu Latmu Ward	09 250018729
42	U San Aung	100 Households Leader	1/Anawmar Ward	09 412294224
43	U Ye Htet Oo	General Manager	Kingdom Power Co.,ltd	09 452335166
44	U Win Kying	Vice Chairman	ASW REAM	09 4394315
45	U Aung Myo Thu	Administrator	2 Ashave	09 444807722
46	U Aye Kyu	100 Households Leader	9 Ward	
47	U Nyi Nyi Win	Administrator	9 Taung Ward	09 456235383
48	U Aye Lwin	Town's Elder Person	10 Myauk Ward	09 251473896
49	U Myo Htun Oo	100 Households Leader	3 Yanpyay Ward	09 450009421
50	U Naing Win	10 Households leader	3 Yanpyay Ward	9687609209
51	U Kyaw Myat Htoo	General Manager	TPC Co., Ltd.	
52	Daw San Wai Oo	Assistant BD Manager	TPC Co., Ltd.	09 420220563
53	Daw Zin May Thein	Junior Engineer	TPC Co., Ltd.	09 961714195
54	U Wana Swe	BD Manager	TPC Co., Ltd.	09 250977887
55	U Mg Mg Than	100 Households Leader	Shu Khin Thar Ward	09 250680290
56	U Ohnn Kyaw		10 Myauk Ward	09 6500909
57	U Khin Maung Swe		Kwema Housing	09 254375296
58	U Myo Min Htun		Kwema Housing	09 798177578
59	Daw Aye Than		Kwema Housing	09 5182758
60	U Htay Lin Htoo	Department of Irrigation	1 Htuparyon Ward	09 5079979
61	Daw Yin Min Aung	Project Manager	Kingdom Power Co., Ltd	09 253677620
62	U Hla Kyi	Administrator	9 ward	09 978111978
63	Daw Yin Yin Lin		9 ward	09 262550406
64	U Aye Han	Town's Elder Person	9 ward	
65	U Ohnn Myint	100 Households Leader	9 ward	09 257030090
66	U Aung Kyaw Oo		Mirror Newspaper	09 440046966
67	U Tint Lwin	Administrator	10 Myauk Ward	09 420307205
68	U Hla Soe		10 Myauk Ward	09 450064878
69	U Myint Wai		10 Myauk Ward	09 25310750
70	U Pauk Sa		10 Myauk Ward	
71	U Myo Min Lat	10 Households leader	10 Myauk Ward	09 254213524
72	Daw Hla Myo Myint	Assistant	General Department	09 966831895
73	Daw Khin Cho Thet	Dispatcher	Operation Department	09 953447455

Date: 25/6/ 2019 (Tuesday)	Time: 9:30 to 11:00 am	Venue: U ENERGY Thaketa Gas Power Plant, Thaketa

Organization	**Name/ Title**		**Total**
Parliament member of upper house, Chairman of Local and Overseas Labour Affairs Committee, Chairman of National league for Democracy, Tharketa Township	U Kyaw Htwe		1
General Administration Department (GAD, Thaketa Township)	U Soe Linn Htaike Township Administrator	U Thein Htike Aung	2
NLD Members	U Aung Nyein Kyaw U U Thura Zaw	Daw Mya Thandar Hlaing	3
Yangon Electricity Supply Cooperation (YESC)	U Yin Htun Lwin Deputy General Manager	U Zaw Zaw Win Htun Executive Engineer	2
Thaketa Power Plant	U Ye Min Tun		1
Environmental Conservation Department	U Aung Thu Kyaw Deputy Director	U Thet Lwin Oo Staff Officer	2
YCDC	U Maung Maung Than U Ye Min Tun	U Aung Myo Han	3
U Energy Co., Ltd	Mr Yang Being U Sai Aik Tun	Daw Tin Yadi Htet Ms Yang Zisuy Daw Khin Cho Thet	5
REM Co., Ltd	U Thura Aung Daw Phyu Phyu Shein Daw Phyo Thinzar Wint Daw Ei Ei Win Myat	Daw Khin Ohnmar Htwe Daw Lei Lei Win Daw May Thu Daw Nan Thazin U Aung Thu Phyo	9
Education Department	Daw Aye Aye Myint	U U Ye Win Daw Su Su Khine	3
Fire service Department	U Win Aung		1
Myanmar Environmental Assessment Association	U Aye Thiha Vice Chairman		1
1 Htuparyone Ward	U Htay Linn Htoo	U Myo Min Latt U Aye Myint	3

1 Anawmar Ward	U Lwin Min Oo	U San Aung	2
2 (East) ward	U Aung Myo Thu		1
2 (South) ward	U Tin Win		1
2 (North) ward	U Thint Lwin		1
3 Yanpyay ward	U Myo Htun Oo	U Naing Win	2
9 ward	U Aye Kyu U Hla Kyi U Nyi Nyi Win	U Daw Yin Yin Linn U Aye Han U Ohn Myint	6
10 ward	U Myint Wai U Ye Nyunt U Thint Lwin U Pauk Sa	Daw Nyein Nyein Aye U Than Swe U Aye Lwin U Myo Min Latt	8
Shu Khin Thar ward	U Soe Myint	U Mg Mg Than	2
Kwem Ma Housing	U Win Naing U Khin Maung Swe	U Myo Min Tun Daw Aye Than Daw Nu Nu Aung	5
Satmu Latmu ward	U Htay Aung		1
Newspaper	U Aung Kyaw Oo Mirror Newspaper	U Htin Paw Win Myanmar New Light	2
TPC Co., Ltd	U Kyaw Myat Htoo Daw San Wai Oo	U Wana Soe Daw Zin May Thein	4
King Power Co., Ltd	U Ye Htet Oo		1
Orphange Co., Ltd	U Maung Maung		1
IPRD Co., Ltd	Daw Hsaung Hnin Phyu	U Kyaw Hein	2
Total			75

ဆွေးနွေးပွဲရလဒ်များ

ရန်ကုန်တိုင်းဒေသကြီး မဲဆန္ဒနယ်အမှတ်(၈) အမျိုးသားလွှတ်တော်ကိုယ်စားလှယ်၊ ပြည်တွင်းပြည်ပ အလုပ်သမားရေးရာ ကော်မတီ ဥက္ကဋ္ဌနှင့် သာကေတမြို့နယ်အမျိုးသားဒီမိုကရေစီ အဖွဲ့ချုပ်ဥက္ကဋ္ဌ ဦးကျော်ထွေးမှအဖွင့်မှာစကားပြောကြားပါသည်။ U energy company အနေနဲ့ ယခုလို ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာအတွက် ပြည်သူလူထုကိုတင်ပြတာလို့သဘောပေါက် ပါတယ်။ ခုလိုတင်ပြတဲ့နေရာမှာ ခုထက်ပိုပြီး ကျယ်ကျယ်ပြန့်ပြန့် လုပ်ဖို့လိုပါတယ်။ ရပ်ကျေးအုပ်ချုပ်ရေးမှူးတွေ အနီးအနားက ဒေသခံတွေအနည်းအကျဉ်း လောက်နဲ့ တွေ့ဆုံရုံနဲ့တော့ မလုံလောက်ပါဘူး။ စက်ရုံဒီနေရာမှာ တည်ရှိနေခြင်းက ရပ်ကွက် ၁ရပ်ကွက်ပဲ သက်ရောက်မှာမဟုတ်ဘဲ သာကေတ တစ်မြို့နယ်လုံးကိုသက်ရောက်မှာဖြစ်ပါတယ်။ ရပ်ကျေး အုပ်ချုပ်ရေးမှူးတွေအနေနဲ့လည်းပြန်သွားတဲ့အခါ ဒီအစီရင်ခံစာအပေါ်သုံးသပ်ပြီး သက်ဆိုင်ရာလုပ်ထုံးလုပ်နည်းနဲ့အတူ အထက်ကိုတင်ပြအကြံပြုတာရယ် ကိုယ့်ဒေသက ပြည်သူလူထုကို အချိန်ရရင် ရသလိုရှင်းပြတာမျိုး တွေလုပ်စေချင်ပါတယ်။ ဒီလိုဆန်းစစ်တဲ့အစီရင်ခံစာဆိုတာ အလွယ်တကူရထားတာ မဟုတ်ပါဘူး။ ပတ်ဝန်းကျင်ဆိုတာ အားလုံးအနားမှာရှိနေပေမယ့် သိသလိုလို ရှိပေမယ့် တကယ်တမ်း သက်ရောက်မှုဖြစ်လာတဲ့အခါ ပညာရှင်တွေကသာစွမ်းဆောင်နိုင်မှာဖြစ်ပါတယ်။ ဒါပေမယ့်ကိုယ့်ရှုထောင့်နဲ့ ကိုယ်တော့ ဒီစက်ရုံရဲ့ တည်ရှိမှုနဲ့

ပတ်ဝန်းကျင်မှာဖြစ်ပေါ်လာတဲ့ လူမှုရေး၊ စီးပွားရေးသက်ရောက်မှုတွေကိုတော့ ကိုယ်တွေပဲခံစားရမှာ ဖြစ်ပါတယ်။ စက်ရုံ ကထွက်တဲ့ စွမ်းအင်ကို ပြန်လည်ဖြန့်ဖြူးရောင်းချတာမျိုးတွေ ဖြစ်ကောင်းဖြစ်လာ ပါလိမ့်မယ်။ အဲဒီအချိန်ကျရင် စက်ရုံအနီးက ဒေသခံတွေအတွက် ဘာတွေအကျိုးရှိအောင်ဆောင်ရွက်ထားလဲ။ ဘာတွေလုပ်ပေးထားလဲဆိုတာ သာကေတ တစ်မြို့နယ်လုံးက သိထားဖို့လိုအပ်ပါတယ်။ အထူးသဖြင့် အုပ်ချုပ်ရေးအပိုင်းတွေက ဒါကို သေသေချာချာသုံးသပ်ထားဖို့ လိုအပ်ပါတယ်။ လုပ်ငန်းရှင်အနေနဲ့ကလည်း စက်ရုံအပေါ် အကျိုးစီးပွားတွေကို တွက်ချက်ထားသလိုပဲ ဒေသခံတွေအနေနဲ့ကလည်း ဒီစက်ရုံကြောင့် ဘယ်လို အကျိုးစီးပွားတွေရလာနိုင်လဲ။

ဥပမာအားဖြင့် ဒီစက်ရုံမှာ ခန့်အပ်မယ့်လုပ်သားအင်အားတွေမှာ ဒေသခံလုပ်သားဘယ်နှစ်ယောက်လောက်ခန့်အပ်ထားပြီလဲ၊ ဒေသခံဘယ်နှစ်ယောက်ကို အရည်ချင်းအဆင့်မြှင့်တင်ပေးပြီး စီမံခန့်ခွဲရေးနေရာတွေပေးနေပြီလဲ ဒါမျိုးလေးတွေပါအစီရင်ခံ စာထဲမှာထည့်ရေးပေးရင်ပိုပြည့်စုံမှာပါ။ ဘာကြောင့်လဲဆို ဖွဲ့စည်းပုံအခြေခံဥပဒေ ဇယား(၁) အရ လူမှုရေးကဏ္ဍအောက်မှာ လုပ်သားတွေနဲ့ပတ်သက်ပြီးပြဋ္ဌာန်းထားတဲ့ အချက် ၄ခုရှိပါတယ်။ အဲဒါတွေကတော့ ခွင့်ရက်၊ အလုပ်ပိတ်ရက် နှင့်အခကြေးငွေပေးချေတဲ့ ဥပဒေတွေ ပြဋ္ဌာန်းပေးရမယ်။ ပြီးတော့ပဋိပက္ခဖြစ်လာရင်ဘယ်လိုဖြေရှင်းရမယ်။ တခြားခံစားခွင့်တွေ ဘယ်လိုဖန်တီးပေးရမလဲ။ အဲဒါတွေကို ဖွဲ့စည်းပုံအခြေခံဥပဒေ ထဲမှာ ပြဋ္ဌာန်းပေးထားပြီးဖြစ်ပါတယ်။ ဒီ ESIA အစီရင်ခံစာမှာလည်း ဒါမျိုးတွေပါထည့်ပေးနိုင်ရင် အားလုံးအတွက် အကျိုးရှိတဲ့အခြေအနေဖြစ်ပါလိမ့်မယ်။ လက်ရှိ ကမ္ဘာမှာလည်း ထွက်လာတဲ့ အရင်းအမြစ်တွေအကုန်လုံး ကသန့်ရှင်းတဲ့အရင်းအမြစ်တွေဖြစ်ဖို့ ဦးစားပေးပါတယ်။ ကမ္ဘာ့နိုင်ငံတွေပြန်ကြည့်ရင်လည်း ထွက်လာတဲ့ ထုတ်ကုန်ရဲ့အရင်းအမြစ်က ဘယ်ကနေ ဘယ်လို ထွက်လာလဲ၊ ထုတ်လုပ်တဲ့ဒေသရဲ့ ပတ်ဝန်းကျင်တွေကို ဘယ်လိုသက်ရောက်မှုရှိလဲ ပတ်ဝန်းကျင်ကို ထိခိုက်နစ်နာမှုတွေရှိလား၊ လုပ်ငန်းခွင်မှာလည်း လုပ်သားတွေအပေါ် ခေါင်းပုံဖြတ်တာတွေ ရှိ/မရှိ စတဲ့သုံးသပ်ချက် တွေနဲ့ ဒီထုတ်ကုန်အပေါ် ဝယ်ယူသုံးစွဲမှုတွေရှိလာပါတယ်။ သာမန်အရင်းအမြစ်ကထွက်လာတဲ့ ထုတ်ကုန်နဲ့ သန့်ရှင်းတဲ့အရင်းအမြစ်က ထွက်လာတဲ့ ထုတ်ကုန်တွေဟာ တန်ဘိုးကွာကောင်းကွာနိုင်သော်လည်း ဂုဏ်သိက္ခာအရ သန့်ရှင်းတဲ့ ထုတ်ကုန်ကိုပဲ စျေးပိုပေးပြီး သုံးစွဲကြပါလိမ့်မယ်။ မြန်မာနိုင်ငံရင်းနှီးမြှုပ်နှံမှုကော်မရှင် မှာပြဋ္ဌာန်းထားတာကတော့ ပြည်ပလုပ်သားကို ဘယ်နှစ်ရာခိုင်နှုန်း၊ ဒေသခံတွေကိုဘယ်နှစ်ရာခိုင်နှုန်း၊ ကျွမ်းကျင် လုပ်သားဘယ်နှစ်ရာခိုင်နှုန်း ခန့်ရမယ် ပြီးတော့ဒေသခံလုပ်သားတွေရဲ့ ကျွမ်းကျင်မှု အဆင့်ကိုမြှင့်တင်ပေးတဲ့လုပ်ငန်းစဉ်တွေရှိပါတယ်။ အဲဒါတွေကို REM အနေနဲ့ထည့်သွင်းအကြံပေးစေလိုပါတယ်။ REM ဆိုတာဟာ နာမည်ကျော်ကြားတဲ့ ကုမ္ပဏီတစ်ခုပါ။ တချို့သောရွာထောင့်တွေဖြစ်တဲ့ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုဆိုင်ရာရွာထောင့်နဲ့ လူမှုစီးပွားရွာ ထောင့်တွေမှာ တူခြင်မှလည်းတူပါလိမ့်မယ်။ အဓိကကတော့ ဒီစက်ရုံကနေ သာကေတမြို့နယ်အတွင်းမှာရှိတဲ့ လူမှုစီးပွားရေး၊ ပညာရေး၊ ကျန်းမာရေးအဆင့်အတန်းတွေ ဘယ်လောက်ထိ အထောက်အပံ့ဖြစ်လဲ ဆိုတာတွေနဲ့တိုင်းတာနေမှာဖြစ်ပါတယ်။ ခုလိုဆောင်ရွက်နေတာတွေအားလုံးက CSR ဆိုတဲ့ ခေါင်းစဉ်အောက်ကနေပဲသွားနေတာ မလုံလောက်ပါဘူး။ ဒေသခံတွေအနေနဲ့ စီးပွားရေးအဆင့်အတန်း၊ ပညာရေး ကျန်းမာရေးအဆင့်အတန်းတွေမှာ ဘယ်လောက်ထိမြှင့်တင်နိုင်မလဲဆိုပြီး တွက်ချက်ဖော်ပြ ပေးတာက ပိုပြီးတော့ အကျိုးရှိပါတယ်။ နိဂုံးချုပ်အနေနဲ့ U energy မှဆောင်ရွက်မယ့်စီမံကိန်းတွေအတွက် ခုလို ESIA အစီရင်ခံစာကို တင်ပြပေးတဲ့အတွက် အထူးပင်ကျေးဇူးတင်ရှိပါတယ်။ အစီရင်ခံစာမှာ ခုလက်ရှိ အုပ်ချုပ်ရေးမှူးတွေ ဒေသခံ အနည်းငယ်လောက်နဲ့ တော့်မပြည့်စုံပါဘူး၊ ပြည်သူလူထုအားလုံးပါဝင်နိုင်တဲ့ အခမ်းအနားမျိုးတွေနဲ့တင်ပြပြီး ဒေသခံတွေရဲ့အမြင် လေးတွေနဲ့ ပေါင်းစပ် ဖန်တီးလိုက်မယ်ဆို ပိုပြီးပြည့်စုံတဲ့ အစီရင်ခံစာဖြစ်လာမှာလို့ အကြံပြုရင်းနိဂုံးချုပ်ပါသည်။

ရန်ကုန်တိုင်းဒေသကြီး၊ ရင်းနှီးမြှုပ်နှံမှုကော်မရှင်၊ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီဌာန၊ ဒုတိယညွှန်ကြားရေးမှူး - ဦးအောင်သူကျော် မှ အဖွင့်မှာစကားပြောကြားသည်။ တက်ရောက်လာတဲ့ရည်ရွယ်ချက်ကတော့ ဝန်ကြီးဌာနရဲ့မှာကြားချက်တွေကို ရှင်းပြချင်လို့ပါ။ စက်ရုံရဲ့ ဆောင်ရွက်နေမှုကို အကျဉ်းချုပ်ဖော်ပြရမယ်ဆိုရင် ခု တတိယအဖွဲ့အစည်းအနေနဲ့ EIA ကိုဆောင်ရွက်ပြီးပါပြီ။ အစီရင်ခံစာကို ပြန်လည်သုံးသပ်တဲ့နေရာမှာ သူတို့အနေနဲ့လိုအပ်ချက်လေးတွေရှိနေပါသေးတယ်။ စီမံကိန်းအနီးပတ်ဝန်းကျင်ဆိုတာ စက်ရုံ အနီး အနားကို ဆိုလိုတာမဟုတ်ဘဲ စီမံကိန်းနဲ့ပတ်သတ်ဆက်နွယ်နေတဲ့ သက်ဆိုင်ရာလုပ်ငန်းရှင်တွေ၊ ဌာနတွေ၊ အားလုံးကို ဆိုလိုတာပါ။ အစီရင်ခံစာကို သုံးသပ်တဲ့အခါကောင်းမွန်ပါတယ် သို့ပေမယ့်လိုအပ်ချက် လေးတွေရှိနေသေးပါတယ်။ လိုအပ်ချက်လေးတွေကတော့ စီမံကိန်းနဲ့ပတ် သတ်ဆက်နွယ်သူများနှင့်ဆွေးနွေးပြီး ပိုပြီးတော့ အသေးစိတ်ကျတဲ့ issue တွေကို ဆွဲထုတ်ပြီး ဒါတွေကိုဘယ်လို နည်းစနစ်တွေနဲ့ လျော့ပါး သက်သာသွား အောင်လုပ်မလဲဆိုပြီး တတိယအဖွဲ့အစည်းအနေနဲ့ လုပ်ငန်းရှင်တွေကိုအကြံပေးပြီး ဒီအစီရင်ခံစာမှာ ထည့်သွင်းဆောင်ရွက်သွားဖို့ဖြစ်ပါတယ်။ ဒီအစီရင်ခံစာထဲမှာ ပြန်လည်ပြင်ဆင်ရေးဆွဲလိုက်မယ်ဆိုရင် ပြည်သူတွေအတွက် ဘာအကျိုးကျေးဇူး တွေရမလဲဆိုတော့ ကျွန်တော်တို့ဆွဲထားတဲ့ EIA Procedure ဆိုတာက လုပ်ငန်းရှင်ဘက်ကလိုက်နာရမယ့် နိုင်ငံတကာစံချိန်စံညွှန်းတွေ၊ စည်းမျဉ်းစည်းကမ်းတွေ၊ ပညာရှင်တွေရဲ့ အကြံပြုချက်တွေကို ဘယ်လိုလိုက်နာဆောင်ရွက်သွားမလဲ ဆိုတာတွေကို လုပ်ငန်းရှင်တွေဘက်မှ ကတိကဝတ် ပြုထားတာတွေဖြစ်ပါတယ်။ ဘယ်လောက်ကောင်းတဲ့လုပ်ငန်းစဉ်တွေနဲ့ ဆောင်ရွက်ထားတဲ့ လုပ်ငန်းဖြစ်ပါစေ နောင်တစ်ချိန်ကျရင် လုပ်ငန်းကြောင့်ထိခိုက်နိုင်တဲ့ ကိစ္စရပ်တွေအနည်းနဲ့အများ ပေါ်ပေါက် လာနိုင်အတွက် ဆူညံစွာဖြေရှင်းတာထက် ယခုလို ကတိကဝတ်ပြုထားမယ်ဆို ကတိကဝတ် ပါအစီအစဉ်အတိုင်း ရသင့်ရထိုက်တဲ့ အခွင့်အရေး တွေကို မိဘပြည်သူများတောင်ဆိုနိုင်ဖို့နဲ့ ဒီဟာထက် ကျော်လွန်ပြီးဖြစ်တဲ့ ကိစ္စရပ်တွေအတွက်လည်း တရားဥပဒေ ကြောင်းအရတင်ပြနိုင်ဖို့ ဒီဟာကို ပြန်လည် ချပြခြင်းဖြစ်ပါတယ်။ ခုတတိယအဖွဲ့အစည်းက ပြန်လည်တင်ပြတဲ့အခါမှာလည်း အချုပ်လေးပါပါတယ်။ လုပ်ငန်းကိုဆောင်ရွက်တဲ့အခါ ထိခိုက်နိုင်တဲ့ဆိုးကျိုးလေးတွေကတော့ ရေထုညစ်ညမ်းမှု၊ လေထုညစ်ညမ်းမှု၊ အသံဆူညံမှုတွေလည်း ဖြစ်နိုင်ပါတယ်။ နောက်တစ်ခု ကတော့ စက်ရုံရဲ့ လုပ်သားတွေအနေနဲ့ ရသင့်ရထိုက်တဲ့ရပိုင်ခွင့်တွေနဲ့ပတ်သတ်ပြီး မိမိတို့ရဲ့ထင်မြင်သုံးသပ်ချက်တွေကို ပြောခွင့်ရှိပါတယ်။ ဒါတွေကို အစီရင်ခံစာထဲမှာ ပြည့်စုံလုံလောက်အောင်ထည့်သွင်းသွားမှာပါ။ အဲဒါကိုရတဲ့အခါကျမှဘဲ တတိယအဖွဲ့အစည်းတွေကလည်း ဖြေရှင်းနိုင်မယ့်နည်းလမ်းတွေကို အကြံပြုပြောကြားနိုင်မှာဖြစ်ပါတယ်။ ဒီလို အကြံပြုချက်တွေကပဲ နောင်အခါ လုပ်ငန်းရှင်၊ ပြည်သူ နဲ့ ကြီးကြပ်သူတို့ကြားမှာ အကောင်းဆုံးနည်းနဲ့ ရေရှည်ဆောင်ရွက်သွားနိုင်မှာဖြစ်ပါတယ်။

နောက်ဆုံး အနေနဲ့တင်ပြချင်တာကတော့ EIA Procedure ရဲ့ စာမျက်နှာ ၃၉မှာတော့ ဆိုးကျိုးသက်ရောက် မှုအားလုံးရဲ့တာဝန်ကတော့ စီမံကိန်း ဆောင်ရွက်သူ(စီမံကိန်းအဆိုပြုသူ) သည်-မိမိကိုယ်တိုင်ကြောင့်ဖြစ်စေ မိမိကိုယ်စား ဆောင်ရွက်ရန်ခန့်ထားခြင်း သို့မဟုတ် ငှားရမ်းခြင်း သို့မဟုတ် အခွင့်အာဏာပေးခြင်းပြုထားသည့် ကန်ထရိုက်တာ၊ လက်ခွဲ ဆောင်ရွက်ပေးသူ ဆပ်ကန်ထရိုက်တာ၊ အရာရှိ၊ အလုပ်သမား၊ ကိုယ်စားလှယ် သို့မဟုတ် အတိုင်ပင်ခံများ၏ ပြုလုပ်မှု သို့မဟုတ် ပျက်ကွက်မှု ကြောင့်ဖြစ်စေ ပေါ်ပေါက်သည့် ဆိုးကျိုးသက်ရောက်မှု များ အားလုံးတို့အတွက် တာဝန်ရှိသည်။ စီမံကိန်းကြောင့် ထိခိုက်ခံစားရသူများအား လက်ရှိ သို့မဟုတ် စီမံကိန်းမဆောင်ရွက်မီ ကာလထက်မနိမ့်ကျသောလူမှုစီးပွားရေးတည်ငြိမ်ခိုင်မာမှု ရရှိသည်အထိ ဆောင်ရွက်ပေးရန်နှင့် သက်မွေးဝမ်းကျောင်းလုပ်ငန်းများ ပြန်လည်တည

ထောင်ရေးနှင့် ပြန်လည်နေရာချထားရေး အစီအစဉ်များကို စီမံကိန်းကြောင့် ထိခိုက်ခံစားရသူများ၊ သက်ဆိုင်ရာအစိုးရဌာန၊ အဖွဲ့အစည်းများ၊ အခြားသက်ဆိုင်သူများနှင့် တိုင်ပင်ဆွေးနွေး၍ လိုအပ်သလို ပံ့ပိုးပေးရန် စီစဉ်ဆောင်ရွက်ရမည်။ ဒါတွေကတော့ ဖြစ်ပေါ်လာနိုင်တဲ့ သက်ရောက်မှုတွေအတွက် ကျွန်တော်တို့ ကြိုတင်ဆောင်ရွက်သွားရမှာတွေပါ။ လူကြီးမင်းတို့ အနေနဲ့လည်း မိမိတို့ရဲ့ ထင်မြင်ယူဆ ချက်တွေကိုလွတ်လပ်စွာတင်ပြလို့ရပါတယ်၊ အဲဒီတင် ပြချက်တွေကို ထည့်သွင်းစဉ်းစားပြီး လိုအပ်တဲ့ အစီအမံတွေနဲ့ သက်ဆိုင်ရာတွေကဆောင်ရွက်သွားမှာပါ။ အားလုံးပြီးသွားရင်ရော ကုမ္ပဏီအနေနဲ့ တာဝန်ယူ ဆောင်ရွက်ရမယ့် အပိုင်းတွေဖြစ်သွားပါပြီ၊ ကျေးဇူးတင်ပါတယ်။

မေး- ဦးအုန်းကျော် (ကွေ့မအိမ်ရာ)

ကျွန်တော်တို့ရပ်ကွက်ဟာဆိုရင် ဒီဓာတ်အားပေးစက်ရုံကထွက်တဲ့ နွံတွေဟာ မနှစ်ကတစ်ခါ ဒီနှစ် တစ်ခါဝင်ပါတယ်။ မနှစ်က ရပ်ကွက်ကပေါင်းပြီးတော့ ရှင်းလင်းခဲ့ပြီး ၄သိန်းလောက်ကုန်ကျခဲ့ပါတယ်။ ဒီနှစ်မှာတော့ စက်ရုံနဲ့ရပ်ကွက်နဲ့ပေါင်းပြီးတော့ သိန်း၃၀ လောက်အကုန်ခံပြီးရှင်းလင်းခဲ့ပါတယ်။ အရင်က ကျွန်တော်တို့ရပ်ကွက်က ရေစီးရေလာအလွန်ကောင်းခဲ့ပါတယ်။ မြောင်းကတော့ ၆ပေလောက် နက်ပါတယ်။ အဲထဲကို ခု ၍နှံ့တွေက ၅ပေလောက်ထိဝင်လာပါတယ်။ အဲအခါ မနိုင်တော့တဲ့ အခြေအနေမို့ စက်ရုံကို အကူ အညီတောင်းဖြေရှင်းခဲ့ရပါတယ်။ ခုလိုဖြစ်ခဲ့တဲ့အတွက် နောင်လာမယ့်နှစ်တွေမှာလည်းမဖြစ်ဖို့တောင်း ဆိုခြင်ပါတယ်။ ဒုတိယတစ်ချက် ကတော့ ၁ပတ်တစ်ခါ ၂ပတ်တစ်ခါ လောက်ကို ရေအမည်းတွေစွန့်ပစ် နေတာတွေ့ရပါတယ်။ အဲရေတွေ ရပ်ကွက်ထဲဝင်လာတဲ့အခါကျ တော့ ငါးတွေသေကုန်ပါတယ်။ အဲဒါတွေ ကိုလည်းဖြစ်နိုင်ရင် သေသေချာချာ ဖြေရှင်းပေးဖို့ အကြံပြုလိုပါတယ်။

ဖြေ- U Energy Co., Ltd.

ကြွရောက်လာကြသော လူကြီးမင်းများအားလုံးကို U Energy Company ကိုယ်စားအထူးပင် ကျေးဇူးတင်ရှိပါတယ်။ လူကြီးမင်း များအားလုံးမေးစရာရှိတာတွေကို ကျွန်တော့်ကိုမေးလို့ရပါတယ်။ စက်ရုံတွင်း လေ့လာတဲ့အခါမှာလည်း သိချင်တာတွေကိုမေးမြန်းလို့ ရပါတယ်။

ခုဆရာပြောတဲ့ ကိစ္စအတွက်လည်း ကျွန်တော်တို့ နည်းပညာကိုအဆင့်မြှင့်တင်လုပ်ဆောင်နေပါတယ်။ နွံထွက်ရတဲ့ကိစ္စ ကတော့ ကျွန်တော်တို့ လိုအပ်တဲ့ရေကို ငမိုးရိပ်ချောင်းက စုပ်တင်ရတာပါ။ နွေရာသီမှာရေခမ်းခြောက်လာပြီး ကျွန်တော်တို့က အနည် ထိုင်ပြီးပြန်သုံးရတာဖြစ်တဲ့အတွက် ပြန်စွန့်တဲ့အခါမှာ နွံနည်းနည်းပါသွားတာ ဖြစ်ပါတယ်။ အနူးအညွှတ် တောင်းပန်ပါတယ်။ ခုဖြစ်သွား တဲ့ဟာကနေ နောက်တစ်ဆင့် ကာကွယ်ဖို့ ဘာလုပ်ထားသလဲဆိုရင် မြစ်နားမှာ ဇကာနဲ့စစ်ပြီးအထိုင်ချဖို့ လုပ်နေပါတယ်။ အရင်က တိုက်ရိုက်သွယ်တန်းပြီး နောက်ဆို တစ်ဆင့်ခံ အနည်ချပြီးမှ ရေကိုသယ်ယူပါ့မယ်။ နှစ်စဉ်နှစ်တိုင်းလည်း စီမံချက်ချပြီး မိုးတွင်းမရောက် မီ ပတ်ဝန်းကျင်မှာရှိတဲ့ရေနှုတ်မြောင်းအားလုံးကို အချိန်မီလေ့လာဆန်းစစ်ပြီး ဒီပြဿနာကို နှစ်စဉ် ဖြေရှင်းပေးပါ့မယ်။ ကုမ္ပဏီရဲ့တာဝန် ရှိသူတွေအားလုံးကလည်း စက်ရုံအတွင်းမှာရှိတဲ့ ရေစီးရေလာ ကောင်းမွန်ဖို့ပဲ မဟုတ်ဘဲနဲ့ သက်ဆိုင်ရာဌာနတွေနဲ့ ပူးပေါင်းပြီးတော့ ရေစီးရေလာကောင်းမွန်အောင် ဆောင်ရွက်ဖို့အတွက် အစီအစဉ်ရှိပါတယ်။ ကျေးဇူးတင်ပါတယ်။

မေး - ဦးတင့်လွင် (၁၀/မြောက်၊ အုပ်ချုပ်ရေးမှူး)

ဒီစက်ရုံ စတင်ဆောက်လုပ်တဲ့အချိန်ကစပြီးတော့ ကောင်းကျိုး၊ ဆိုးကျိုးခံစားရတာတော့ ဒီရပ်ကွက်ဖြစ်ပါတယ်။ ဆိုးကျိုးကတော့များပါတယ်။ ဒါပေမယ့်လည်း ဖြစ်သမျှဆိုးကျိုးမှန်သမျှလည်း

စက်ရုံရဲ့မန်နေဂျာတွေက ဝိုင်းဝန်းကူညီဖြေရှင်းပေးပါတယ်။ နှံကိစ္စကလည်း အင်မတန်ဆိုးရွားပါတယ်။ ၁၀/မြောက် ရပ်ကွက်ထဲမှာလည်း ရေမြောင်းထဲမှာ နှံက ၆ပေ၊ ၇ပေလောက်ထိမြင့်တက်လာပါတယ်။ ကွေ့မ အိမ်ရာရော၊ ၁၀/မြောက် ရပ်ကွက် ရဲ့မိန်းလမ်း စက်ရုံရဲ့အဝင်အထွက်လမ်းတွေပါ အင်မတန်ပိတ်ဆို့တတ်တဲ့အတွက် ကြောင့် မနစ်က အ မ က (၁၈) ကျောင်းတစ်ခြမ်းလုံးရေမြုပ်ခဲ့ပါတယ်။ စက်ရုံရဲ့ မန်နေဂျာတွေနဲ့ ကျွန်တော်တို့ ပူးပေါင်းလုပ်ဆောင်ခဲ့မှုကြောင့် ယခုတော့ ရေနစ်မြုပ်မှုမရှိပါဘူး။ ကျွန်တော်တို့ သိချင်တာကတော့ ရှေ့လျှောက်လည်း ဒီလိုပဲ နှံတွေကို စွန့်ပစ်နေဦးမှာလား၊ ပြီးတော့ စက်ရုံ အထွက်ကရေမြောင်းတွေက ကွန်ကရစ်နဲ့မဟုတ်ပါဘူး။ မန်နေဂျာတွေပြောတာကတော့ နှံတွေကို ကန်နဲ့လုပ်ပြီး စွန့်ပစ်ထားတာတွေရှိပါတယ်။ ဒါတွေကို စနစ်တကျနဲ့လုပ်မယ်ဆိုရင်တော့ ရပ်ကွက်မှာ နှံနစ်တာတွေကင်း ဝေးသွားမှာဖြစ်ပါတယ်။ ကျေးဇူးတင်ပါတယ်။

ဖြေ - U Energy Co., Ltd.

အရင်နှစ်တွေကတော့ ချောင်းဘေးမှာ အနည်စစ်တဲ့ဟာတွေ မလုပ်ရသေးပါဘူး။ ဒီနှစ်မှာတော့ လုပ်ထားပါတယ်။ ဒါပေမယ့် အနည်းနဲ့အများတော့ ပါလာနိုင်ပါတယ်။ ကျွန်တော်တို့ဘက်ကလည်း အမြဲတမ်းပဲစောင့်ကြည့်ပြီး ရေစီးရေလာကောင်းဖို့အတွက် မိုးဝင်ခါ မှ မဟုတ်ဘဲ အမြဲကြည့်ရှုလေ့လာနေပါ့မယ်။

မေး - မြို့နယ်အုပ်ချုပ်ရေးမှူး

အဲဒီ Fitter လုပ်ပြီးသွားပြီလား။

ဖြေ - U Energy Co., Ltd.

ခုစတင်လုပ်ဆောင်နေပါပြီ၊ နောက်နွေရာသီမှာ ခုလိုပြဿနာမျိုးထပ်ပေါ်ပေါက်မယ်လို့မထင်ပါဘူး။ ကျွန်တော်တို့ရဲ့ လူမှုဆက်ဆံရေးနဲ့ လူမှုပတ်ဝန်းကျင်ပရဟိတ လုပ်ငန်းလေးတွေနဲ့ နဲနဲမိတ်ဆက်ပေးချင်ပါတယ်။ MIC ကသတ်မှတ်ထားတဲ့ CSR လုပ်ငန်းအတွက် နှစ်စဉ် လုပ်ငန်းမှ ထွက်လာတဲ့ ပမာဏတစ်ခုကို ဒီလူမှုပတ်ဝန်းကျင်လုပ်ငန်းတွေမှာအသုံးပြုမှာဖြစ်ပါတယ်။ CSR လုပ်ငန်းဆိုတာက စက်ရုံရဲ့ စက်လည်ပတ်မှု နောက်ပိုင်းမှာသတ်မှတ်ထားတာဖြစ်ပါတယ်။ စက်ရုံတည်ဆောက်ရေးကာလမှာလည်း ကျွန်တော်တို့ဆောင်ရွက်ချက်တွေကို ပြောပြချင်ပါတယ်။ တည်ဆောက်ရေးကာလကတော့ ၂နှစ်နီးပါး လောက်တည် ဆောက်ခဲ့ပါတယ်။ မြန်မာနေ့စား ဝန်ထမ်း ၁၀၀ဝနီးပါးလောက်အသုံးပြုခဲ့ပါတယ်။ ၂၀၁၈မှာတော့ စက်ရုံရဲ့အမြဲတမ်း မြန်မာဝန်ထမ်း ၅၃ယောက်ရှိပါတယ်။ ဒီ၅၃ ယောက် တင်မကဘဲ ဆက်လက်ဖြည့်တင်းပြီးတော့ သင်တန်းတွေပို့ချသွားမှာပါ။ U energy foundation တစ်ခုတည်ထောင်ထားပြီး အမြဲတမ်း ပညာရေးထောက်ပံ့မှုတွေ နှစ်စဉ်လုပ်ပေးသွားဖို့ အစီအစဉ်ရှိပါတယ်။ အရင်ကလှူဒါန်းမှုတွေလည်း လုပ်ခဲ့ပါတယ်၊ ရှေ့ဆက်ပြီးတော့လည်း လိုအပ်တဲ့နေရာတွေမှာလည်း ကျွန်တော်တို့ကို အသိပေးပြီး ကျွန်တော်တို့ဘက်ကလည်း ကူညီဖို့အဆင်သင့်ရှိပါတယ်။ စက်ရုံ ရဲ့အနီးအနားမှာတော့ ထိခိုက်မှု အနည်းနဲ့အများရှိနိုင်ပေမယ့် စက်ရုံကိုတော့ ကမ္ဘာ့အဆင့်မီ ဆောင်ရွက်သွားမှာပါ။

ဦးအုန်းကျော် နှင့် ၁၀/မြောက် အုပ်ချုပ်ရေးမှူးပြောတာအပြင် အခုရှိနေတဲ့လူကြီးမင်းတွေမှ အကူညီတောင်းစရာရှိတဲ့ ကိစ္စဆို ရင်လည်း ကျွန်တော်တို့ဘက်ကကူညီဖို့ အဆင်သင့်ပါပဲ။ လုပ်ငန်းဒနှစ်ကျော် လည်ပတ်ပြီးသွားတဲ့အခါ ရန်ကုန်မြို့အတွက် လျှပ်စစ် ဝပ် သိန်း ၉၀၀ဝကျော် လောက်ထုတ်ပေးခဲ့ပြီးပါပြီ။ စက်ရုံအနေနဲ့ သတ်မှတ်ထားတဲ့ MW တွေပြည့်မီအောင် နဲ့ ပတ်ဝန်းကျင်ထိခိုက်မှု အနည်းဆုံးဖြစ်အောင် ဆောင်ရွက်ပါ့မယ်လို့ ကတိပြုပါတယ်။

မေး - ဦးကျော်ထွေး (လွှတ်တော်ကိုယ်စားလှယ်)

၅၃ ဦးခန့်အပ်တယ်ဆိုတာ သာကေတကလူတွေပဲလား၊ ပြည်တွင်းလုပ်သားတွေလား သိချင်ပါတယ်။

ဖြေ - U Energy Co., Ltd.

အင်ဂျင်နီယာတွေ နည်းပညာပိုင်းတွေ ပါနေတဲ့အတွက် ၅၃ ဦးလုံးကတော့ သာကေတ ကမဟုတ် ပါဘူး၊ များသောအားဖြင့် ကတော့ သာကေတ ကဖြစ်ပါတယ်။

မေး - ဦးကျော်ထွေး (လွှတ်တော်ကိုယ်စားလှယ်)

CSR ရဲ့အဓိကအကျဉ်းချုပ်ကတော့ လုပ်ငန်းရဲ့ပြင်ပကို ပံ့ပိုးတာထက် လုပ်ငန်းခွင်မှာရှိတဲ့ လုပ်သားတွေရဲ့ စွမ်းအားကို အရည်အချင်းမြှင့်တင်ပေးတာမျိုးတွေမှာ ဘယ်လိုမျိုးအစီအစဉ်ရှိလည်း သိချင်ပါတယ်။

ဖြေ - U Energy Co., Ltd.

CSR လုပ်ငန်းဆိုတာကတော့ လျှပ်စစ်ဝန်ကြီးဌာနက ပြေပြထားသလို ပတ်ဝန်းကျင်နဲ့ အလုပ်သမားတွေအတွက်လည်းပါဝင် ပါတယ်။ ကျွန်တော် အပါအဝင်အလုပ်သမားတွေ တကယ် အခက်အခဲ ဖြစ်လာတဲ့အခါ Company ဘက်မှ အပြည့်အဝ ကူညီဖြေရှင်းပေး ပါတယ်။

မေး - ဦးကျော်ထွေး (လွှတ်တော်ကိုယ်စားလှယ်)

ဆိုလိုချင်တာကတော့ သာကေတ လူတွေကိုပဲ အဓိကထားပြီး အလုပ်အကိုင်ဖန်တီးပေးစေချင်ပါတယ်။ သာကေတက လူတွေကို လုပ်ငန်းအတွက်အရည်အချင်းရှိလာအောင် သင်တန်းပေးတဲ့စီမံချက်တွေရှိလား။ လုပ်ငန်းခွင်ဘေးအန္တရာယ်ကင်းရှင်း ရေးနှင့် ကျန်းမာရေးစောင့်ရှောက်မှုတွေကို အပြည့်အဝဆောင်ရွက်ပေးစေချင်ပါတယ်။ REM ကတင်ပြသွားတာကတော့ အမှုန်အမွှားတွေ အနံ့အသက်တွေက ထိခိုက်နိုင်မှုတွေရှိတာတွေ့ရပါတယ်။

ဖြေ - U Energy Co., Ltd.

စက်ရုံမှဝန်ထမ်းတွေကို အလုပ်သမားဝန်ကြီးဌာနကပြဋ္ဌာန်းထားတဲ့အတိုင်း တစ်ပတ်တစ်ရက် အလုပ်ပိတ်ရက် တွေရှိပါတယ်။ OT ကြေးတွေပေးတာလည်းရှိပါတယ်။

မေး - ဦးကျော်ထွေး (လွှတ်တော်ကိုယ်စားလှယ်)

နိုင်ငံကချမှတ်ထားတဲ့ စံချိန်စံညွှန်းနဲ့ အလုပ်သမားဥပဒေတွေကို သတ်သတ်မှတ်မှတ်လိုက်နာနိုင်အောင် ကြပ်မတ်ထားတဲ့ အဖွဲ့ဆိုတာမျိုးရှိလား၊ HR ဌာနတွေ၊ Supervisor တွေဟာ အလုပ်သမား ဥပဒေကို အပြည့်အဝ နားလည်အသုံးချနိုင်သူတွေ နဲနဲရှား ပါတယ်၊ အဲဒါနဲ့ပတ်သက်ပြီးအလုပ်သမားတွေ အတွက် master plan လိုမျိုးရေးဆွဲထားတာရှိပါသလား။

ဖြေ - U Energy Co., Ltd.

ဒီကဝန်ထမ်းတွေကိုလည်း ပြည်ပကဝန်ထမ်းတွေနဲ့ တပြေးညီ ဆက်ဆံပြီး အလုပ်သမားဝန်ကြီးဌာနက ချမှတ်ထားတဲ့ ဥပဒေ တွေကိုလည်း လိုက်နာပါ့မယ်လို့ကတိပေးပါတယ်။ ကောင်းကောင်းကြပ်မတ်ဖို့လည်း အစီအစဉ်ရှိပါတယ်။

မေး - ဦးကျော်ထွေး (လွှတ်တော်ကိုယ်စားလှယ်)

မနှစ်ကစပြီး မာတ်အားဖြန့်ချီနေပြီဆိုတော့ ဘယ်လိုမျိုးဖြန့်ချိပါသလဲ၊ မဟာဓါတ်အားလိုင်းနဲ့ ဖြန့်ချီတာလား။ စျေးနှုန်းကရော ဘယ်လိုမျိုးသတ်မှတ်ပါသလဲ။ စျေးနှုန်းအပြောင်းအလဲတွေရောရှိပါသလား။

ဖြေ - ဦးရဲမင်းထွန်း၊ သာကေတ ဓါတ်အားပေးစက်ရုံမှူး

ကျွန်တော်တို့ သာကေတဓါတ်အားခွဲစက်ရုံရဲ့ ၆၆ KV ဓါတ်အားနဲ့လက်ခံပြီးတော့ ရန်ကုန်မြို့နဲ့ချိတ်ဆက်ပြီးဓါတ်အားပေး ပါတယ်။ စျေးနှုန်းကတော့ အစိုးရနဲ့စာချုပ်ချုပ်ထားတဲ့အတိုင်းပါပဲ နှစ်၃၀အတွင်းမှာတော့စျေးနှုန်းမပြောင်းပါဘူး။

မေး - ဦးစိုးလင်းထိုက်၊ မြို့နယ်အုပ်ချုပ်ရေးမှူး

ECD ရဲ့သဘောထားမှတ်ချက်တွေကို Third party ကပြန်လည်ဖြေကြားတဲ့အခါ ကိုယ့်ဘာသာကိုယ် ဆန်းစစ်တာလားသိချင်ပါတယ်။ နောက်တစ်ချက်ကတော့ ၂၀၁၈ ခုနှစ်စည်ပင်ဥပဒေရှိပါတယ် အဲဒီအပေါ်မှာချိတ်ဆက်ပြီးဆောင်ရွက်တာလား၊ YCDC နဲ့ ဒီကစွန့်ပစ်ပစ္စည်းတွေကို ဘယ်လိုချိတ်ဆက် ဆောင်ရွက်သလဲ ဆိုတာ သိချင်ပါတယ်။

ဖြေ - REM

ဒီကနေ့လုပ်တဲ့ အစည်းအဝေးရဲ့ရည်ရွယ်ချက်ကလည်း ၂၀၁၃ ခုနှစ်ကတည်းကဒီနေရာကို လေ့လာတယ်၊ ၂၀၁၄ မှာ အစီရင်ခံစာကိုတင်ပါတယ်၊ ၂၀၁၅ မှာ ECD နဲ့ Review လုပ်ပါတယ်၊ ဒီလိုအဆောက်အဦမဖြစ်ခင်ကတည်းက လေ့လာခဲ့တာပါ။ အကြောင်းကြောင်းကြောင့် ဒီအစီရင်ခံစာကို review လုပ်ဖို့ နောက်ကျနေတာပါ၊ ၂၀၁၈ မှာတော့ ဒီစီမံကိန်းမှာ ဘာတွေလုပ်သင့်တယ် ဆိုတဲ့ Comment တွေရရှိခဲ့ပါတယ်။ အဲအပေါ်မူတည်ပြီးတော့ ဒီနေ့အစည်းအဝေးကိုထပ်လုပ်ပေးတာပါ။ ဒါကိုထပ်မလုပ်လည်းရသော်လည်း ကျွန်မတို့အနေနဲ့ ၂၀၁၃ ကတည်းကလေ့လာမှုတွေလုပ်ထားတာရှိပေမယ့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး လုပ်ထုံးလုပ်နည်းအရ လိုအပ်ချက်တွေရှိကောင်းရှိနေမှာပါ။ ဒါတွေကိုဖြည့်ဆည်းနိုင်ဖို့နဲ့ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဌာနကပေးတဲ့ comment တွေကို အတတ်နိုင်ဆုံးဖြည့်စွက်ပါမယ်။ ဒီလိုအစည်းအဝေးကတော့ ကျွန်မတို့ဖြည့်စွက်နိုင်မှုတွေထဲက တစ်ခုပါပဲ။ YCDC ရဲ့ဥပဒေအတိုင်းပဲလုပ်ဖို့ ညှိနှိုင်းထားပါတယ်။ ပေးထားတဲ့ comment တွေအပေါ်မူတည်ပြီး အစီရင်ခံစာကို အကုန်လုံးဖြည့်စွက်ပေးမှာပါ။ ဒါတွေကတော့ ကျွန်မ တို့ရဲ့တာဝန်ဖြစ်ပါတယ်။

ဖြေ - ဦးအောင်သူကျော်၊ ဒုတိယညွှန်ကြားရေးမှူး၊ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန

ဖြည့်စွက်ပြောကြားချင်တာကတော့ လုပ်ငန်းတစ်ခုလုပ်တဲ့အခါ လုပ်ငန်းလုပ်မယ့်သူ၊ ဒေသခံ နဲ့ စောင့်ကြပ်ကြည့်ရှုသူတွေ ရှိပါတယ်၊ CSR ဆိုတာကတော့ ဖြစ်လာနိုင်တဲ့လူမှုရေးကိစ္စရပ်တွေ အားလုံးကို အကျိုးစီးပွားရှာဖွေတဲ့ လုပ်ငန်းရှင်ဘက်မှအကုန် တာဝန် ယူတာဖြစ်ပြီး အလွန်ကျယ် ပြန့်ပါတယ်။ MIC မှာ commitment လုပ်ထားတာဖြစ်ပြီးတော့ CSR နဲ့ပတ်သက်ပြီးစည်းမျဉ်းစည်းကမ်း တွေမရှိသေးတဲ့အတွက် ကတိကဝတ်အနေနဲ့နောင်တစ်ချိန်မှာ စည်းကြပ်နိုင်အောင် ဆောင်ရွက်ထားတာပါ။ လုပ်ငန်းကို ဆန်းစစ်တဲ့အခါမှာလည်း လုပ်ငန်းရှင်တွေက်မလုပ်နိုင်တဲ့အတွက် ပညာရှင်တွေကို ငှားရမ်းရပါတယ်။ ဖြစ်လာနိုင်တဲ့ ထိခိုက်မှုတွေအတွက်လည်း ဖော်ထုတ်ပြီး ဆန်းစစ်ပါတယ်။ ဆန်းစစ်တဲ့အခါမှာလည်း နည်းပညာအရ နဲ့ လူမှုရေးအပိုင်းဆိုပြီးရှိပါတယ်၊ ဒါကတော့ လူမှုရေးအပိုင်းပါ။ ထိခိုက်မှုတွေ အတွက်လျော့ပါးသက်သာစေရေးနည်းလမ်း များကိုလည်း နိုင်ငံရဲ့စည်းမျဉ်းစည်းကမ်းတွေ ဥပဒေတွေအတိုင်း ကိုက်ညီမှု ရှိတဲ့ ဟာတွေနဲ့ တတိယအဖွဲ့အစည်းက အကြံပြုတာပါ။ ဒီအစီရင်ခံစာကို တင်လိုက်တဲ့အခါမှာလည်း ဝန်ကြီးဌာနက

သက်ဆိုင်ရာဌာန ပေါင်းစုံပါတဲ့ အဖွဲ့ကိုဖွဲ့ထားပြီးတော့ ဒီအစီရင်ခံစာဟာ လုံလောက်မှုရှိလား၊ ဒီထက်ပိုပြီးတော့ ဘာတွေထပ်လုပ်ပေးရမလဲဆိုတာ Review လုပ်ပေးပါတယ်။ အဲဒီ Review ရဲ့တွေ့ ရှိချက်ပေါ်မူတည်ပြီးတော့မှ ဘာတွေဆက်လုပ်ရင်ကောင်းမလဲဆိုတဲ့အပိုင်းကို သွားပါတယ်။ တင်လာတဲ့ အစီရင်ခံစာကို ဆန်းစစ်ချက်လုပ်လိုက်တဲ့အခါ ဒီလူမှုရေးဆိုင်ရာဆောင်ရွက်ချက်တွေမှာတော့ ဝန်ကြီးဌာနက ပြည့်စုံမှုမရှိသေးဘူးလို့ယူဆပါတယ်။ ဒါဟာပြဿနာ မဟုတ်ပါဘူး။ ပြည့်စုံမှုရှိအောင် ရှာဖွေဖော်ထုတ်ရပါမယ်၊ အုပ်ချုပ်ရေးပိုင်း နဲ့ ပေါင်းစပ် ညှိနှိုင်းဖို့ကလည်း အရမ်းအရေးကြီးပါတယ်၊ ကျွန်တော့်အနေနဲ့ကတော့ ဒီ ဥဦး ဥဖလှယ်ကို ပေါင်းစပ်ညှိနှိုင်းဖို့ပါ။ တာဝန်ယူမှု တာဝန်ခံမှု အပိုင်းမှာကတော့ ၃၉ ဌာနပါတဲ့အဖွဲ့နဲ့ သဘောထားမှတ်ချက်တွေပေးရပါတယ်၊ ခုဟာက လူမှုရေးတစ်ပိုင်းပဲရှိပါသေးတယ် ကျန်တဲ့ နည်းပညာ ပိုင်းတွေရှိပါသေးတယ်၊ Review လုပ်တဲ့နေရာမှာလည်း စည်ပင်သာယာရေးကော်မတီက ပါပါတယ်၊ မြို့နယ်အုပ်ချုပ်ရေးမှူး ဖြစ်တဲ့ ဆရာ့ကိုအသိပေးချင်တာကတော့ ဒီပတ်ဝန်းကျင်လေ့လာဆန်းစစ်တဲ့ အစီရင်ခံစာဟာ ဌာနအသီးသီးနဲ့ သက်ဆိုင်တဲ့အတွက် ဆရာ့အနေနဲ့ ကြည့်ရှုခွင့်၊ စစ်ဆေးခွင့်၊ အကြံပြုခွင့်တွေ ရှိပါတယ်။ သက်ဆိုင်ရာဌာနတွေအနေနဲ့လည်း ဒီအစီရင်ခံစာကို တောင်းယူ ကြည့်ရှုခွင့်ရှိပါတယ်။ ပတ်ဝန်းကျင်ဆိုင်ရာလုပ်ထုံးလုပ်နည်းအရ ဒီစာအုပ်ကို လုပ်ငန်းဆောင်ရွက်သူတင်မဟုတ်ဘဲ သက်ဆိုင်ရာ ပြည်သူတွေကို ချပြထားရပါမယ်။ ပြည်သူတွေအနေနဲ့လည်း သိရှိခွင့်ရပြီး သူတို့ပေးတဲ့ အကြံဉာဏ်တွေပါရှိကြောင်းလည်းတွေ့မြင်ရမှာပါ။

ဖြေ - REM

ဒီအစီရင်ခံစာကို ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာနရဲ့ အကြံပြုချက်တွေကိုဖြည့်စွက်ပြီးတဲ့အခါ ခွင့်ပြုချက်ကြလာပြီဆို မြန်မာဘာသာပြန်ပြီး သက်ဆိုင်ရာဌာနတွေကို ဖြန့်ဝေမှာပါ၊ အဲအခါကျရင်လည်း ဆရာတို့ရဲ့အကြံဉာဏ်တွေယူဦးမှာပါ။ တတိယအဖွဲ့ အစည်းနဲ့ လုပ်ငန်းရှင်နဲ့ သက်ဆိုင်ရာဌာနတွေ နဲ့ ဒေသခံတွေနဲ့ ပူးပေါင်းပြီး ဆောင်ရွက်ရင် အစီရင်ခံစာဟာ ပိုပြီးပြည့်စုံသွားမှာပါ။

မေး - ဦးကျော်ထွေး (လွှတ်တော်ကိုယ်စားလှယ်)

စည်းကမ်းချိုးဖောက်မှုတွေအပေါ်ကိုလည်း ဘယ်လိုမျိုးအရေးယူဆောင်ရွက်တာတွေလုပ်လို့ရလဲ သိချင်ပါတယ်။

ဖြေ - ဦးအောင်သူကျော်၊ ဒုတိယညွှန်ကြားရေးမှူး၊ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန

ဒီကိစ္စကတော့ အရမ်းအရေးကြီးပါတယ်၊ ကျွန်တော်တို့ ဌာနမှာလည်း ရင်ဆိုင်တွေ့ကြုံနေရပါတယ်။ နိုင်ငံမှာ ဥပဒေတွေအများး ကြီးပြဌာန်းထားသော်လည်း အများစုကအသက်ဝင်အောင် လုပ်လို့မရဘူး ဖြစ်နေပါတယ်။ ပြီးခဲ့တဲ့လတွေကဆို ဌာနက ညွှန်ကြားရေးမှူး ကိုယ်တိုင်ဦးစီးပြီးတော့ အစည်းအဝေး တွေလုပ်ပါတယ်။ ဆရာကြီးပြောတဲ့ enforcement ပိုင်းကိုသွားဖို့ပါပဲ၊ enforcememt ပိုင်းကိုသွား ဖို့ဆိုရင် နိုင်ငံရေးအခြေအနေကိုလည်းပြန်ကြည့်ရပါတယ်၊ ကျွန်တော်တို့ကြုံတွေ့နေရတဲ့ အခတ်အခဲတွေကတော့ enforcement လုပ်ဖို့ ဟာအချိန်ယူနေရပါတယ်။ တစ်ယောက်နဲ့တစ်ယောက်ကတော့အမြင်ချင်း မတူကြပါဘူး။ ကျွန်တော်ပြောချင်တာကတော့ အထက်လူ ကြီးရဲ့အမြင်ကတစ်မျိုးပါ။ လိုအပ်ချက်အရ လုပ်ငန်းတွေကို ခွင့်မပြုလို့မရပါဘူး၊ ဒါတွေကြောင့်ဖြစ်လာတဲ့ဟာတွေကိုလည်း လစ်လျူရှု လို့လည်းမရပါဘူး။ လစ်လျူ မရှုဖို့အတွက်လည်း ဥပဒေ၊ နည်းဥပဒေပြဌာန်းချက်တွေ ပြဌာန်းထားတာပါ။ မကြာခင်မှာပဲ အရေးယူနိုင်ရန် အတွက် ဆောင်ရွက်ဖို့ အစီအစဉ်ရှိပါတယ်၊ EIA ကလည်း ကတိကဝတ်ဖြစ်တဲ့အတွက် သေချာ အောင်လုပ်နေတာပါ၊ ပြည်သူတွေအနေ နဲ့သိချင်တယ်ဆိုရင်တော့ ၂၀၁၂ခုနှစ်ကထုတ်ထားတဲ့

ပတ်ဝန်းကျင်ဆိုင်ရာဥပဒေ ရှိပါတယ်၊ ဒီဥပဒေကို အသက်ဝင်အောင်ဆောင်ရွက် တဲ့နည်းဥပဒေဆိုတာ ရှိပါတယ်။ ပြီးတော့ လုပ်ငန်းဆောင်ရွက်ချက်တွေအတွက် ၂၀၁၅ မှာထုတ်ထားတဲ့ EIA Procedure ဆိုတာရှိပါ တယ်။ EIA Procedure စာအုပ်ကိုလေ့လာမယ်ဆိုရင် ခုနက enforcement ကိုဘယ်လိုလုပ်မလဲဆိုတာကို refer လုပ်ထားပါတယ်။ တရားစွဲတဲ့ နေရာမှာ ၂ပိုင်းရှိပါတယ်၊ စီမံခန့်ခွဲရေးအရဆိုရင်တော့ ဌာနတွင်းမှာဆောင်ရွက်ပြီးတော့ အဲထက်ကျော်လာတဲ့ကိစ္စ ဆိုရင် တော့ ဝန်ကြီးဌာနရဲ့ခွင့်ပြုမိန့်နဲ့ တရားရုံးမှာ တရားစွဲရပါတယ်။ အုပ်ချုပ်ရေးဌာနကဆရာ့အနေနဲ့ အရေးယူဆောင်ရွက်မယ်ဆိုရင်တော့ ရာသီဥတု နှင့်ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးကော်မတီ ကိုတင်ပြပြီးဆောင်ရွက်လို့ရပါတယ်၊ ဆုံးဖြတ်တာကတော့ ဝန်ကြီးဌာန က လူကြီးတွေဆုံးဖြတ်ပေးမှာပါ။ ကျေးဇူးတင်ပါတယ်။

ဖြေ - ဦးရဲမင်းထွန်း၊ သာကေတ ဓါတ်အားပေးစက်ရုံမှူး

ခုန ဦးအုန်းကျော်နဲ့ မြို့နယ်အုပ်ချုပ်ရေးမှူး ဦးတင့်လွင်တို့ ဆွေးနွေးသွားတဲ့ နှံအနည်ကိစ္စကတော့ ကျွန်တော်တို့ဝန်ကြီးဌာနနဲ့ ဒီဓါတ်အားပေးစက်ရုံနဲ့ ညှိနှိုင်းပြီးဆောင်ရွက်သွားမှာပါ။ လက်ရှိမှာတော့ DT က 69.6 MW ထွက်နေပြီးတော့ SDG က 36.8 MW ထွက်ပါတယ်။ နွေရာသီ နှံတွေထုတ်ရတဲ့အချိန်ဆို အဲ SDG က ရပ်ရပါတယ်။ နွေရာသီ ဓါတ်အားလိုအပ်ချက်ပြဿနာတွေကိုလည်း ကျွန်တော်တို့ ဌာနနဲ့ ပူးပေါင်း ဆောင်ရွက်ရပါတယ်။ ဒီစက်ရုံအနေနဲ့လည်း ငမိုးရိပ်ချောင်းကရေကို ယူရတာဖြစ်တဲ့အတွက် နွေရာသီမှာဆို နှံအနည်တွေကစက်ရုံအထိရောက်လာပြီးတော့ လွန်ခဲ့တဲ့ နွေရာသီပိုင်းကဆိုရင် နှံတွေကများလာပြီးတော့ ရေ Supply လုပ်တဲ့ နေရာတွေမှာ နဲနဲကြန့်ကြာပါတယ်။ စွန့်ပစ်အပူသုံးထွက်ပစ္စည်းက ရပ်လိုက်ပြီးတော့ နှံတွေကို စုပ်ထုတ်ရပါတယ်။ နောက်နှစ်တွေမှာ အဲ လိုမလုပ်ရဖို့အတွက် ငမိုးရိပ်ချောင်းဘေးမှာ ရေစစ်ကန်လုပ်ဖို့ စီစဉ်ထားပါတယ်၊ ရေအရင်းမြစ်နှင့်မြစ်ချောင်းများဖွံ့ဖြိုးတိုးတက်ရေးဦးစီးဌာန နဲ့ ဆက်သွယ် ပြီးတော့ ဆောင်ရွက်သွားမှာဖြစ်ပါတယ်။ ရေစီးရေလာကောင်းဖို့ကိုတော့ သက်ဆိုင်ရာလူကြီးမင်းတွေ၊ ဌာနတွေနဲ့ စက်ရုံတို့ပူးပေါင်းပြီး ကူညီဆောင်ရွက်နိုင်ရန် အကြံဉာဏ်များ ပေးစေ လိုပါတယ်။

ဖြေ - U Energy Co., Ltd.

နောက်နှစ်ရေစီးရေလာကောင်းမွန်ဖို့ အတွက်နှံတွေကို ဖြေရှင်းမယ့် အစီအစဉ်လေးကို တင်ပြချင်ပါတယ်၊ တစ်ချက်အနေနဲ့ ကတော့ ချောင်းဘေးမှာ ရေစစ်ကန်တစ်ဆင့်လုပ်ပြီး စုပ်ထုတ်ပြီးတော့ ပြုလုပ်သွားခြင်းဖြစ်ပါတယ်၊အတတ်နိုင်ဆုံးနှံတွေကို စက်ရုံထဲ မရောက်အောင် လုပ်ပါ့မယ်။ အနည်းငယ်ပါလာ နိုင်တဲ့နှံတွေကိုတော့ ရေစီးရေလာကောင်းမွန်အောင် ရေမြောင်းတွေကို လုပ်ဆောင်ပေး ဖို့ အစီအစဉ်ရှိပါတယ်။ စက်ရုံဝင်းမှ အပြင်ထွက်သွားတဲ့ ရေမြောင်းကတော့ တကွေ့တပတ်နဲ့ ရထားလမ်းပြန်ပေါက်ကနေထွက်ရတာပါ။ ပြီးခဲ့တဲ့ဖေဖော်ဝါရီကတော့ ဒီကိစ္စအတွက် ခရိုင်အုပ်ချုပ်ရေးမှူးနဲ့ လွှတ်တော်ကိုယ်စားလှယ်တွေ၊ စည်ပင်နဲ့ စက်ရုံရဲ့တာဝန်ရှိသူတွေဟာ ဒီစက်ရုံမှာပဲ အစည်းအဝေးတစ်ခုလုပ်ခဲ့ပါတယ်။ ရေစီးရေလာ ကောင်းဖို့ အတွက်ဆို စထွက်တဲ့ ရေမြောင်းကနေတစ်ဆင့် ကွေ့မသွားဘဲ ဒဲ့ထွက်သွားဖို့ကို လုပ်ဆောင်ဖို့ အစီအစဉ်ရှိပါတယ်။ သန့်ရှင်းရေးဌာနပိုင်မြေက မြောင်းအတွက် အဆင်ပြေပါတယ်။ လုပ်ဆောင်ဖို့ ဘာ အခက်အခဲ ရှိလည်းဆို မကွေဘဲနဲ့ မီးရထားပိုင်မြေ သံလမ်းအောက်ကနေ ဒဲ့ထွက်ရမှာဖြစ်ပါတယ်။ မီးရထားပိုင်မြေဆိုတော့ စက်ရုံအနေ နဲ့လည်း မလုပ်ရဲပါဘူး။ ကျွန်တော်တို့ကို လုပ်ပေးမယ်ဆိုရင်တော့ သက်ဆိုင်ရာဌာနတွေမှကူညီပြီး ကျွမ်းကျင်အင်ဂျင်နီယာတွေနဲ့ ဖောက်လုပ်မယ်ဆိုရင်တော့ ကျွန်တော်တို့ စက်ရုံကို စာလေးတစ်စောင်နဲ့ တင်ပေးပြီးဆောင်ရွက်ခဲ့ရင်လည်း ကျွန်တော်တို့ဘက်မှ ဘက်ဂျက်ကို

သုံးစွဲဖို့အစီအစဉ်ရှိပါတယ်။ မြောင်းကဒဲ့ထွက်နိုင်ရင်တော့ ရေစီးရေလာကောင်းပြီး နှံကိစ္စတွေနဲ့ ရပ်ကွက် ရေကြီးတဲ့ကိစ္စ လည်းကင်းရှင်းသွားမှာပါ။ စက်ရုံမှာကတော့ လူသုံးကို အမှိုက်ပဲထွက် တာဖြစ်တဲ့အတွက် YCDC သန့်ရှင်းရေးကားနဲ့ပဲဆောင်ရွက် ပါတယ်။ စက်ရုံထဲမှာတော့ အမှိုက်ပုံးတွေကို သီးခြားခွဲခြားထားပြီးတော့ သန့်ရှင်းရေးကားတွေနဲ့ ရက်သတ်မှတ်ပြီးတော့ သိမ်းပါတယ်၊ ဝန်ထမ်းတွေ ကိုယ်တိုင်ကလည်း အမှိုက်ကို စနစ်တကျစွန့်ပစ်ပါတယ်။ ကျေးဇူးတင်ပါတယ်။

U Energy Co., Ltd. (နိဂုံးချုပ်စကားပြောကြား)

အမျိုးသားလွှတ်တော်ကိုယ်စားလှယ် ဦးကျော်ထွေး၊ ECD မှ ဆရာဦးအောင်သူကျော်၊ YCDC သာကေတ ဥက္ကဋ္ဌ နှင့်ကြွရောက် လာကြသော လူကြီးမင်းများအားလုံးကို ကျေးဇူးတင်ပါတယ်။ ကြွရောက်လာသော ဒေသခံများကိုလည်းအရမ်းကျေးဇူးတင်ပါတယ်။ လူကြီးမင်းများရဲ့ထောက်ခံချက်နဲ့ ဒီစက်ရုံက ကောင်းသတဲ့ကောင်းလာပါတယ်။ U energy company ကလျှပ်စစ်စွမ်းအင်တော်တော် များထုတ်လုပ်နိုင်တဲ့ ကုမ္ပဏီဖြစ်ပါတယ်၊ U energy company က ၁၉၉၃ခုနှစ်မှာ မြန်မာနိုင်ငံကို စတင် ရောက်ပြီး လျှပ်စစ်စွမ်းအားဖွံ့ဖြိုး တိုးတက်ဖို့အတွက် ရေအားလျှပ်စစ်များ၊ ဓါတ်အားခွဲရုံများ၊ သာကေတ စက်ရုံလိုမျိုး ဓါတ်အားခွဲရုံများကို အများကြီးတည်ဆောက်ခဲ့ပါတယ်။ ကျွန်တော့် အနေနဲ့ မြန်မာ့ယဉ်ကျေးမှုက အရမ်းကိုစိတ်ဝင်စားဖို့ကောင်းပြီး မြန်မာလူမျိုးများကိုလည်း ချစ်ပါတယ်။ ကုမ္ပဏီ အနေ နဲ့လည်း မြန်မာပြည်အကြောင်းအရမ်းကို သိပါတယ်။ မြန်မာအစိုးရက ကူညီပေးတာတွေအတွက် အရမ်းကို ကျေးဇူး တင်ပါတယ်။ သာကေတ စက်ရုံအနေနဲ့လည်း မြန်မာပြည်ရဲ့ပတ်ဝန်းကျင်ကိုထိန်းသိမ်းရင်း ပြည်သူလူထု အကျိုးအတွက် ဆောင်ရွက်သွားပါ့မယ်လို့ ကုမ္ပဏီကိုယ်စား ကတိပြုပါတယ်။ လူကြီးမင်းများ အားလုံး ယုံကြည်ပေးပါ။

Feedback Form

၁။ ဝေ-၆၉၄၁၉၃၂၂၀

- လေထု၊ မြေထု၊ ရေထုတိုင်းတာရေးစနစ်များအားရပ်ကွက်နေပြည်သူများအားသိရှိနိုင်ရေးအတွက် စက်ရုံရှေ့တွင် LED ဘုတ်များတပ်ဆင်၍ နားလည်သော ဘာသာစကားဖြင့် စဉ်ဆက်မပြတ်ကြော်ငြာပေးစေလိုခြင်း။
- ရပ်ကွက်နေပြည်သူများသံသယကင်းရှင်းနိုင်ရေးအတွက် ကျောင်းများ၊ရပ်ကွက်လူမှုရေးအဖွဲ့အစည်းများမှ တောင်းဆိုလာပါကစက်ရုံအတွင်း လေ့လာခွင့်ပေးစေလိုခြင်း။
- ရပ်ကွက်နှင့်စပ်ဆက်လျက်ရှိသော ရေဆိုးထုတ်မြောင်းများကောင်းစေရေးအတွက် ပူးပေါင်းကူညီ ဆောင်ရွက်ပေး စေလိုခြင်း။
- စက်ရုံမှအပူစွမ်းအင်သုံးအအေးခံစနစ်မှထွက်ရှိလာသော အနည်ထိုင်၍ထွက်လာသော နှုန်းများအားသီးခြား စွန့် ပစ်သည့်စနစ်ဖြင့် စွန့် ပစ်နိုင်ရေးဆောင်ရွက်ပေးရန်။
- ပြည်သူလူထုနှင့်တွေ့ဆုံပွဲများအားတစ်နှစ်လျှင်တစ်ကြိမ် ဆောင်ရွက်ခြင်းအားပြုလုပ်ပေးရန်၊ ပြုလုပ်ပေးခြင်း ဖြင့် ရပ်ကွက်နေပြည်သူလူထု၏ သံသယအား ကင်းရှင်းစေလိုခြင်း။
- စက်ရုံနှင့်ပတ်သတ်ပြီး ဖြစ်လာသောရေကြီးရေလျှံမှုဖြစ်ပေါ်လာပါက ကူညီဆောင်ရွက်ပေးစေလိုခြင်း။
- စက်ရုံပတ်ဝန်းကျင် သာယာလှပစေရေးအတွက် သစ်ပင်ပန်းမန်များစိုက်ပျိုးပေးခြင်းများ ပြုလုပ်ပေးရန်။
- ဒေသခံပြည်သူများ အလုပ်အကိုင်အခွင့်အလမ်း ဆောင်ရွက်ပေးခြင်းအတွက် လူအများသိရှိအောင် ဆောင်ရွက် ပေးရန်။

၂။ အစီရင်ခံစာအား ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း လုပ်ထုံးလုပ်နည်းအဝိုဒ်(၆၃) နှင့် အညီပြင်ဆင်ပြုစုရန် ပြန်လည်တင်ပြနိုင်ရေး စီစဉ်ဆောင်ရွက်ရန်။

- PCM ပြုလုပ်ရာတွင်စီမံကိန်းကြောင့်ဖြစ်ပေါ်လာနိုင်သော ပတ်ဝန်းကျင်ဆိုင်ရာထိခိုက်နိုင်မှုများအား ရှင်းလင်းချပြရာတွင် တက်ရောက်ခဲ့သောစီမံကိန်းအနီးပတ်ဝန်းကျင်ရှိကျေးရွာသူ၊ကျေးရွာသားများ၊ ဒေသခံလူအဖွဲ့အစည်းများ၊ ဒေသဆိုင်ရာအုပ်ချုပ်ရေးအဖွဲ့အစည်းများ၊ ရပ်ရွာအခြေပြုအဖွဲ့အစည်းများမှ ဆွေးနွေးချက်များအား တက်ရောက်သူစာရင်းနှင့်အညီပြုစု၍ ဝန်ကြီးဌာနသို့ပြန်လည်တင်ပြသွားရန်။
- ယခုထပ်မံဆောင်ရွက်ခဲ့သည့် PCM မှ လေ့လာသိရှိရမည့် issue များကိုသေချာစွာလေ့လာ ဆန်းစစ်ဖော်ထုတ်သတ်မှတ်ပြီး လျော့ပါးသက်သာအောင် ဆောင်ရွက်မည့်နည်းလမ်း၊ အသုံးပြုဆောင်ရွက်သွားမည့်နည်းစနစ်များကိုသေချာစွာပြုစုရန်၊ ဝန်ကြီးဌာနသို့ ပြန်လည်တင်ပြရန်။
- ဝန်ကြီးဌာန၏သဘောထားမှတ်ချက်အပေါ် လိုက်နာဆောင်ရွက်ရမည့်အချက်များကိုတိကျစွာ လိုက်နာအကောင်အထည်ဖော်ဆောင်ရွက်ရန်ဖြစ်ပြီးသီးခြားမှတ်ချက်ပေးရန်မရှိပါ။

၃။ ဦးအုန်းကျော် ဝဒ္ဓ - ၅၅၀၀၉၀၉ ၊ အမှတ် ၁/ခ ကွေ့မ လုံးချင်းအိမ်ရာ(၁၀) မြောက်သာကေတ

- ကွေ့မလုံးချင်းအိမ်ရာဝင်းအတွင်းနှစ်စဉ် ရွှံနွံများဝင်ရောက်ပါသဖြင့် လူအင်အား ငွေအင်အားသုံး၍ရေမြောင်းများမပိတ်ဆို့ရန်စက်ရုံနှင့်ညှိနှိုင်းပြီးဆယ်ထုတ်ယူခဲ့ရပါသည်။ ယခုကဲ့သို့နှစ်စဉ် ဖြစ်ပွားပါကရေမြောင်းများရေစီးရေလာမကောင်းခြင်း၊ ခြင်များခိုအောင်းခြင်း၊ နွံများမြောင်းအတွင်း ၅ပေခန့်အထိ ဝင်ရောက်ခဲ့သဖြင့် ကလေးများ အန္တရာယ်များပါသဖြင့် နွံများမြောင်းအတွင်း မစွန့်ပစ်ခြင်း (သို့မဟုတ်) သင့်တော်သော နည်းတစ်နည်းနည်းဖြင့် စွန့်ပစ်နိုင်ရေးဆောင်ရွက်ပေးစေလိုသည်။
- စက်ရုံမှတစ်ပတ်တစ်ကြိမ်(သို့မဟုတ်) နှစ်ပတ်တစ်ကြိမ် မာတုဆေးရည်ဟုယူဆရသော အရည်မဲမဲများ စက်ရုံမှစွန့်လွှတ်လျက်ရှိပါသည်။ ၎င်းမာတုဆေးရည်များစွန့်ပစ်သောအခါ မြောင်းအတွင်း ငါးကလေးများ သေနေသည်ကိုတွေ့ရှိရပါသဖြင့် ၎င်းမာတုဆေးရည်များကိုပိုက်လုံးဖြင့်စွန့်ပစ်ခြင်း (သို့မဟုတ်) water treatment ပြုလုပ်ပြီး ရေကောင်းဖြစ်သွားမှစွန့်လွှတ်သင့်ကြောင်း။
- ကျွန်တော်တို့ ကွေ့မလုံးချင်းအိမ်ရာမှာ စက်ရုံနှင့်ခြံစည်းရိုးသာကွာပြီး သာကေတမြို့နယ်အထဲတွင်ပါဝင်ပြီး မိတာခကိုသာကေတမြို့နယ်တွင်ဆောင်ရသော်လည်းမီးပျက်သောအခါ ဒဂုံဆိပ်ကမ်းသို့ အကြောင်းကြား ရသဖြင့် ကြုံကြာမှုများရှိပါသည်။ ကျွန်တော်တို့ ရပ်ကွက်သည် စက်ရုံမှထုတ်လွှတ်သော အပူငွေ့များ အများ ဆုံး ခံစားရသောအိမ်ရာဖြစ်သဖြင့် လျှပ်စစ်မီးမပျက်ရေးအတက်နိုင်ဆုံး ကူညီဆောင်ရွက်ပေးပါရန်တင် ပြအပ်ပါသည်။

၄။ ဦးတင့်လွင် ဝဒ္ဓ- ၄၂၀၃၀၇၂၀၅

- မည်သည့်စီမံကိန်းမဆိုဆောင်ရွက်မည်ဆိုပါကမလုပ်ဆောင်မီ စီမံကိန်းပတ်ဝန်းကျင်ရှိ ရပ်ကွက်ပြည်သူများ ကို တွေ့ဆုံပြီး ပွင့်လင်းမြင်သာစွာ အဆိုးအကောင်း ခြုပြသင့်ကြောင်း။
- စွန့်ပစ်ရေဆိုးများ၌ နွံများမည်သို့ စွန့်ပစ်မည်နည်း။
- ပတ်ဝန်းကျင်ရပ်ကွက်မှ လုပ်သားခေါ်ယူမှု မရှိခြင်း။

၅။ ဦးခင်မောင်ဆွေ ဝဒ္ဓ-၂၅၄၃၇၅၂၆ ၁၃/A ကွေ့မ လုံးချင်းအိမ်ရာ

- နိုင်ငံတော်နှင့် ပြည်သူလူထုအတွက် လျှပ်စစ်မာတ်အားတိုးတက်ထုတ်လွှတ်ပေးမည့် စီမံကိန်းဖြစ်၍ လိုက်လိုက်လဲလဲကြိုဆိုပါ၏။

- သို့သော် စက်ရုံကြောင့်ပတ်ဝန်းကျင်နှင့် ပတ်ဝန်းကျင်နေပြည်သူလူထုအား ထိခိုက်စေမည့် ဘေးထွက်ဆိုး ကျိုးနှင့်အန္တရာယ်များမပေါ်ပေါက်မတွေ့ကြုံစေရေးအထူးဦးစားပေးရန်။ စဉ်းစားဆုံးဖြတ်ရွေးချယ်ပေးပါရန် တင်ပြပါသည်။
- ပတ်ဝန်းကျင်နေပြည်သူလူထု ကျန်းမာရေးထိခိုက်စေမည့်အန္တရာယ်ရှိသော အနံ့အသက်ဆိုးများ မဖြစ်ပေါ် စေရေး။
- ပတ်ဝန်းကျင်လေထုအား ပိုမိုပူနွေးစေမည့် အကျိုးသတ်ရောက်မှု များမဖြစ်ပေါ်စေရေး။
- အလွန်အကျွံ ဆူညံသံများမထွက်ပေါ်စေရေး။
- စက်ရုံမှထွက်ရှိလာမည့် စွန့်ပစ်ရေများ၊စွန့် ပစ်ပစ္စည်းများကြောင့်ပတ်ဝန်းကျင်ထိခိုက် အန္တရာယ်ဖြစ်စေခြင်း များကာကွယ်ပေးရေး၊(ဥပမာ - လက်ရှိစက်ရုံမှ နေ့စဉ်ထုတ်လွှတ်နေသောစွန့်ပစ်ရေများ ရှိ့နှံနှုန်းနှစ်များ ပတ်ဝန်းကျင်ရေမြောင်းများအတွင်း ပိတ်ဆို့မှု များနှစ်စဉ်ကြုံတွေ့ နေရခြင်း။
- စက်ရုံပေါ်ပေါက်လာပြီးနောက်ပိုင်းကာလများတွင် စက်ရုံလုပ်ငန်းကြောင့် မမြင်နိုင်သော အန္တရာယ်များ မပေါ်ပေါက်စေရေးကြိုတင်စဉ်းစားကာကွယ်ပေးထားရန်။
- ပတ်ဝန်းကျင် နှင့် ပတ်ဝန်းကျင်နေပြည်သူလူထုအား ထိခိုက်မှုအန္တရာယ်နည်းနိုင်သမျှနည်းအောင်အကောင်း ဆုံး အသင့်တော်ဆုံး အမှန်ကန်ဆုံး နည်းလမ်းရှိပါကရွေးချယ်ပေးရန်။
- နိုင်ငံတော်ပြည်သူလူထု၏ အကျိုးနှင့် ကုမ္ပဏီ၏အကျိုး အချိုးအစား မျှတမှု ရှိစေရေး။
- သားစဉ်မြေးဆက် တစ်သက်တာပတ်လုံးရင်ဆိုင်ကြုံတွေ့ရမှာဖြစ်သဖြင့် အကောင်းဆုံး အသင့်တော်ဆုံး အခြေအနေရရှိအောင် စဉ်းစားဆုံးဖြတ်ရွေးချယ်ပေးနိုင်ပါရန် အကြံပြုတင်ပြအပ်ပါသည်။

၆။

- ယခုဆွေးနွေးပွဲတွင် လူကြီးမင်းများရဲ့ ပြောကြားတင်ပြချက်များကို ပတ်ဝန်းကျင်ထိခိုက်နစ်နာမှုများ မရှိစေရန် မှန်မှန်ကန်ကန်ဆောင်ရွက်စေချင်ပါတယ်။
- ပတ်ဝန်းကျင်နေပြည်သူများကို တခုခုထိခိုက်မှုများ ပတ်ဝန်းကျင်ထိခိုက်မှုများ ရှိလာပါက ပြည်သူများ၏ အကြောင်းကြားခြင်းများကို မြန်မြန်ဆန်ဆန် မှန်မှန်ကန်ကန်ဆောင်ရွက်ပေးစေလိုပါတယ်။
- ဝန်ထမ်းများရဲ့ အခွင့်အရေးများ၊ ရပိုင်ခွင့်များကို မျှမျှတတရှိစေချင်ပါတယ်။
- ရပ်ကွက်နေပြည်သူများအတွက် ရပ်ကွက်ရေလှျံခြင်းများအတွက် မြောင်းပိတ်ဆို့ခြင်းမရှိစေရန် ရေစီးရေလာ ကောင်းအောင် ဆောင်ရွက်စေချင်ပါတယ်။

၇။ ၂ တောင် သာကေတ

- ပတ်ဝန်းကျင်မထိခိုက်စေဘဲ သဘာဝအရင်းအမြစ်များမပျက်စီးစေဘဲ ဆောင်ရွက်မှုများကို ကြိုဆိုပါသည်။
- စွန့်ပစ်ပစ္စည်းများမှ ပြန်လည်အသုံးချမှုများမှ ပတ်ဝန်းကျင်နှင့် လူသားအရင်းအမြစ်များ မထိခိုက်မပျက်စီး အောင် ပညာရှင်များဆောင်ရွက်ပေးနိုင်ရန် အကြံပြုပါသည်။
- နိုင်ငံတော်အတွက် မရှိမဖြစ်လိုအပ်သော လျှပ်စစ်မာတ်အားအရင်းအမြစ်အမြန်ဆုံးအောင်မြင် ဖြစ်ထွန်းနိုင်ပါ စေကြောင်းအကြံပြုရင်း ဦးဆောင်ကြသည့်ပညာရှင်များ ကိုယ်စိတ်နှစ်ဖြာကျန်းမာစေကြောင်းဆန္ဒပြု ဆုတောင်းပါသည်။

၈။ ဦးအေးလွင် ၀၉- ၂၅၁၁၄၇၃၉၆ ၊၁၅၆/က ရတနာပုံ(၂)လမ်း ၁၀ မြောက်ရပ်ကွက်

- U ENERGY စက်ရုံတည်ရှိရာသည် ကျနော်တို့ ၁၀ မြောက်ရပ်ကွက် တစ်ခုလုံးက ရေနုတ်မြောင်း စီးဆင်းရာလမ်းကြောင်းပေါ်တွင် တည်ရှိပါသည်။
- စက်ရုံရေနုတ်မြောင်းများပိတ်ဆို့မှုမရှိရေးက ကျွန်တော်တို့ရပ်ကွက်ကရေစီးရေလာ ကောင်းမွန်စေခြင်းဖြင့် ရပ်ကွက်ရေကြီးရေလျှံ ဘေးအန္တရာယ်ကိုမိုးတွင်းကာလတွင် ရှောင်ရှားနိုင်မှာ ဖြစ်ပါတယ်။
- သို့ဖြစ်ပါ၍ သာကေတမြို့နယ် သဘာဝဓာတ်ငွေ့ နှင့် စွန့်ပစ်အပူသုံးဓာတ်အားပေးစက်ရုံ စီမံကိန်းအတွင်း ရှိစက်ရုံရှေ့ မျက်နှာစာအတွင်းရေမြောင်းများ နှုံးပိတ်ဆို့ခြင်း၊ သဲမြေပိတ်ဆို့ခြင်း၊ အမှိုက်ပိတ်ဆို့ခြင်းများမရှိစေရန် အစဉ်သဖြင့်ဆောင်ရွက်ပေးရန်လိုအပ်ပါသည်။
- စက်ရုံ၏ ရေသန့်စင်သုံးစွဲမှုမှ စွန့်ပစ်နွံများ နှင့် အခြားပစ္စည်းများစီးဆင်းမှုကြောင့် ပတ်ဝန်းကျင်ထိခိုက်နစ်နာမှုမရှိစေရေးစနစ်တကျဆောင်ရွက်ပေးရန် လိုအပ်ပါသည်။
- စက်ရုံပတ်ဝန်းကျင် အဓိကတည်ရှိရာရပ်ကွက်ဇရိယာအတွင်း မှ ပညာရှင်ကျွမ်းကျင်လုပ်သားများခန့်အပ်ပေးခြင်းဖြင့် အလုပ်အကိုင်ရရှိရေး နှင့် ဆင်းရဲမွဲတေမှု ပပျောက်ရေးကိုဖော်ဆောင်နိုင်ပါသည်။
- ရပ်ကွက်တွင် စက်ရုံပြင်ပနှင့် ထိတွေ့ရမည့် လုပ်ငန်းစဉ်တိုင်းအတွက် သက်ဆိုင်ရာရပ်ကွက်၊ မြို့နယ်၊ တာဝန်ရှိသူများနှင့် ဆက်သွယ်ဆောင်ရွက်ခြင်းအသိပေးညှိနှိုင်းဆောင်ရွက်ခြင်းများ မပျက်ကွက်ရန် လိုအပ်ပါသည်။

ဓါတ်ပုံမှတ်တမ်းများ

3. Photograph


25/06/2019


25/06/2019


25/06/2019


25/06/2019


25/06/2019


25/06/2019

တွေ့ဆုံပွဲတွင် တင်ပြသော Power Point Presentation

U ENERGY THAKETA POWER CO.,LTD

ပတ်ဝန်းကျင် နှင့် လူမှုစီးပွား သက်ရောက်မှု ဆန်းစစ်လေ့လာခြင်း

ရန်ကုန်၊ သာကေတ စွန့်ပစ်အပူသုံး ပေါင်းစပ်ဓာတ်အားပေး စက်ရုံ

အဆင့် ၁ (၁၀၆ မဂ္ဂါဝပ်)

အများပြည်သူနှင့်တွေ့ဆုံဆွေးနွေးခြင်း

REM

၂၅ ရက်၊ ဖွန်လ၊ ၂၀၁၉

မာတိကာ

စိမ်ကိန်း ခြုံငုံသုံးသပ်ချက်

စိမ်ကိန်း အကြောင်းအရာ

- သာကေတ စွန့်ပစ်အပူသုံး ပေါင်းစပ်လျှပ်စစ်ဓာတ်အားပေးစက်ရုံသည် China's Union Resources and Engineering Co (UREC) နှင့် မြန်မာ လျှပ်စစ်နှင့် စွမ်းအင်ဝန်ကြီးဌာန တို့ အကျိုးတူ ပူးပေါင်းလုပ်ဆောင်သော စိမ်ကိန်းဖြစ်ပါသည်။
- JVA (Joint Venture Agreement) ကို ၂၂-၉-၁၆ တွင် လက်မှတ်ရေးထိုးခဲ့ပြီး မြန်မာ လျှပ်စစ်နှင့် စွမ်းအင်ဝန်းကြီးဌာ မှ ၃% အခမဲ့ ရှယ်ယာ ရယူနိုင်ပါသည်။ U Energy Co., သည် နှစ် ၃၀ ကြာထုတ်လုပ် အပြီးတွင် မြန်မာ လျှပ်စစ်နှင့် စွမ်းအင်ဝန်ကြီးဌာန သို့လွှဲပြောင်းမည်ဖြစ်ပါသည်။
- SEPCOIII သည် GE's 6F.03 ဓာတ်ငွေ့တာဘိုင်ကို အသုံးပြုမည်ဖြစ်ပါသည်။
- သာကေတ စွန့်ပစ်အပူသုံး ပေါင်းစပ်လျှပ်စစ်ဓာတ်အားပေးစက်ရုံသည် ဓာတ်ငွေ့ နှင့် ရေနွေးငွေ့ ပေါင်းစပ် အသုံးပြုမည်ဖြစ်ပြီး တူညီသော လောင်စာမှ ၅၀ ရာခိုင်နှုန်းထက်ပို လျှစ်စစ်ဓာတ်အား ထုတ်လုပ်မည်ဖြစ်ပါသည်။ ဓာတ်ငွေ့တာဘိုင်မှ ထုတ်လွှတ်သော အပူအား အနီးအနားရှိ ရေနွေးငွေ့တာဘိုင် နှင့် ဆက်သွယ်ထားပြီး ၎င်းမှ အပိုစွမ်းအင်ထွက်ရှိလာမည်ဖြစ်ပါသည်။

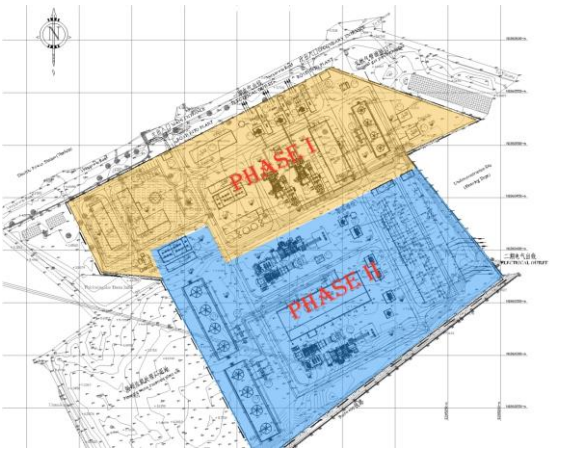
စိမ်ကိန်း ခြုံငုံသုံးသပ်ချက်

စိမ်ကိန်းတည်နေရာ

အဆိုပါ စိမ်ကိန်းသည် ရန်ကုန်မြို့မှ ၁၀ ကီလိုမီတာ နှင့် သီလဝါ အထူးစီးပွားရေးဇုန်မှ ၁၆ ကီလိုမီတာအကွာတွင် တည်ရှိပါသည်။

စီမံကိန်း ခြုံငုံသုံးသပ်ချက်

- စာချုပ်ပါသဘောတူညီချက်အရ ကုမ္ပဏီသည် နှစ် ၃၀ လည်ပတ်မည် ဖြစ်ပြီး ဇာတိက ကမ်းလွန် ဓာတ်ငွေ့မှ စက်ရုံအတွက် တစ်နေ့လျှင် ၂၀ ကုဗမီတာ ရယူသုံးစွဲမည် ဖြစ်ပါ သည်။
- ကုမ္ပဏီ၏ အဆိုအရ ၅၀၀ မီဂါဝပ် (အဆင့် ၁ + အဆင့် ၂) စက်ရုံ ပြီးစီးပြီးနောက် ရန်ကုန်မြို့ စွမ်းအင် လိုအပ်ချက် ဖြစ်သော နှစ်စဉ် သန်း ၇၂၀ KW ကို ထုတ်လုပ်နိုင်မည်ဖြစ်ပါသည်။

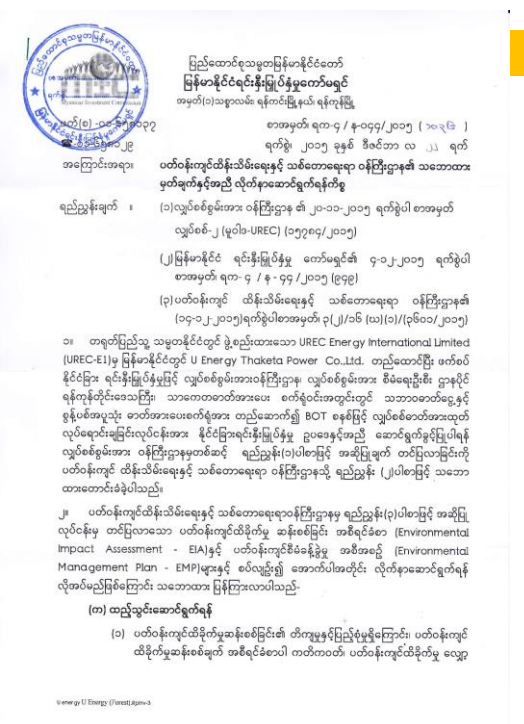


စီမံကိန်း ခြုံငုံသုံးသပ်ချက်

စဉ်	နေ့ရက်	ဖော်ပြချက်
၁.	ဇန်နဝါရီ ၂၀၁၃	စီမံကိန်းအတွက် နှစ်ဦးသဘောတူနားလည်မှုစာချွန်လွှာ လက်မှတ်အား ဇန်နဝါရီ ၂၀၁၃ တွင် ပထမဆုံးလက်မှတ်ရေးထိုးသည်။
၂.	နိုဝင်ဘာလ ၂၀၁၄	သဘောတူညီချက်စာချွန်လွှာ လက်မှတ်ရေးထိုးပွဲ။
၃.	၂၅ ဇန်နဝါရီ ၂၀၁၆	စွမ်းအင်ဝယ်ယူခြင်း သဘောတူညီ လက်မှတ်ရေးထိုးသည့် ရက်စွဲ
၄.	မေ ၂၀၁၆	ဆောက်လုပ်ရေးစတင်သည့်ရက်စွဲ (တရုတ် SEPCOIII လျှပ်စစ်စွမ်းအား ဆောက်လုပ်ရေး ကော်ပိုရေးရှင်းတို့ မှ ဆောက်လုပ်ထား)
၅.	၂၂ စက်တင်ဘာလ ၂၀၁၆	ဖက်စပ် သဘောတူညီချက် ရေးထိုးသည့် နေ့စွဲ
၆.	၁၉ ဒီဇင်ဘာလ ၂၀၁၆	MIC မှ ခွင့်ပြုသည့်ရက်စွဲ
၇.	ဖေဖော်ဝါရီ ၂၀၁၈	ဆောက်လုပ်ရေး ပြီးဆုံးသည့်ကာလ
၈.	၂၈ ဖေဖော်ဝါရီ ၂၀၁၈	လျှပ်စစ်ဓါတ်အား စတင်ထုတ်လုပ်သည့် ရက်စွဲ။

ပတ်ဝန်းကျင် ထိခိုက်မှု ဆန်းစစ်လေ့လာခြင်း အစီရင်ခံပြင်ဆင်သည့် ကာလ

နေ့စွဲ	လုပ်ဆောင်ချက်များ
၂၀ ဇွန် ၂၀၁၃	(500 MW CCPP) အတွက် EIA အကြမ်းတင်သွင်းခြင်း
၁၃ မေလ ၂၀၁၅	အပိုင်း ၁ အစီအရင်ခံစာ အားပြန်လည်ပြင်ဆင်ခြင်း
၂၂ ဒီဇင်ဘာ ၂၀၁၅	- Letter No. Ya Ka-4/Na-044/2015 (1036) Reference Letter – 1) Letter No. Electric-2(Policy-UREC) (15784/2015)/MOEP 2) MIC Letter No. Ya Ka-4/Na-44/2015 (949) 3) MOECAF Letter No. 3(2)/16 (D) (1)/(3601/2015)
၁ ဇွန် ၂၀၁၆	- ပြင်ဆင်ထားသည့် အစီရင်ခံစာအားပြန်လည်တင်သွင်းခြင်း (Revised according to MOECAF's Comments)
၁၉ ဒီဇင်ဘာ ၂၀၁၆	- **MIC** ခွင့်ပြုသည့်နေ့စွဲ
၁၁ ဖေဖြို ၂၀၁၈	- ဒုတိယအကြိမ်ပြန်လည်ပြင်ဆင်တင်သွင်းခြင်း
၁၄ ဇန်နဝါရီ ၂၀၁၉	- DEPP letter No. Thermal Power (UREC) (028)/2019 - ECD မှ ချမှတ်သော comments များအားပြန်လည် ပြင်ဆင်ခြင်း
၂၅ ဇွန် ၂၀၁၉	- လူထုတွေ့ဆုံဆွေးနွေးပွဲ
နောင်လုပ်ဆောင်မည့်	- EIA အစီရင်ခံစာအား ပြန်လည်တင်သွင်းခြင်း



ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်
မြန်မာနိုင်ငံရင်းနှီးမြှုပ်နှံမှုကော်မရှင်
အမှတ်(၁)သစ္စာလမ်း၊ ရန်ကင်းမြို့နယ်၊ ရန်ကုန်မြို့

စာအမှတ်၊ ရကc-၄ / နa-၀၄၄/၂၀၁၅ (၁၀၃၆)
ရက်စွဲ၊ ၂၀၁၅ ခုနှစ် ဒီဇင်ဘာ လ ၂၂ ရက်

အကြောင်းအရာ၊ **ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနှင့် သစ်တောရေးရာ ဝန်ကြီးဌာန၏ သဘောထားမှတ်ချက်နှင့်အညီ လိုက်နာဆောင်ရွက်ရန်ကိစ္စ**

ရည်ညွှန်းချက် ။ (၁)လျှပ်စစ်ဓွမ်းအား ဝန်ကြီးဌာန ၏ ၂၀-၁၁-၂၀၁၅ ရက်စွဲပါ စာအမှတ် လျှပ်စစ်-၂ (မူဝါ-UREC) (၁၅၇၈၄/၂၀၁၅)

(၂)မြန်မာနိုင်ငံ ရင်းနှီးမြှုပ်နှံမှု ကော်မရှင်၏ ၄-၁၂-၂၀၁၅ ရက်စွဲပါ စာအမှတ်၊ ရကc- ၄ / နa - ၄၄ / ၂၀၁၅ (၉၃၉)

(၃)ပတ်ဝန်းကျင် ထိန်းသိမ်းရေးနှင့် သစ်တောရေးရာ ဝန်ကြီးဌာန၏ (၁၄-၁၂-၂၀၁၅)ရက်စွဲပါစာအမှတ်၊ ခ(၂)/၁၆ (ဃ)(၁)/(၃၆၀၁/၂၀၁၅)

၁။ တရုတ်ပြည်သူ သမ္မတနိုင်ငံတွင် ဖွဲ့စည်းထားသော UREC Energy International Limited (UREC-E1)မှ မြန်မာနိုင်ငံတွင် U Energy Thaketa Power Co.,Ltd. တည်ထောင်ပြီး ဖက်စပ်နိုင်ငံခြား ရင်းနှီးမြှုပ်နှံမှုဖြင့် လျှပ်စစ်ဓွမ်းအားဝန်ကြီးဌာန၊ လျှပ်စစ်ဓွမ်းအား စီမံရေးဦးစီး ဌာနရိုင်းရန်ကုန်တိုင်းဒေသကြီး၊ သာကေတခရိတ်အားပေး စက်ရုံဝင်းအတွင်းတွင် သဘာဝခေတ်ဓွေ့နှင့် ဓွန်ုပစ်အပူသုံး ခရိတ်အားပေးစက်ရုံအား တည်ဆောက်၍ BOT စနစ်ဖြင့် လျှပ်စစ်ခရိတ်အားထုတ်လုပ်ရောင်းချခြင်းလုပ်ငန်းအား နိုင်ငံခြားရင်းနှီးမြှုပ်နှံမှု ဥပဒေနှင့်အညီ ဆောင်ရွက်ခွင့်ပြုပါရန် လျှပ်စစ်ဓွမ်းအား ဝန်ကြီးဌာနမှတစ်ဆင့် ရည်ညွှန်း(၁)ပါစာဖြင့် အဆိုပြုချက် တင်ပြလာခြင်းကို ပတ်ဝန်းကျင် ထိန်းသိမ်းရေးနှင့် သစ်တောရေးရာ ဝန်ကြီးဌာနသို့ ရည်ညွှန်း (၂)ပါစာဖြင့် သဘောထားတောင်းခံခဲ့ပါသည်။

၂။ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနှင့် သစ်တောရေးရာဝန်ကြီးဌာနမှ ရည်ညွှန်း(၃)ပါစာဖြင့် အဆိုပြုလုပ်ငန်းမှ တင်ပြလာသော ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း အစီရင်ခံစာ (Environmental Impact Assessment - EIA)နှင့် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအဉီ (Environmental Management Plan - EMP)များနှင့် စပ်လျဉ်း၍ အောက်ပါအတိုင်း လိုက်နာဆောင်ရွက်ရန် လိုအပ်မည်ဖြစ်ကြောင်း သဘောထား ပြန်ကြားလာပါသည်-

(က) ထည့်သွင်းဆောင်ရွက်ရန်

(၁) ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း၏ တိကျမှုနှင့်ပြည့်စုံမှုရှိကြောင်း၊ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ချက် အစီရင်ခံစာပါ ကတိကဝတ်၊ ပတ်ဝန်းကျင်ထိခိုက်မှု လျော့

J

ခုရေးလုပ်ငန်းများနှင့် အစီအစဉ်များကို အပြည့်အဝ အစဉ်အမြဲ လိုက်နာဆောင်ရွက်မည်ဖြစ်ကြောင်း စီမံကိန်းအဆိုပြုသူ၏ အတည်ပြု ဝန်ခံချက်။

(၂) အစီရင်ခံစာအကျဉ်းချုပ်၊ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်အား အကောင်အထည်ဖော်ဆောင်ရွက်ရန် ယေဘုယျအသုံးစရိတ်များ ထပ်မံထည့်သွင်းဖော်ပြရန်။

(၃) လွှမ်းခြုံမြေပုံကြိုးများ၊ လုပ်ငန်းခွင်အလိုက် မြေပုံများ၊ ဓာတ်ပုံများ၊ ကောင်းကင်ဓာတ်ပုံများ၊ ဂြိုလ်တုဓာတ်ပုံများ ထည့်သွင်းဖော်ပြရာတွင် ရောင်စုံလွှမ်းခြုံမြေပုံကြိုးများ၊ လုပ်ငန်းခွင်အလိုက် မြေပုံများ၊ ဓာတ်ပုံများ၊ ကောင်းကင် ဓာတ်ပုံများ၊ ဂြိုလ်တုဓာတ်ပုံများအား အသုံးပြုဖော်ပြသွားရန်။

(ခ) လိုက်နာဆောင်ရွက်ရန်

(၁) အထက်ဇယိုး(၂-က)ပါအပိုဒ်များတွင် ပါဝင်သောအချက်အလက်များ ထည့်သွင်းဖော်ပြလျက် ပတ်ဝန်းကျင်ထိိုက်မှု ဆန်းစစ်ခြင်း အစီရင်ခံစာ (Environmental Impact Assessment - EIA) နှင့် ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှု အစီအစဉ် (Environmental Management Plan-EMP)တို့အား ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနှင့်သစ်တောရေးရာ ဝန်ကြီးဌာနသို့ ပြန်လည်တင်ပြသွားရန်။

(၂) စီမံကိန်းအနီးဝန်းကျင်ဒေသခံ ပြည်သူများအတွက် လှုမှုစီးပွားဆိုင်ရာ ဖွံ့ဖြိုးတိုးတက်မှုများရရှိနိုင်ရေး နည်းလမ်းများရှာကြံအကောင်အထည်ဖော် ဆောင်ရွက်သွားရန်။

၃။ သို့ဖြစ်ပါ၍ဇာပိုဒ်-၂(က)နှင့် (ခ)ပါ အချက်များအား သိရှိနိုင်ပါရန်နှင့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနှင့်သစ်တောရေးရာ ဝန်ကြီးဌာန၏သဘောထား မှတ်ချက်နှင့်အညီ ဆောင်ရွက်မည့် အစီအစဉ်အားကော်မရှင်သို့ ပြန်လည်တင်ပြပေးပါရန် အကြောင်းကြားပါသည်။

ဥက္ကဋ္ဌ(ကိုယ်စား)
(အောင်နိုင်ဦး၊ အတွင်းရေးမှူး)

U Energy Thaketa Power Co.,Ltd.
မိတ္တူကို
ပြည်ထောင်စုဝန်ကြီးရုံး၊ ပတ်ဝန်းကျင် ထိန်းသိမ်းရေးနှင့် သစ်တောရေးရာ ဝန်ကြီးဌာန
ပြည်ထောင်စုဝန်ကြီးရုံး၊ လျှပ်စစ်စွမ်းအားဝန်ကြီးဌာန
ညွှန်ကြားရေးမှူးချုပ်၊ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဦးစီးဌာန
ညွှန်ကြားရေးမှူးချုပ်လျှပ်စစ်စွမ်းအားစီမံရေးဦးစီးဌာန
ရုံးလက်ခံ/ မျှောစာတွဲ

U Energy (Forest).Rqstw-3

THE REPUBLIC OF THE UNION OF MYANMAR
The Myanmar Investment Commission
PERMIT

Form (2)
Sr.No. 461-B
Date 19-9-2016

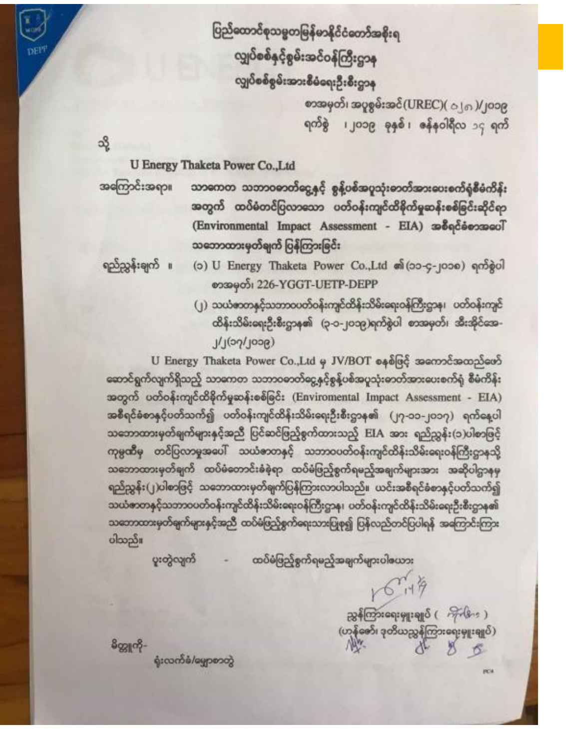
Permit No. 1157/ 2016 Date 19th September, 2016

This Permit is issued by the Myanmar Investment Commission according to the section 13, sub - section (b) of the Republic of the Union of Myanmar Foreign Investment Law-

(a) Name of Investor/Promoter MR. GUAN YUKUN
(b) Citizenship CHINESE
(c) Address 175 # BEIJING Rd, YUNNAN FOREIGN TRADE BUILDING KUNMING, YUNNAN, CHINA
(d) Name and Address of Principle Organization UREC ENERGY INTERNATIONAL CO., LTD. UNIT C, 16th FL, CNT TOWER, 338 HENNESSY ROAD, WANCHAI, HONG KONG
(e) Place of Incorporation PEOPLE'S REPUBLIC OF CHINA
(f) Type of Investment Business CONSTRUCTION OF 106 MW GAS FIRED COMBINED CYCLE POWER PLANT FOR ELECTRICITY GENERATION AND POWER SUPPLY
(g) Place(s) at which investment is PERMITTED THAKETA POWER PLANT COMPOUND, THAKETA TOWNSHIP, YANGON REGION
(h) Amount of Foreign Capital US$ 125.672 MILLION
(i) Period for Foreign Capital Brought in 2 YEARS
(j) Total amount of capital (Kyat) EQUIVALENT IN KYAT OF US$ 125.672 MILLION
(k) Construction Period 2 YEARS
(l) Permitted duration of investment 30 YEARS
(m) Form of investment JOINT VENTURE INVESTMENT
(n) Name of Company incorporated in Myanmar U ENERGY THAKETA POWER COMPANY LIMITED

19.9.16

Chairman
The Myanmar Investment Commission



ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ
လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန
လျှပ်စစ်စွမ်းအားစီမံရေးဦးစီးဌာန

စာအမှတ်၊ အပွစွမ်းအင်(UREC)(၀၂၈)/၂၀၁၉
ရက်စွဲ ၊ ၂၀၁၉ ခုနှစ်၊ ဇန်နဝါရီလ ၁၄ ရက်

သို့
U Energy Thaketa Power Co.,Ltd

အကြောင်းအရာ။ သာကေတ သဘာဝဓာတ်ငွေ့နှင့် စွန့်ပစ်အပူသုံးဓာတ်အားပေးစက်ရုံစီမံကိန်းအတွက် ထပ်မံတင်ပြလာသော ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ (Environmental Impact Assessment - EIA) အစီရင်ခံစာအပေါ် သဘောထားမှတ်ချက် ပြန်ကြားခြင်း

ရည်ညွှန်းချက် ။ (၁) U Energy Thaketa Power Co.,Ltd ၏(၁၁-၄-၂၀၁၈) ရက်စွဲပါ စာအမှတ်၊ 226-YGGT-UETP-DEPP

(၂) သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန၊ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန၏ (၃-၁-၂၀၁၉)ရက်စွဲပါ စာအမှတ်၊ အီးအိုင်အေ-၂/၂(၁၇/၂၀၁၉)

U Energy Thaketa Power Co.,Ltd မှ JV/BOT စနစ်ဖြင့် အကောင်အထည်ဖော်ဆောင်ရွက်လျက်ရှိသည့် သာကေတ သဘာဝဓာတ်ငွေ့နှင့်စွန့်ပစ်အပူသုံးဓာတ်အားပေးစက်ရုံ စီမံကိန်းအတွက် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း (Enviromental Impact Assessment - EIA) အစီရင်ခံစာနှင့်ပတ်သက်၍ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန၏ (၂၇-၁၁-၂၀၁၇) ရက်နေ့ပါ သဘောထားမှတ်ချက်များနှင့်အညီ ပြင်ဆင်ဖြည့်စွက်ထားသည့် EIA အား ရည်ညွှန်း(၁)ပါစာဖြင့် ကုမ္ပဏီမှ တင်ပြလာမှုအပေါ် သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသို့ သဘောထားမှတ်ချက် ထပ်မံတောင်းခံခဲ့ရာ ထပ်မံဖြည့်စွက်ရမည့်အချက်များအား အဆိုပါဌာနမှ ရည်ညွှန်း(၂)ပါစာဖြင့် သဘောထားမှတ်ချက်ပြန်ကြားလာပါသည်။ ယင်းအစီရင်ခံစာနှင့်ပတ်သက်၍ သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန၊ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန၏ သဘောထားမှတ်ချက်များနှင့်အညီ ထပ်မံဖြည့်စွက်ရေးသားပြုစု၍ ပြန်လည်တင်ပြပါရန် အကြောင်းကြားပါသည်။

ပူးတွဲလျက် - ထပ်မံဖြည့်စွက်ရမည့်အချက်များပါဝယား

ညွှန်ကြားရေးမှူးချုပ် ( )
(ဟန်ဇော်၊ ဒုတိယညွှန်ကြားရေးမှူးချုပ်)

မိတ္တူကို-
ရုံးလက်ခံ/မျှောစာတွဲ

11

စီမံကိန်း အစိတ်အပိုင်း

အစိတ်အပိုင်း ၁: ၁၀၆ MW CCPP
အစိတ်အပိုင်း ၂: ၆၆ kV ဓာတ်အားပေးစနစ်
အစိတ်အပိုင်း ၃: သဘာဝ ဓာတ်ငွေ့ ဓာတ်အားပေး ပိုက်လိုင်း

အစိတ်အပိုင်း ၁: ၁၀၆ MW CCPP

စီမံကိန်းတွင် အပိုင်းနှစ်ပိုင်းပါဝင်ပြီး နောက်ဆုံး စွမ်းအင်ထုတ်လုပ်မှု မှာ ၅၀၀ မီဂါဝပ် ဖြစ်ပါသည်။

အစိတ်အပိုင်း ၂: ၆၆ kV ဓာတ်အားပေးစနစ်

ဓာတ်အားပေးရုံ မှ ဆက်သွယ်သည့်စနစ်

ဓာတ်အားပေးရုံ အပိုင်း ၁ အား two-circuit 230/66kV လိုင်းဖြင့် သာကေတ ဓာတ်အားပေးရုံခွဲ ဖြင့်ဆက်သွယ်ထားပါသည်။ ဓာတ်အားပေးရုံခွဲ စီမံကိန်းအတွက် MOEP သည် executing agency (EA), ဖြစ်ပြီး Myanmar Electric Power Enterprise (MEPE) သည် အကောင်အထည်ဖော်သည့် အဖွဲ့အစည်းဖြစ်ပါသည်။

12

အစိတ်အပိုင်း ၃: သဘာဝ ဓာတ်ငွေ့ ဓာတ်အားပေး ပိုက်လိုင်း

လောင်စာအရင်းအမြစ်

အပိုင်း ၁ ၏ သဘာဝဓာတ်ငွေ့အား မြန်မာနိုင်ငံ၏ ဇောတိကကမ်းလွန်လုပ်ကွက် မှ ထုတ်လုပ်မည်ဖြစ်ပါသည်။ ထို့အပြင် ၁၀ လက်မ ဓာတ်ငွေ့ပိုက်လိုင်းဖြင့် သာကေတာ ခါတ်ငွေ့ရုံ (Gas Station) မှရယူမည်ဖြစ်ပြီး ဓာတ်ငွေ့ပိုက်လိုင်း အကွာအဝေးမှာ ၆ မိုင် ဖြစ်ပါသည်။

သဘာဝဓာတ်ငွေ့ပိုက်လိုင်းအား မြေအောက်တွင် မြှုပ်နှံထားမည် ဖြစ်ပါသည်။

13

စက်ရုံအတွက် သဘာဝဓာတ်ငွေ့ အထောက်အပံ့

လောင်စာ သုံးစွဲမှု

အပိုင်း ၁ ၏ သဘာဝဓာတ်ငွေ့ သုံးစွဲမှု အား စီစစ်ရာတွင် အောက်ဖော်ပြပါ သဘာဝဓာတ်ငွေ့ သုံးစွဲမှု ကို အခြေခံ၍ တွက်ချက်ထားပါသည်။

သဘာဝဓာတ်ငွေ့ သုံးစွဲမှု

စွမ်းအင် (သဘာဝဓာတ်ငွေ့) အသုံးပြုမှု နှင့် ဖန်လုံအိမ်ဓာတ်ငွေ့ထုတ်လုပ်မှု

Unit Size	Daily Gas Consumption (24h)	Annual Gas Consumption (7,000h)	Greenhouse gas emission
Phase I	19.85mmcf/d	5789mmcf/y	300,000t/y
Phase II	79.4mmcf/d	23154mmcf/y	1,200,000t/y

Notes: **The calculation principles of unit gas consumption based on Low heating value (LHV) of the supplied natural gas is 840 BTU/SCF (31289kJ/Nm³**

ရေ အရင်းအမြစ်

- စီမံကိန်းအတွက် လိုအပ်သော ရေအရင်းအမြစ်အား စီမံကိန်း အနောက်ဘက် ၁ ကီလိုမီတာ အကွာတွင်ရှိသော ငမိုးရိပ် (ပုဇွန်တောင်) ချောင်း မှ သုံးစွဲမည်ဖြစ်ပါသည်။
- အပိုင်း ၁ ၏ ရေလိုအပ်ချက်မှာ ၁၈၀ m^3/h (၀.၀၅ m^3/s) ဖြစ်ပါသည်။
- အဆိုပါ ရေ အရင်းအမြစ်သည် စီမံကိန်းတစ်ခုလုံးအတွက် ဖြစ်သည်, ရေသုံးစွဲမှု၏ အဓိက မှာ ဓာတုဗေဒ အရ ရေသန့်စင်သည့် စနစ်အတွက်ဖြစ်ပါသည်။ ရေသန့်စင်သည့် စနစ်မှာ အောက်ပါ အတိုင်းဖြစ်ပါသည်။

Ngamoeyeik > Raw water basin > Raw water treatment plant > Chemical raw water basin > Chemical water treatment plant

- A floating pontoon was designed to lift the Ngamoeyeik Creek water to raw water treatment plant in the plant.
- Two intakes lift pumps are provided (One work and the other standby), each pump flow is: q=400 m3/h, H=20m, motor power is 45 kW.

ရေ အရင်းအမြစ်

စီမံကိန်းအတွက်လိုအပ်သော ထပ်မံဖြည့်တင်းမည့်ရေ (Make-up water) ကို secondary circulating water supply system အသုံးပြုပြီး ရေအအေးခံသည့် စနစ်ဖြင့် လည်ပတ်စေမည်ဖြစ်ပြီး၊ စက်ရုံ မြောက်ဘက် ၁.၂ ကီလိုမီတာ အကွာတွင် ရှိသော ငမိုးရိပ် (ပုဇွန်တောင်ချောင်း) မှရယူပါမည်။

Make-up water quantity

NO	Item	Unit (m^3/h)
1	Evaporation of the cooling power	128.1
2	Drift of the cooling power	10.2
3	Blowdown of the cooling power	117.9
4	Service (For chemical) water	16
5	Potable water (include HVAC make-up water)	5
6	Self-water consumption of raw water treatment station	16.8
7	Unforeseen loss water	20
	Total	314

ဆောက်လုပ်ရေး နှင့် လည်ပတ်ရေး အတွက် လုပ်သားအင်အား

ဆောက်လုပ်ရေး အဆင့်တွင် ဝန်ထမ်း ၄၃၁ ခန့် ဖြင့် ဆောက်လုပ်မည်ဖြစ်ပါသည်။

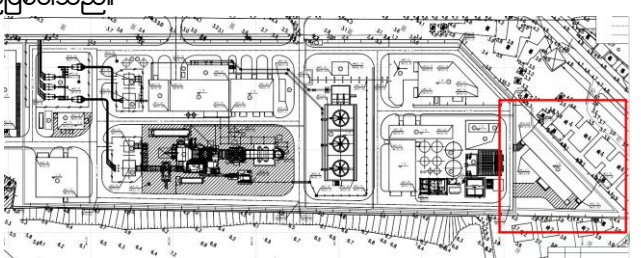
Temporary Dormitory


စီမံကိန်းလည်ပတ်ရာတွင် အလုပ်သမား ၆၀ ခန့် ဖြင့် လည်ပတ်မည်ဖြစ်ပါသည်။
စက်ရုံစီမံခန့်ခွဲသူ နှင့် ထိန်းသိမ်းသည့် ဝန်ထမ်း၊ စက်ပိုင်းဆိုင်ရာကျွမ်းကျင်သူ၊ လျှစ်စစ် ပညာရှင်၊ ကားမောင်း၊ ဆေးပညာရှင်၊ အရည်အသွေးထိန်းချုပ်သူ နှင့် သန့်ရှင်းရေးသမားများ နှင့် ကျွမ်းကျင် လည်ပတ်သူများ ဖြင့် ထိန်းသိမ်းလည်ပတ်မည်ဖြစ်ပါသည်။ ထိုဝန်ထမ်းများအား ပြည်တွင်းပြည်ပမှ ဝန်ထမ်းခန့်ထားမည်ဖြစ်ပါသည်။

ဆောက်လုပ်ရေး နှင့် လည်ပတ်ရေး အတွက်လုပ်သားအင်အား

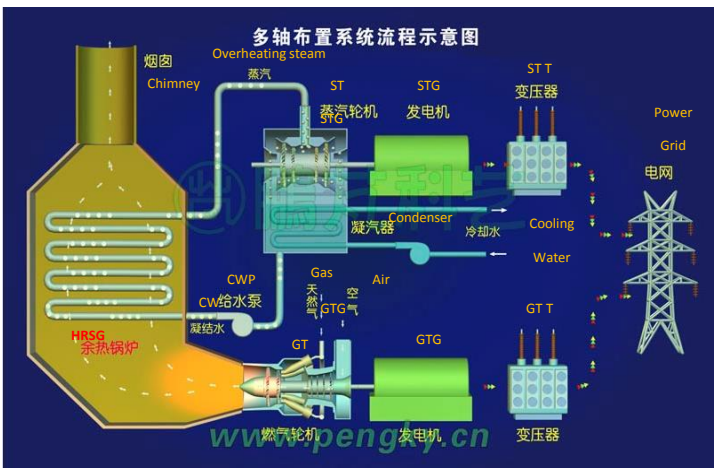
လည်ပတ်သည့် ကာလတွင် အလုပ်သမားများအတွက် အခန်းဆောင်

လည်ပတ်သည့် ကာလတွင် အလုပ်သမားများအတွက် အခန်းဆောင်အား အယောက် ၆၀ အတွက် ဆောက်လုပ်မည်ဖြစ်ပါသည်။



တာဘိုင်ဖြင့် လျှပ်စစ်ထုတ်လုပ်သည့် စနစ်

စွန့်ပစ်အပူသုံး ပေါင်းစပ်လျှပ်စစ်မောတ်အားပေးစက်ရုံ လည်ပတ်သည့် စနစ်



ထုတ်လွတ်မှု ထိန်းချုပ်ရေး (သဘာဝပတ်ဝန်းကျင် ကာကွယ်စောင့်ရှောက်ရေး)

အခိုးငွေ့ ညစ်ညမ်းမှု ထိန်းချုပ် တိုင်းတာခြင်း

လောင်စာမောတ်ငွေ့အား ဓါတ်ခွဲစမ်းသပ်ချက်အရ ဆာလဖါ နှင့် ပြာပါဝင်မှုမှာ လုံးဝမရှိပေ။ အဓိကပါဝင်မှုမှာ နိုက်ထရိုဂျင် အောက်ဆိုက် (Nox) ဖြစ်ပါသည်။

sulfur dioxide ညစ်ညမ်းမှု ထိန်းချုပ်ခြင်း

ဤစီမံကိန်းတွင် အသုံးပြုသော သဘာဝဓါတ်ငွေ့တွင် hydrogen sulfide ပါဝင်မှုနည်းပါး (2x10-5mol/mol) သည့်အတွက် sulfur dioxide အနည်းငယ်သာ ထွက်ရှိနိုင်ပါသည်။ ထို့ကြောင့် desulphurization စနစ် တပ်ဆင်ရန်မလိုအပ်ပါ။

မီးခိုးညစ်ညမ်းမှု ထိန်းချုပ်ရေး

ယခုစီမံကိန်းသည် သဘာဝမောတ်ငွေ့ ကိုအသုံးပြု၍ တာဘိုင်လည်ပြီး လျှပ်စစ်ထုတ်ယူခြင်းဖြစ်သဖြင့် သဘာဝမောတ်ငွေ့များ တာဘိုင်အတွင်းသို့ စီးဆင်းစေမည် ဖြစ်ပြီး သန့်စင်ပြီးနောက် လောင်ကျွမ်းပြီး ချိန်တွင် မီးခိုးမထုတ်လုပ်ပါ။ ထိုကြောင့် မောတ်ငွေ့မှုန့်ကို ဖယ်ရှားသည့် စနစ် တပ်ဆင်ရန်မလိုပါ။

ထုတ်လွှတ်မှု ထိန်းချုပ်ရေး (သဘာဝပတ်ဝန်းကျင် ကာကွယ်စောင့်ရှောက်ရေး)

NOX ညစ်ညမ်းမှု ထိန်းချုပ် တိုင်းတာခြင်း

အဆိုပါ စီမံကိန်းအား ultra-low ကာဗွန်လောင်ကျွမ်းခြင်း DLN လောင်ကျွမ်းမှု နည်းပညာတို့ဖြင့် သတ်မှတ်ဆောင်ရွက်ထားပါသည်။ NOX ထုတ်လွှတ်မှုသည် သဘာဝဓာတ်ငွေ့ လောင်ကျွမ်းချိန်တွင် 15 ppm အတွင်းတွင်ရှိပါသည်။

မိုးနိုးခေါင်းတိုင်မှ ထွက်သော လေထုညစ်ညမ်းမှု သတ်မှတ်ခြင်း

မီးခိုးခေါင်းတိုင်မှ ထုတ်လွှတ်သာ အခိုးအငွေ့သည် မြေပြင်ညစ်ညမ်းမှု လျော့ချရန် အရေးကြီးသော တိုင်းတာမှု ဖြစ်ပါသည်။ ယခုစီမံကိန်း အဝိုင်း ၁ တွင် ၄၀ မီတာမြင့်သော မီးခိုင်းခေါင်းတိုင် နှစ်ခုတပ်ဆင်ထားပါသည်။

အထက်ဖော်ပြပါ လေထုညစ်ညမ်းမှုလျော့ချသော အစီအစဉ်ချမှတ်ပြီးနောက် စီမံကိန်းမှ ထုတ်လွှတ်သော မီးခိုးသည် Air Pollutants for Thermal Power Plants (GB13223-2011) အတွက် သတ်မှတ်ထားသော စံချိန်စံနှုန်းနှင့် အညီ ကိုက်ညီမှုရှိပါသည်။

ထုတ်လွှတ်မှု ထိန်းချုပ်ရေး (သဘာဝပတ်ဝန်းကျင် ကာကွယ်စောင့်ရှောက်ရေး)

HRSG system (stack included in the system):

အမျိုးအစား: dual-pressure, non-reheat, without duct burner, integral deaerator, horizontal, natural circulation

According to Good International Industry Practice (GIIP)

Stack Height Calculation :

H_G= H + 1.5L; where

H_G = 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

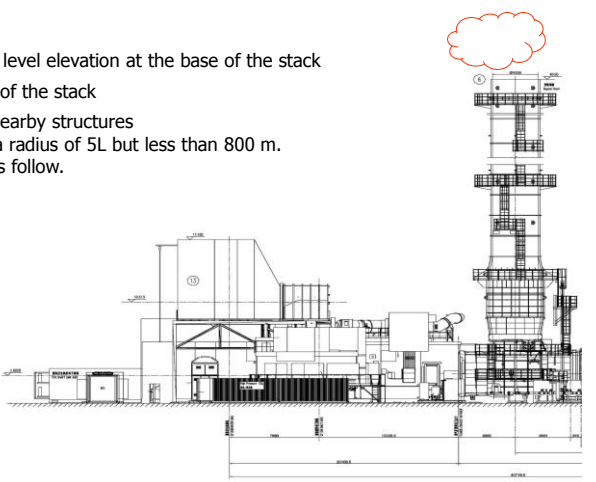
L= Lesser dimension, height (h) or width (w), of nearby structures

"Nearby structures" = Structures within/touching a radius of 5L but less than 800 m.

Based on the section drawing show stack height as follow.

HG= H + 1.5L=17.1m+1.5 x 12m=35.1m

So final selected stack height is 40m



စုပေါင်းထုတ်လွှတ်မှု နှင့် လေထုညစ်ညမ်းမှု ကန့်သတ်ချက် သတ်မှတ်ခြင်း

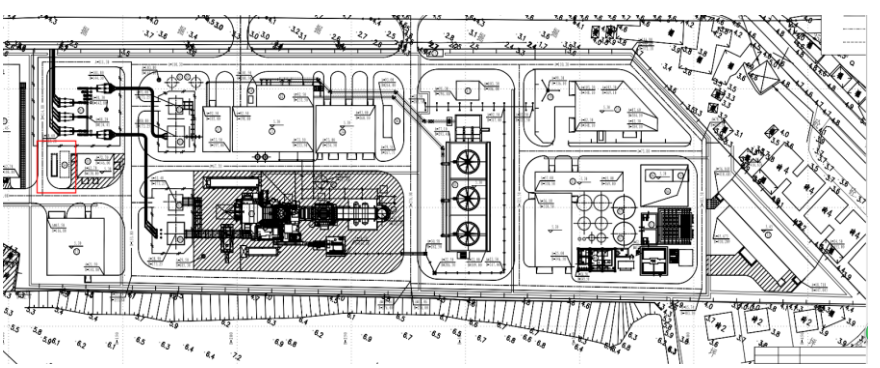
UREC သည် air dispersion modelling အား World Health Organization (WHO) Ambient Air Quality Guidelines မှ သတ်မှတ်ထားသော WBG EHS General Guidelines ဖြင့် တွက်ချက်သတ်မှတ်ထားပါသည်။ စီမံကိန်း အပိုင်း ၁ နှင့် ၂ တွင် တူညီသော သဘာဝ ဓာတ်ငွေ့ကိုသာ သုံးမည်ဖြစ်ပါသည်။ ထုတ်လွှတ်သည့် ဓာတ်ငွေ့ပမာဏမှာ အောက်ပါအတိုင်းဖြစ်ပါသည်။

Parameter	Averaging Period	Guideline Value	Thaketa Data
Sulphur dioxide (SO2)	24-hour	20µg/m3	0
	10 minute	500µg/m3	0
Nitrogen dioxide (NO2)	1-year	40µg/m3	-
	1-hour	200µg/m3	50µg/m3
Particulate matter (PM10)	1-year	20µg/m3	-
	24-hour	50µg/m3	25µg/m3
Particulate matter (PM2.5)	1-year	10µg/m3	-
	24-hour	25µg/m3	10µg/m3
NOx	-	51 mg/m3	35 mg/Nm3
CO	-	51 mg/Nm3	35 mg/Nm3
Greenhouse gas emission	-	-	Phase I：300,000t/y Phase II：1,200,000t/y

အိမ်သုံးရေ သန့်စင်စနစ် နှင့် စက်ရုံမှ ရေသန့်စင်သည့် စနစ်

ဓာတုပစ္စည်း သန့်စင်ထားသည် ရေနှင့် ရေနွေးငွေ့တာဘိုင်မှာ ထွက်ရှိလာသော ရေဆိုးများ (အပိုင်း ၂ ခု အတွက်) စီမံကိန်းဇရိယာ အတွင်းရှိ (V=100m^3) ရေဆိုးကန်ထဲသို့စွန့်ပစ်ပါမည်။

pH- အတိုင်းအတာ ချိန်ကိုက်ပြီးနောက် အနည်ထိုင်သောနည်းဖြင့် ခဲထားစေပြီး ရေဆိုး သန့်စင်စက်ထဲသို့ စစ်ထုတ်ပြီး သန့်စင်စေမည်ဖြစ်ပါသည်။



ရေဆိုးသန့်စင် စနစ်ပြမြေပုံ

အိမ်သုံးရေ သန့်စင်စနစ် နှင့် စက်ရုံမှ ရေသန့်စင်သည့် စနစ်






Pictures of Sanitary Waste Water Treatment System

ပါဝင်သည့် အကြောင်းအရာများ

၁။ စီမံကိန်း အကြောင်းအရာ
၂။ EIA လုပ်ငန်းစဉ် နှင့် ယခုအထိ ပြီးစီးမှုများ
၃။ ရည်ရွယ်ချက်များ
၄။ သက်ရောက်မှု ဆန်းစစ်ခြင်း နည်းလမ်း
၅။ အဓိက သက်ရောက်မှုများ ဆန်းစစ်ချက် နှင့် ထိခိုက်မှု လျော့ပါးရေး နည်းလမ်းများ
၆။ သဘာဝဘေးအန္တရာယ် ဖြစ်ပေါ်နိုင်ခြေ အတိုင်းအတာ
၇။ ထိခိုက်မှု ဆန်းစစ်ချက် အကြောင်းအရာ
၈။ အကျိုးကျေးဇူးများ ဆန်းစစ်ချက်
၉။ စီမံကိန်း ကာလတစ်လျှောက် အများပြည်သူ နှင့် တွေ့ဆုံဆွေးနွေးခြင်း
၁၀။ အနာဂတ် လှုပ်ရှားမှု အစီအစဉ်

ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးလုပ်ထုံးလုပ်နည်းများ အရ အများပြည်သူနှင့်တွေ့ဆုံ ဆွေးနွေးပွဲပြုလုပ် ရခြင်း၏ ရည်ရွယ်ချက်

စီမံကိန်းကြောင့် ဖြစ်ပေါ်လာနိုင်သော သဘာဝဝန်းကျင်နှင့် လူမှုဝန်းကျင်ဆိုင်ရာ သက်ရောက်မှုများ နှင့်အတူ ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်လေ့လာခြင်းအတွက် ဆောင်ရွက်ရမည့်အရာများနှင့် စပ်လျဉ်း၍ ပြည်သူများ၏ သဘောထားအမြင်များကို ပေါင်းစပ်ဆောင်ရွက်နိုင်ရန် လူထုတွေ့ဆုံဆွေးနွေးပွဲ ဆောင်ရွက်ရခြင်းဖြစ်သည်။

၁။ စီမံကိန်း၏ ရည်ရွယ်ချက်၊ အစီအစဉ်၊ ခန့်မှန်းသက်ရောက်မှုများ၊ လျော့ပါးရေး နည်းလမ်းများနှင့် လုပ်ငန်းစဉ် စသည့် အချက်အလက်များအားဖြန့်ဝေခြင်း

၂။ စီမံကိန်း ပြင်ဆင်ဆောင်ရွက်နေစဉ်ကာလအတွင်း စီမံကိန်းနှင့် ပတ်သက်သည့် စိုးရိမ်ပူပန်မှုများ၊ အကြံပေးချက်များကို စီမံကိန်းနှင့် သက်ဆိုင်သူများအား ပြောကြားနိုင်မည့် အခွင့်အရေးများ ပေးအပ်ခြင်း

၃။ လူထုတွေ့ဆုံဆွေးနွေးပွဲ ဆောင်ရွက်နေစဉ်အတွင်း အမြင်သဘောထားများ နှင့် စီမံကိန်းလုပ်ငန်းစဉ် ပြင်ဆင်ခြင်းနှင့် ပတ်သက်သည့် တုံ့ပြန်ချက်များ ရယူခြင်း

၄။ စီမံကိန်း၏ ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ဆိုင်ရာ သက်ရောက်မှုများနှင့် အကျိုးရလဒ်များနှင့် သက်ဆိုင်သည့် သတင်းအချက်အလက်များ ဖြည့်စွက်ပေးခြင်း

အများပြည်သူတွေ့ဆုံဆွေးနွေးခြင်းများ နှင့် ထုတ်ဖော်ပြသခြင်း

အဆိုပြု စီမံကိန်းနေရာ နှင့် အနီးဝန်းကျင်တွင် နေထိုင်သူများ၏ လက်ရှိအခြေအနေကို သိရှိရန် နှင့် စီမံကိန်း လုပ်ငန်းစဉ်များနှင့် ပတ်သက်ပြီး ၎င်းတို့ထံမှ အကြံပြုချက်များကို သိရှိရန်အတွက် လူမှုစီးပွားစစ်တမ်း ကောက်ယူခဲ့ပါသည်။ စစ်တမ်းကောက်ယူရခြင်း၏ အဓိက ရည်ရွယ်ချက်များမှာ -

- လူမှု စီးပွားအခြေအနေကို သိရှိရန်
- ဒေသခံလူထုအနေဖြင့် လက်ရှိ အခြေခံ ဝန်ဆောင်မှုများကို ရရှိသုံးစွဲနိုင်မှု အခြေအနေကို သိရှိရန်
- အဆိုပြု ဓာတ်အားပေး စက်ရုံစီမံကိန်း နှင့် ပတ်သက်၍ ဒေသခံလူထု၏ ခံယူချက်ကို သိရှိရန် နှင့်
- ထိခိုက်မှု လျော့ပါးရေး နည်းလမ်းများ နှင့် ပတ်သက်၍ ဒေသခံလူထုထံမှ တင်ပြချက်များကို သိရှိရန်

အဆိုပြု ဓာတ်အားပေးစက်ရုံအတွက် လူမှု စီးပွား သက်ရောက်မှု ဆန်းစစ်ချက်ပြုလုပ်ရာတွင် မေးခွန်းလွှာများဖြင့် စစ်တမ်းကောက်ယူသည့် အပြင် သက်ဆိုင်သူများ နှင့် တွေ့ဆုံဆွေးနွေးခြင်း၊ အလားတူ ညှိနှိုင်းတိုင်ပင်ခြင်းများကို လည်း ပြုလုပ်ခဲ့ပါသည်။

အများပြည်သူတွေ့ဆုံဆွေးနွေးခြင်းများ နှင့် ထုတ်ဖော်ပြသခြင်း

စီမံကိန်း နှင့် သက်ဆိုင်သူများ ကို တွေ့ဆုံမေးမြန်းခြင်း တို့ တွင် သာကေတမြို့နယ် အထွေထွေအုပ်ချုပ်ရေး ဦးစီးဌာနမှ ဦးစီးအရာရှိ၊ (၉) ရပ်ကွက် နှင့် (၁၀) ရပ်ကွက် (မြောက်) ရပ်ကွက်အုပ်ချုပ်ရေးမှူးများ နှင့် ရပ်မိရပ်ဖများ ပါဝင်ပါသည်။ စီမံကိန်း နှင့် ဆက်နွယ်သူများ သတ်မှတ်ပြီးနောက်တွင် ၄င်းတို့၏ သက်ဆိုင်ရာ စိတ်ဝင်စားမှု အသီးသီး နှင့် စီမံကိန်းအပေါ် အတွက် အရေးပါမှု အခြေအနေ အသီးသီး အပေါ် အခြေခံ၍ စစ်တမ်းကောက်ယူမှုများ ပြုလုပ်ခဲ့ပါသည်။ ထို့နောက် အဓိက အရေးပါသူများ နှင့် တွေ့ဆုံဆွေးနွေးခြင်းများကို လည်း ပြုလုပ်ခဲ့ပါသည်။

အများပြည်သူတွေ့ဆုံဆွေးနွေးခြင်းများ နှင့် ထုတ်ဖော်ပြသခြင်း လှုပ်ရှားမှုများ

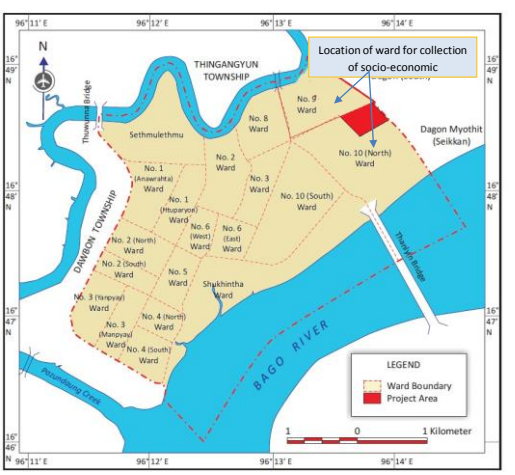
စဉ်း	ရက်စွဲ	တွေ့ဆုံဆွေးနွေးမှု ပြုလုပ်ရာ နေရာ	တက်ရောက်သူများ	စီစဉ်သူ
1.	9.4.2013	Thaketa Gas Turbine office	Officer, Thaketa Gas Turbine and REM Company	REM Company
2.	9.4.2013	GAD Office, Thaketa Township	Township officer and REM	REM Company
3.	10.4.2013	No.10 (North)Ward	Respondents and REM	Head of No.10(N) Ward
4.	11.4.2013	No.9 and No.10(N) Ward	Respondents and REM	Head of No.9 and No.10(N) ward
5.	29.4.2013	GAD Office, Thaketa Township	Township Administrator, GAD, Thaketa Township, Elderly Persons of No.9 and No.10(N) wards and REM	REM Company

29

အများပြည်သူတွေ့ဆုံဆွေးနွေးခြင်းများ နှင့် ထုတ်ဖော်ပြသခြင်း

နည်းလမ်း နှင့် ဇရိယာ

- အင်တာဗျူးများ ပြုလုပ်ခြင်း၊ မေးခွန်းလွှာများ ဖြန့်ဝေမေးမြန်းခြင်း နှင့် အဓိကသက်ဆိုင်သူများ နှင့် တွေ့ဆုံဆွေးနွေးခြင်းများကို သာကေတမြို့နယ် (၉) ရပ်ကွက် နှင့် (၁၀) ရပ်ကွက် (မြောက်) တို့တွင် ပြုလုပ်ခဲ့ပါသည်။
- စစ်တမ်းကောက်ယူမှုကို ပြန်လည်ဖြေကြားပေးသူ အယောက် (၁၀၀) ရှိပါသည်။
- စစ်တမ်းကောက်ယူမှုတွင် စီမံကိန်းဇရိယာ ဘေးပတ်ဝန်းကျင်အပေါ် စီမံကိန်းမှ ဖြစ်ပေါ်နိုင်သော သက်ရောက်မှုများအပေါ် မေးမြန်းမှုများ ပါဝင်ပါသည်။



30

အများပြည်သူတွေ့ဆုံဆွေးနွေးခြင်းများ နှင့် ထုတ်ဖော်ပြသခြင်း

နည်းလမ်း နှင့် ဖရိယာ

- အင်တာဗျူးများ ပြုလုပ်ခြင်း၊ မေးခွန်းလွှာများ ဖြန့်ဝေမေးမြန်းခြင်း နှင့် အဓိကသက်ဆိုင်သူများ နှင့် တွေ့ဆုံဆွေးနွေးခြင်းများကို သာကေတမြို့နယ် (၉) ရပ်ကွက် နှင့် (၁၀) ရပ်ကွက် (မြောက်) တို့တွင် ပြုလုပ်ခဲ့ပါသည်။
- စစ်တမ်းကောက်ယူမှုကို ပြန်လည်ဖြေကြားပေးသူ အယောက် (၁၀၀) ရှိပါသည်။
- စစ်တမ်းကောက်ယူမှုတွင် စီမံကိန်းဖရိယာ ဘေးပတ်ဝန်းကျင်အပေါ် စီမံကိန်းမှ ဖြစ်ပေါ်နိုင်သော သက်ရောက်မှုများအပေါ် မေးမြန်းမှုများ ပါဝင်ပါသည်။




Public Consultation Meeting

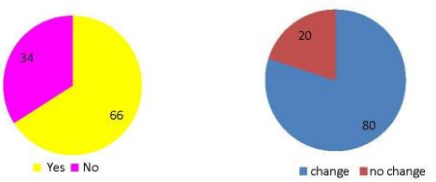



အများပြည်သူတွေ့ဆုံဆွေးနွေးခြင်းများ နှင့် ထုတ်ဖော်ပြသခြင်း

စီမံကိန်း အပေါ် လူထု၏ ထင်မြင်ချက်

သဘာဝဓာတ်ငွေ့ နှင့် စွန့်ပစ်အပူသုံး ပေါင်းစပ်ဓာတ်အားပေး စက်ရုံ အပေါ် လူထု သိရှိမှု အခြေအနေ

ပြန်လည်ဖြေကြားသူများ၏ ၆၆ ရာခိုင်နှုန်းသည် ယခုစီမံကိန်းကို သတိထားမိပါသည်။ (၈၀) ရာခိုင်နှုန်းက ပြောသည်မှာ ယခုစီမံကိန်းကြောင့် သဘာဝပတ်ဝန်းကျင် အခြေအနေအပေါ် ထိခိုက်နိုင်ခြေ မရှိဘူး ဟု ဖော်ပြကြပါသည်။

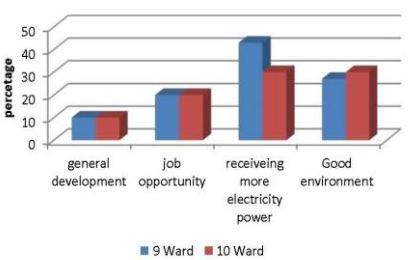


စီမံကိန်း နှင့် ပတ်သက်သည့် သတင်းအချက်အလက်များ သိရှိမှု အခြေအနေ

အများပြည်သူတွေ့ဆုံဆွေးနွေးခြင်းများ နှင့် ထုတ်ဖော်ပြသခြင်း

စီမံကိန်း အပေါ် လူထု၏ ထင်မြင်ချက်

စီမံကိန်းကြောင့် ဖွံ့ဖြိုးတိုးတက်မှု၊ အလုပ်အကိုင်အခွင့်အလမ်း၊ ပိုမိုကောင်းမွန်သော ပတ်ဝန်းကျင် နှင့် လျှပ်စစ်ဓာတ်အား ပိုမို ရရှိလာမည်ဟု ထင်မြင်ကြပါသည်။ (၉) ရပ်ကွက် နှင့် (၁၀) ရပ်ကွက် (မြောက်) မှ ဖြေကြားသူ (၃၀) ရာခိုင်နှုန်းကျော်သည် စီမံကိန်းကြောင့် လျှပ်စစ်ဓာတ်အား ပိုမိုရရှိမည်ဟု ထင်မြင်ကြပါသည်။



ဖြေကြားသူများ၏ ထင်မြင်ချက်များ

အများပြည်သူတွေ့ဆုံဆွေးနွေးခြင်းများ နှင့် ထုတ်ဖော်ပြသခြင်း

စိမ်ကိန်းကြောင့် ဖြစ်ပေါ်နိုင်သော ဆူညံသံဆိုင်ရာ ပြဿနာများ

ဖြေကြားသူများ၏ ထင်မြင်ချက်အရ ၄င်းတို့အနေဖြင့် စိမ်ကိန်းမှ ဆူညံသံများ၊ အနှံ့ဆိုးများ နှင့် မီးဘေးအန္တရာယ်များ ဖြစ်ပေါ်နိုင်သည်ဟု ထင်မြင်ကြပါသည်။ ဓာတ်အားပေး စက်ရုံမှ ထွက်ရှိမည့် ဆူညံသံ၊ စက်ယန္တရားကြီးများ ၏ အသံကြောင့် စိတ်ပိုင်းဆိုင်ရာ ထိခိုက်နိုင်မှု၊ မီးဘေး အန္တရာယ်ဖြစ်ပေါ်နိုင်မှု နှင့် ဓာတ်ငွေ့ပိုက်လိုင်းများမှ ဓာတ်ငွေ့ယိုစိမ့်မှုများ ကြောင့် အနှံ့ဆိုးများ အပေါ် စိုးရိမ်ပူပန်မှုများ ရှိပါသည်။

အများပြည်သူတွေ့ဆုံဆွေးနွေးခြင်းများ နှင့် ထုတ်ဖော်ပြသခြင်း

အကြံပြုချက်များ

စစ်တမ်းကောက်ယူမှု ရလဒ်များအရ အောက်ပါတို့ကို အကြံပြုပါသည်။

၁။ စက်ရုံကို ခေတ်မီစက်ကိရိယာများ အသုံးပြု၍ လည်ပတ်စေခြင်း

၂။ စက်ရုံမှ ဆိုးရွားသော အသံများကို လျော့ချခြင်း

၃။ စက်ကိရိယာများမှ ထွက်သော ဆိုးရွားသော အသံများ မရှိစေခြင်း

၄။ မီးဘေးအန္တရာယ် မဖြစ်စေခြင်း

၅။ ဓာတ်ငွေ့ပိုက်လိုင်းများ ယိုစိမ့်မှု မဖြစ်အောင် ထိန်းသိမ်းခြင်း

၆။ဝန်ထမ်းများအတွက် ဝန်ထမ်းအိမ်ယာများပြုပြင်ပေးစေခြင်း

ယခု. အများပြည်သူ သို့ ထုတ်ဖော်ပြောကြားခြင်း နှင့် အနာဂတ် တွေ့ဆုံဆွေးနွေးမှု အစီအစဉ်များ

- ယခု စီမံကိန်းကို BOT စနစ် ဖြင့် အကောင်အထည်ဖော်မည်ဖြစ်သည်။
- ထို့ကြောင့် အောက်ပါလုပ်ငန်းများကို လုပ်ဆောင်ရန် လျှပ်စစ်နှင့် စွမ်းအင် ဝန်ကြီးဌာန အောက်ရှိ လျှပ်စစ်စွမ်းအင် နှင့် စီမံကိန်း ဌာန ထံမှ ခွင့်ပြုချက်တောင်းဆိုရန် လိုအပ်ပါသည်။
- စီမံကိန်းဆိုင်ရာ သတင်းအချက်အလက်များကို လူထုထံသို့ အသိပေးပြီး ရရှိလာသော ထင်မြင်ယူဆချက်များ ကို EIA လေ့လာမှု ထဲတွင် ထည့်သွင်းမည်ဖြစ်ပါသည်။
- သက်ဆိုင်သူများ နှင့် တွေ့ ဆုံဆွေးနွေးခြင်း သည် EIA လေ့လာမှု ပြုလုပ်ရာတွင် အဓိကကျသော ကဏ္ဍမှ ပါဝင်ပါသည်။
- သတင်းအချက်အလက်များ မျှဝေခြင်း၊ စိုးရိမ်ပူပန်မှုများကို သိရှိရန် တို့ လည်း ပါဝင်ပါသည်။
- ပွင့်ပွင့်လင်းလင်းဆွေးနွေးမှုများ၊ အရေးတယူလုပ်ဆောင်ပေးမှုများဖြင့် ယုံကြည်မှုတည်ဆောက်ရန် လိုအပ်သော ရေရှည်ဖြစ်စဉ်တစ်ခုလည်းဖြစ်ပါသည်။

အများပြည်သူ တွေ့ဆုံဆွေးနွေးခြင်း

- စီမံကိန်း အဆိုပြုသူသည် စီမံကိန်းဝန်းကျင်တွင် နေထိုင်သူများ၊ သက်ဆိုင်ရာ အစိုးရအဖွဲ့အစည်းများ၊ အစိုးရမဟုတ်သော အဖွဲ့အစည်းများ နှင့် စိတ်ပါဝင်စားသူများကို တွေ့ဆုံဆွေးနွေးခြင်းပြုလုပ်ရန် ကြိုတင်ဖိတ်ကြားခြင်းကို မြန်မာဘာသာစကားဖြင့် ပြုစုပါသည်။
- ရှင်းလင်း တင်ပြမှု ပြုလုပ်ရာတွင်လည်း မြန်မာဘာသာစကားကို အသုံးပြုပါသည်။
- အဓေးအဖြေ ကဏ္ဍတွင် တက်ရောက်သူများမှ တင်ပြလာသော ထင်မြင်ယူဆချက်များကို မှတ်တမ်းတင်ပါသည်။
- ထို့အပြင် အများရှေ့တွင် ပြောဆိုရန် တုံ့ ဆိုင်းတတ်သူများကို အဆင်ပြေစေရန်အတွက် အကြံပြုစာ စာရွက်များ (feedback Form)ကိုလည်း ဝေပြီး အကြံဉာဏ်များရယူသွားပါမည်။


မြန်မာ့အလင်း
Myanma Alinn Daily

အမျိုးသားစီမံကိန်းကော်မရှင်ဥက္ကဋ္ဌ နိုင်ငံတော်သမ္မတ ဦးဝင်းမြင့် အမျိုးသားစီမံကိန်းကော်မရှင် (၁/၂၀၁၉) အစည်းအဝေးခွင် အမှာစကားပြောကြား

ဝိဘင်ကြေးလွှာ

106 MW Thaketa Combine Cycle Power Plant နှင့်ပတ်သက်သော ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း၊ အစီရင်ခံစာဆွဲတင်လိုသော စီမံကိန်းနှင့် သက်ဆိုင်သူများနှင့် တွေ့ဆုံဆွေးနွေးခြင်း အကြောင်းအရာ

U Energy Thaketa Power Co.,Ltd.နှင့်JV/BOT စနစ်ဖြင့် အကောင်အထည်ဖော် ထောင်ရွက်လျက်ရှိသည့် သဘာဝဓာတ်ငွေ့နှင့် ခွန်အားသုံးစက်အားပေးစက်ရုံ စီမံကိန်း အတွက် ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း (EIA)အစီရင်ခံစာကို U Energy Thaketa Power Co.,Ltd. နှင့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာနမှ တာဝန်ရှိ စီစစ်ရေးအဖွဲ့သည် ညှိနှိုင်းဆွေးနွေးမှုများပြုလုပ်ခဲ့ပြီး အစီရင်ခံစာကို ၂၀၁၈ခုနှစ်၊ ဧပြီလတွင် ပြန်လည်ပြင်ဆင်တင်သွင်းခဲ့ပါသည်။

သို့ဖြစ်ပါ၍ စီမံကိန်းနှင့်သက်ဆိုင်သူများအား တွေ့ဆုံဆွေးနွေးခြင်း (Stakeholder Consultation Meeting) အစီအစဉ်ကို အောက်ဖော်ပြပါအစီအစဉ်အတိုင်း ထောင်ရွက်မည်ဖြစ်ပါသဖြင့် စိတ်ပါဝင်စားသူများ တက်ရောက်နိုင်ပါရန် လေးစားစွာ ဖိတ်ကြားအပ်ပါသည်။

အစည်းအဝေးအစီအစဉ်

ရက်စွဲ - ၂၀၁၉ ခုနှစ် ဇွန် ၂၅ ရက် (အင်္ဂါနေ့)
အချိန် - နံနက် ၉ နာရီမှ မွန်းတည့် ၁၂ နာရီအထိ
နေရာ - Thaketa Power Plant Compound ၊ သာကေတမြို့နယ်။
U Energy Thaketa Power Co.,Ltd.


ကြေးမုံ
The Mirror Daily

ဘဏ္ဍာရေးကော်မရှင် (၃/၂၀၁၉) ကြိမ်မြောက် အစည်းအဝေး ကျင်းပ

နှစ်စဉ်ခွဲဝေပေးသည့်အသုံးစရိတ်များအား နိုင်ငံတော်နှင့် ပြည်သူများအတွက် ထိရောက်စွာအကျိုးပြုရန်လိုအပ်ကြောင်း၊ နိုင်ငံတော်သမ္မတ ဦးဝင်းမြင့် ပြောကြား

ဝိဘင်ကြေးလွှာ

106 MW Thaketa Combine Cycle Power Plant နှင့်ပတ်သက်သော ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း၊ အစီရင်ခံစာအတွက် လိုအပ်သော စီမံကိန်းနှင့် သက်ဆိုင်သူများနှင့် တွေ့ဆုံဆွေးနွေးခြင်း အစီအစဉ်

U Energy Thaketa Power Co.,Ltd မှ JV/BOT စနစ်ဖြင့် အကောင်အထည် ဆောင်ရွက်လျက်ရှိသည့် သဘာဝဓာတ်ငွေ့နှင့် ခွန်အားသုံးစက်အားပေးစက်ရုံ စီမံကိန်း အတွက် ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း (EIA) အစီရင်ခံစာကို U Energy Thaketa Power Co.,Ltd နှင့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာနမှ တာဝန်ရှိ စီစစ်ရေးအဖွဲ့သည် ညှိနှိုင်းဆွေးနွေးမှုများ ပြုလုပ်ခဲ့ပြီး အစီရင်ခံစာကို ၂၀၁၈ ခုနှစ်၊ ဧပြီလတွင် ပြန်လည်ပြင်ဆင် တင်သွင်းခဲ့ပါသည်။

သို့ဖြစ်ပါ၍ စီမံကိန်းနှင့် သက်ဆိုင်သူများအား တွေ့ဆုံဆွေးနွေးခြင်း (Stakeholder Consultation Meeting) အစီအစဉ်ကို အောက်ဖော်ပြပါအစီအစဉ်အတိုင်း ဆောင်ရွက် မည်ဖြစ်ပါသဖြင့် စိတ်ပါဝင်စားသူများ တက်ရောက်နိုင်ပါရန် လေးစားစွာ ဖိတ်ကြားအပ်ပါသည်။

အစည်းအဝေးအစီအစဉ်

ရက်စွဲ ။ ၂၀၁၉ ခုနှစ်၊ ဇွန်လ ၂၅ရက် (အင်္ဂါနေ့)
အချိန် ။ နံနက် (၉၀၀) နာရီမှ (၁၂၀၀) နာရီထိ
နေရာ ။ **Thaketa Power Plant Compound** သာကေတမြို့နယ်။
U Energy Thaketa Power Co.,Ltd.

39

တက်ရောက်ခြင်းအတွက် အထူးကျေးဇူးတင်ပါသည်။

အမေးအဖြေကဏ္ဍ

40

တက်ရောက်သူများလက်မှတ်

(၇)

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U ENERGY THAKETA POWER CO., LTD

Public Consultation Meeting
Signature Book

Date: 25/06/2019

No.	Name	Position	Department / Address	Phone No.	Sign
1	Aung Thu Kyaw	DD.	ECD	09250155729	[signature]
2	Thet Lwin Oo	SO	[illegible]	09428120[illegible]	[signature]
3	Hsaung Hnin Phyu	,	IPRD	[illegible]	[signature]
4	Kyaw Hein		IPRD	09-458217746	[signature]
5	Daw Aye Aye Myint	TEO.	Education	09.452988734	[signature]
6	U YE WIN	H. H.	Edu	09.4306994[illegible]	[signature]
7	U Ye Min Tun	Plant Manager	Thaketa Power plant	098601919	[signature]
8	U Mg Mg Than	EO	YCDC	0997727510[illegible]	[signature]
9	Htin Paw Win	Repotar	Myanmar Alinn	09720159113	
10	U. Ye Min Htay	Town supervisor	YCDC	0945389185[illegible]	[signature]
11	U. Aung Myo Htay.	〃	YCDC	09.694193230	[signature]
12	[illegible]	[illegible]	[illegible]	09763170882	[signature]

Yangon Crystal Tower 21-04, Kyun Taw Road, Kamaryut Township, Yangon Region, The Republic of the Union of Myanmar. Tel.: 09-788465866

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Date: 25/06/2019

No.	Name	Position	Department / Address	Phone No.	Sign
13	[illegible]	Dy GM	YESC	444804450	[illegible]
14	[illegible]	EE	YESC	456880096	[illegible]
15	[illegible]	[illegible]	[illegible]	5093414	[illegible]
16	[illegible]	Vice Chairman	MEAA	092042233	[illegible]
17	[illegible]	[illegible]	GAD	09-264564151	[illegible]
18	[illegible]	[illegible]	[illegible]	09-5187330	[illegible]
19	[illegible]	[illegible]	10/N.Q..	09-250798714	[illegible]
20	[illegible]	[illegible]	[illegible]	095097144	[illegible]
21	[illegible]	Dir	REM	09400250 5836	[illegible]
22	[illegible]		[illegible]		[illegible]
23	Yang Bing	Dy MD	U ENERGY	09972016158	[illegible]
24	Yang Zisuyun	Represtative	UREC	0976697128	[illegible]
25	[illegible]	[illegible]	U Energy	09788465866	[illegible]

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Date: 25/06/2019

No.	Name	Position	Department / Address	Phone No.	Sign
26	U Aung Myein Kyaw	Chairman	YCDC Thaketa	09255290081	
27	U Soe Lin Htike	township Administrator	GAD Thaketa	094306099	
28	U Kyaw Htwe	MP		095002018	25.6.19
29 4A	Daw May Thandar Hlaing	[illegible] (J)	YCDC	09,783511069	
30 ~~5~~	U THURA ZAW	MEEBER (9)	YCDC	09420052127	
31 6	[illegible]	[illegible]	[illegible]	[illegible]	Nyein
32 7	[illegible]	[illegible]	[illegible]	09-895251 335	
33 8.	Thin Yadi Htet	chemical Analyst	Chemical	09-428100226	Hlin

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Date: 25/06/2019

No.	Name	Position	Department / Address	Phone No.	Sign
34	[illegible]	[illegible]	[illegible]	09-421085257	
35	[illegible]	[illegible]	[illegible]	09 450033110	
36	Daw Nu Nu Aung	Proprietor	Kyaw Hotel	09.20433332	
37	[illegible]	[illegible]		09.402358855	
38	[illegible]	[illegible]	[illegible]	09 7777[illegible]	
39	[illegible]	[illegible]	[illegible]	09-699469105	
40	[illegible]	[illegible]	[illegible]	09-59055-249	
41	[illegible]	[illegible]	[illegible]	09250018729	
42	[illegible]	[illegible]	[illegible]	09 41229422	
43	[illegible]	G.M	Kingdom Power Co., Ltd	452335166	
44	[illegible]	Vice chairman APW	ASW RBAM	09 ~~43943~~	
45	[illegible]	[illegible]	[illegible]	09 4AA80Y722	
46	[illegible]	[illegible]	[illegible]		
47	[illegible]	[illegible]	[illegible]	09456855385	
48	[illegible]	[illegible]	[illegible]	[illegible]	

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Date: 25/06/2019

No.	Name	Position	Department / Address	Phone No.	Sign
49	[illegible]	[illegible]	[illegible]	094500094 21	
50	[illegible]	[illegible]	"	096837609209	
51	[illegible]	GM	TPC	09401558370	
52	[illegible]	Assistant BD Manager	TPC	09420220563	
53	[illegible]	Junior Engineer	TPC	09961714195	
54	[illegible]	BD Manager	TPC	09250977887	
55	[illegible]	[illegible]	[illegible]	09250680290	
56	[illegible]	(10) [illegible]	[illegible]	095500[illegible]	
57	[illegible]	[illegible]	"	09254375296	
58	[illegible]		[illegible]	09798177578	
59	[illegible]	[illegible]	[illegible]	095182738	
60	[illegible]	[illegible]	[illegible]	09.5079977	
61	Daw Yin Minn Aung	Project Manager	Kingdom Power Co;	09 253677620	
62	U Hla Kyi	[illegible]	[illegible]	09-97811978	
63	[illegible]	"	"	[illegible]	

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Date: 25/06/2019

No.	Name	Position	Department / Address	Phone No.	Sign
64					
65				09251030090	
66					
67				09420317205	
68					
69				09.25310750	
70					
71				09-254213524	
72	Daw Hla Myo Myint	Assistant	General Department	09-966831895	
73	Daw Khin Cho Thet	Dispatcher	operation Dep't	09.953447455	

Feed Back Form

အကြံပြုလွှာ

လူထုပူးပေါင်းပါဝင်ဆွေးနွေးပွဲ

သာကေတ သဘာဝဓာတ်ငွေ့နှင့်စွန့်ပစ်အပူသုံးဓာတ်အားပေးစက်ရုံစီမံကိန်း

နေ့စွဲ - ၂၅.၆.၂၀၁၉(အင်္ဂါနေ့) နေရာ- U Energy ဓာတ်အားပေးစက်ရုံ

အကြံပြုချက်များအားအောက်တွင်ဖော်ပြပေးပါရန်။ လူကြီးမင်း၏အကြံပြုချက်အားလိုက်လှဲစွာကြိုဆိုပါသည်။		
အမည်		လူကြီးမင်း၏အမည်မဖော်ပြလိုပါက ချန်လှပ်ထားနိုင်ပါသည်။
ဆက်သွယ်ရန်ဖုန်း	09-694193250	
နေရပ်လိပ်စာ	သာကေတ မြို့နယ်.	

၁။ ဓာတ်ဆီ၊ ဒီဇယ်၊ ရေနံ ဆိုင်းအားရေ၊ မီးစက်များအား ရပ်ကွက်နေ ပြည်သူများ သိရှိနိုင်ရေးအတွက် စက်ရုံရှေ့တွင် LED ဘုတ်များ တပ်ဆင်၍ နှုန်းထားကို [illegible] ဖြင့် [illegible] ဖော်ပြပေးစေလိုခြင်း။

၂။ ရပ်ကွက်နေ ပြည်သူများ သဘာဝဓာတ်ငွေ့ရှင်းနိုင်ရေးအတွက် ကျောင်းများ၊ ရပ်ကွက် လမ်းများ [illegible] များအား ကောင်းကိုလာပါက စက်ရုံဝင်းတွင်း [illegible] ပေးစေလိုခြင်း။

၃။ ရပ်ကွက်နှင့် သင်တန်းသားများ ရေဆိုးထုတ်မြောင်းများ ကောင်းစေရေးအတွက် ပူပေါင်း ကူညီဆောင်ရွက်ပေးစေလိုခြင်း။

၄။ စက်ရုံမှ [illegible] တွင်ရှိသော [illegible] များအား [illegible] ဆောင်ရွက်ပေးရန်။

၅။ ပြည်သူများ [illegible] အား [illegible] ဆောင်ရွက်ခြင်းအား ပြသပေးရန်။ [illegible] ရပ်ကွက်နေ ပြည်သူများ၏ [illegible] စေလိုခြင်း။

၆။ စက်ရုံတည်ဆောက်ခြင်းများ [illegible] ကူညီ ဆောင်ရွက်ပေးနိုင်ရေးအတွက် ဆောင်ရွက်ပေးစေလိုခြင်း။

၇။ စက်ရုံ ပတ်ဝန်းကျင် သဘာဝ [illegible] ရေးအတွက် [illegible] များ စိုက်ပျိုးပေး ခြင်းများ ပြုလုပ်ပေးရန်။

၈။ [illegible] ပြည်သူများ၊ [illegible] ဆောင်ရွက်ပေးခြင်းအတွက် [illegible] သိရှိစေ ဆောင်ရွက်ပေးရန်။

၉။

အကြံပြုလွှာ

လူထုပူးပေါင်းပါဝင်ဆွေးနွေးပွဲ

သာကေတ သဘာဝဓာတ်ငွေ့နှင့်စွန့်ပစ်အပူသုံးဓာတ်အားပေးစက်ရုံစီမံကိန်း

နေ့စွဲ - ၂၅.၆.၂၀၁၉(အင်္ဂါနေ့)

နေရာ- U Energy ဓာတ်အားပေးစက်ရုံ

အကြံပြုချက်များအားအောက်တွင်ဖော်ပြပေးပါရန်။

လူကြီးမင်း၏အကြံပြုချက်အားလိုက်လံစွာကြိုဆိုပါသည်။

အမည်		လူကြီးမင်း၏အမည်မဖော်ပြလိုပါက ချန်လှပ်ထားနိုင်ပါသည်။
ဆက်သွယ်ရန်ဖုန်း		
နေရပ်လိပ်စာ		

- [illegible]
- PC [illegible]
- [illegible] PC [illegible]
- [illegible]

အကြံပြုလွှာ

လူထုပူးပေါင်းပါဝင်ဆွေးနွေးပွဲ

သာကေတ သဘာဝဓာတ်ငွေ့နှင့်စွန့်ပစ်အပူသုံးဓာတ်အားပေးစက်ရုံစီမံကိန်း

နေ့စွဲ - ၂၅.၆.၂၀၁၉(အင်္ဂါနေ့)

နေရာ- U Energy ဓာတ်အားပေးစက်ရုံ

အကြံပြုချက်များအားအောက်တွင်ဖော်ပြပေးပါရန်။

လူကြီးမင်း၏အကြံပြုချက်အားလိုက်လှဲစွာကြိုဆိုပါသည်။

အမည်	ဦး [illegible] ကျော်	လူကြီးမင်း၏အမည်မဖော်ပြလိုပါက ချန်လှပ်ထားနိုင်ပါသည်။
ဆက်သွယ်ရန်ဖုန်း	0955009909	
နေရပ်လိပ်စာ	[illegible]	

၁။ [illegible]

၂။ [illegible] Water treatment [illegible]

၃။ [illegible]

အကြံပြုလွှာ

လူထုပူးပေါင်းပါဝင်ဆွေးနွေးပွဲ

သာကေတ သဘာဝဓာတ်ငွေ့နှင့်စွန့်ပစ်အပူသုံးဓာတ်အားပေးစက်ရုံစီမံကိန်း

နေ့စွဲ - ၂၅.၆.၂၀၁၉(အင်္ဂါနေ့)

နေရာ- U Energy ဓာတ်အားပေးစက်ရုံ

အကြံပြုချက်များအားအောက်တွင်ဖော်ပြပေးပါရန်။ လူကြီးမင်း၏အကြံပြုချက်အားလိုက်လံစွာကြိုဆိုပါသည်။		
အမည်	နိုးတင့်လွင်	လူကြီးမင်း၏အမည်မဖော်ပြလိုပါက ချန်လှပ်ထားနိုင်ပါသည်။
ဆက်သွယ်ရန်ဖုန်း	42030 [illegible]205	
နေရပ်လိပ်စာ		

အကြံပြုချက် - (၁) [illegible] စီမံကိန်းမှာ ဆို [illegible] မပါဘဲ ဆိုပါက [illegible] စီမံကိန်း ပတ်ဝန်းကျင် ကို ဥပဒေ [illegible] များ ကို ပြင်ဆင် [illegible] ဖြစ်စဉ် ပါကြောင်း

(၂) စွန့်ပစ် ရေ/ဆိုး များ / [illegible] များ မည်သို့ စွန့်ပစ် မည်နည်း

(၃) ပတ်ဝန်းကျင်း ဥပဒေ [illegible] ပေါ်ပေါက်မှု [illegible]

အကြံပြုလွှာ

လူထုပူးပေါင်းပါဝင်ဆွေးနွေးပွဲ

သာကေတ သဘာဝဓာတ်ငွေ့နှင့်စွန့်ပစ်အပူသုံးဓာတ်အားပေးစက်ရုံစီမံကိန်း

နေ့စွဲ - ၂၅.၆.၂၀၁၉(အင်္ဂါနေ့)

နေရာ- U Energy ဓာတ်အားပေးစက်ရုံ

အကြံပြုချက်များအားအောက်တွင်ဖော်ပြပေးပါရန်။ လူကြီးမင်း၏အကြံပြုချက်အားလိုက်လှဲစွာကြိုဆိုပါသည်။		
အမည်	ဦးခင်မောင်ဆွေ	လူကြီးမင်း၏အမည်မဖော်ပြလိုပါက ချန်လှပ်ထားနိုင်ပါသည်။
ဆက်သွယ်ရန်ဖုန်း	09254375296	
နေရပ်လိပ်စာ	13/A ကျွဲမလုံးချောင်းမိဘာ	

နိုင်ငံတော်နှင့်ပြည်သူလူထုအတွက် လျှပ်စစ်ဓါတ်အားကို ထုတ်လုပ်ပေးမည့် စီမံကိန်းဖြစ်၍ လိုလားကြိုဆိုပါ၏

သို့သော်

စက်ရုံကြောင့် စက်ရုံအပတ်ဝန်းကျင်နှင့် ပတ်ဝန်းကျင်နေ ပြည်သူလူထုအား ထိခိုက်စေမည့် ဘေးထွက်ဆိုးကျိုးနှင့် အန္တရာယ်များ မပေါ်ပေါက်စေရေး အထူးဦးစားပေး၍ စနစ်တကျ ဆောင်ရွက်ပေးပါရန် တင်ပြပါသည်။

(က) ~~[illegible]~~ ပတ်ဝန်းကျင်နေ ပြည်သူလူထု ကျန်းမာရေး ထိခိုက်စေမည့် အန္တရာယ်ရှိသော အနံ့အသက်ဆိုးများ၊ အခိုး အငွေ့များ မဖြစ်ပေါ်စေရေး

(ခ) ပတ်ဝန်းကျင်လေထုအား ညစ်ညမ်းစေမည့် အကျိုးသက်ရောက်မှုများ မဖြစ်ပေါ်စေရေး

(ဂ) အသံ အကျယ် ဆူညံသံများ မထွက်ပေါ်စေရေး

(ဃ) စက်ရုံမှထွက်ရှိလာမည့် စွန့်ပစ်ရေများ၊ စွန့်ပစ်ပစ္စည်းများကြောင့် ပတ်ဝန်းကျင် ထိခိုက်မည့် အန္တရာယ်ဖြစ်စေခြင်းများ ကာကွယ်ပေးရေး (ဥပမာ လက်ရှိဓါတ်အားပေးစက်ရုံမှ နေ့စဉ်ထုတ်လွှတ်နေသော စွန့်ပစ်ရေများမှ ထွက်ရှိပြီး ဆိုးသော ရွှံ့နွံ နုန်းနှစ်များ ပတ်ဝန်းကျင်ရေမြောင်းများအတွင်း ပိတ်ဆို့မှုများ နှစ်စဉ်ကြုံတွေ့နေရခြင်း)

(င) စက်ရုံပေါ်ပေါက်လာပြီးနောက်ပိုင်းကာလများတွင် စက်ရုံလုပ်ငန်းကြောင့် မဖြစ်နိုင်သော အန္တရာယ်များ မပေါ်ပေါက်စေရေး ကြိုတင်စနစ်တကျ ကာကွယ်ပေးထားရန်

(စ) ပတ်ဝန်းကျင်နှင့် ပတ်ဝန်းကျင်နေပြည်သူလူထုအား ထိခိုက်မှု အန္တရာယ်နည်းနိုင်သမျှ နည်းပါးစေရန် အကောင်းဆုံး၊ အသင့်တော်ဆုံး၊ အမှန်ကန်ဆုံး နည်းလမ်းဖြင့် ဆောင်ရွက်ပေးရန်

(ဆ) နိုင်ငံတော်/ပြည်သူလူထုအတွက် အကျိုးနှင့် ဂုဏ်ဖော်ဆောင်ကျိုး အကျိုးအမြတ် များစွာ ရှိစေရေး

(ဇ) သာကေတမြို့နယ် တစ်ခုတည်းမှာ ပတ်လုံးဝိုင်းကြည့်ဆိုင် ကြုံတွေ့ရမှာဖြစ်သဖြင့် အကောင်းဆုံး အသင့်တော်ဆုံး အခြေအနေ ရှိကြောင်း စနစ်တကျ ဆောင်ရွက်ပေးနိုင်ပါရန် အကြံပြုတင်ပြအပ်ပါသည်။

အကြံပြုလွှာ

လူထုပူးပေါင်းပါဝင်ဆွေးနွေးပွဲ

သာကေတ သဘာဝဓာတ်ငွေ့နှင့်စွန့်ပစ်အပူသုံးဓာတ်အားပေးစက်ရုံစီမံကိန်း

နေ့စွဲ - ၂၅.၆.၂၀၁၉(အင်္ဂါနေ့)

နေရာ- U Energy ဓာတ်အားပေးစက်ရုံ

အကြံပြုချက်များအားအောက်တွင်ဖော်ပြပေးပါရန်။ လူကြီးမင်း၏အကြံပြုချက်အားလိုက်လှဲစွာကြိုဆိုပါသည်။		
အမည်		လူကြီးမင်း၏အမည်မဖော်ပြလိုပါက ချန်လှပ်ထားနိုင်ပါသည်။
ဆက်သွယ်ရန်ဖုန်း		
နေရပ်လိပ်စာ		

ယခုဆွေးနွေးပွဲတွင် လူကြီးမင်းများ၏ ဆွေးနွေးချက်များကို [illegible] ပတ်ဝန်းကျင် ထိခိုက်မှုများ မရှိအောင် [illegible] ဆောင်ရွက်စေချင်ပါသည်

ပတ်ဝန်းကျင် ပြည်သူများကို [illegible] ပတ်ဝန်းကျင် ထိခိုက်မှုများ [illegible] ပြည်သူများ၏ [illegible] များကို [illegible] ဆောင်ရွက်ပေးစေလိုပါသည်

ဝန်ထမ်းများ၏ [illegible] များကို [illegible] စေချင်ပါသည်

ရပ်ကွက်ရှိ ပြည်သူများ အတွက် [illegible] လမ်းများ [illegible] ကောင်းအောင် ဆောင်ရွက်စေချင်ပါသည်

အကြံပြုလွှာ

လူထုတွေ့ဆုံဆွေးနွေးပွဲ

သာကေတ သဘာဝဓာတ်ငွေ့နှင့်စွန့်ပစ်အပူသုံးဓာတ်အားပေးစက်ရုံစီမံကိန်း

နေ့စွဲ - ၂၅.၆.၂၀၁၉(အင်္ဂါနေ့) နေရာ- U Energy ဓာတ်အားပေးစက်ရုံ

အကြံပြုချက်များအားအောက်တွင်ဖော်ပြပေးပါရန်။

လူကြီးမင်း၏အကြံပြုချက်အားလိုက်လံစွာကြိုဆိုပါသည်။

အမည်		လူကြီးမင်း၏အမည်မဖော်ပြလိုပါက ချန်လှပ်ထားနိုင်ပါသည်။
ဆက်သွယ်ရန်ဖုန်း		
နေရပ်လိပ်စာ	၂. [illegible]	

① [illegible] ... မပျက်စီးစေဘဲ . [illegible] ကိုကြိုဆို ပါသည်

② [illegible] ... အကြံပြုပါသည်

③ [illegible] ... ပါသည်

အကြံပြုလွှာ

လူထုပူးပေါင်းပါဝင်ဆွေးနွေးပွဲ

သာကေတ သဘာဝဓာတ်ငွေ့နှင့်စွန့်ပစ်အပူသုံးဓာတ်အားပေးစက်ရုံစီမံကိန်း

နေ့စွဲ - ၂၅.၆.၂၀၁၉(အင်္ဂါနေ့)

နေရာ- U Energy ဓာတ်အားပေးစက်ရုံ

အကြံပြုချက်များအားအောက်တွင်ဖော်ပြပေးပါရန်။

လူကြီးမင်း၏အကြံပြုချက်အားလိုက်လံစွာကြိုဆိုပါသည်။

အမည်	[illegible]	လူကြီးမင်း၏အမည်မဖော်ပြလိုပါက ချန်လှပ်ထားနိုင်ပါသည်။
ဆက်သွယ်ရန်ဖုန်း	၀၉-[illegible]	
နေရပ်လိပ်စာ	[illegible]	

U ENERGY [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

ရန်ကုန်တိုင်းဒေသကြီး၊ သာကေတမြို့နယ်တွင် အကောင်အထည်ဖော်ဆောင်ရွက်မည့် (၁၀၆ မဂ္ဂါဝပ်) သဘာဝဓာတ်ငွေ့ နှင့် စွန့်ပစ်အပူသုံး ဓာတ်အားပေး စက်ရုံစီမံကိန်း၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ(EIA)အပေါ် အစီရင်ခံစာစိစစ်သုံးသပ်ရေးအဖွဲ့ဝင်များ၏ သဘောထားမှတ်ချက်များ

အမည် - [illegible]

ရာထူး - [illegible]

ဌာန - [illegible]

စဉ်	စိစစ်တွေ့ရှိချက်	သဘောထားမှတ်ချက်
၁။	Page(က)တွင် [illegible]	
၂။	[illegible]	[illegible]
၃။	[illegible] 10 inch Gas pipe line [illegible]	[illegible] pipe line [illegible]

ရန်ကုန်တိုင်းဒေသကြီး၊ သာကေတမြို့နယ်တွင် အကောင်အထည်ဖော်ဆောင်ရွက်မည့် (၁၀၆ မဂ္ဂါဝပ်) သဘာဝဓာတ်ငွေ့ နှင့် စွန့်ပစ်အပူသုံး ဓာတ်အားပေး စက်ရုံစီမံကိန်း၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ(EIA)အပေါ် အစီရင်ခံစာစိစစ်သုံးသပ်ရေးအဖွဲ့ဝင်များ၏ သဘောထားမှတ်ချက်များ

အမည် - [illegible]

ရာထူး - [illegible]

ဌာန - [illegible]

စဉ်	စိစစ်တွေ့ရှိချက်	သဘောထားမှတ်ချက်
၁.	[illegible]	- [illegible] E.I.A , EMP [illegible]

ရန်ကုန်တိုင်းဒေသကြီး၊ သာကေတမြို့နယ်တွင် အကောင်အထည်ဖော်ဆောင်ရွက်မည့် (၁၀၆ မဂ္ဂါဝပ်) သဘာဝဓာတ်ငွေ့ နှင့် စွန့်ပစ်အပူသုံး ဓာတ်အားပေး စက်ရုံစီမံကိန်း၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ(EIA)အပေါ် အစီရင်ခံစာစိစစ်သုံးသပ်ရေးအဖွဲ့ဝင်များ၏ သဘောထားမှတ်ချက်များ

အမည် - [illegible]

ရာထူး - [illegible]

ဌာန - [illegible]

စဉ်	စိစစ်တွေ့ရှိချက်	သဘောထားမှတ်ချက်
၁။	[illegible]	[illegible]
၂။	[illegible]	[illegible]

ရန်ကုန်တိုင်းဒေသကြီး၊ သာကေတမြို့နယ်တွင် အကောင်အထည်ဖော်ဆောင်ရွက်မည့် (၁၀၆ မဂ္ဂါဝပ်) သဘာဝဓာတ်ငွေ့ နှင့် စွန့်ပစ်အပူသုံး ဓာတ်အားပေး စက်ရုံစီမံကိန်း၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ(EIA)အပေါ် အစီရင်ခံစာစိစစ်သုံးသပ်ရေးအဖွဲ့ဝင်များ၏ သဘောထားမှတ်ချက်များ

အမည် - ဒေါ်မိုးသူဇာလွင်

ရာထူး - လက်ထောက်ညွှန်ကြားရေးမှူး

ဌာန - အလုပ်ရုံနှင့် အလုပ်သမားဥပဒေစစ်ဆေးရေးဦးစီးဌာန

စဉ်	စိစစ်တွေ့ရှိချက်	သဘောထားမှတ်ချက်
၁။	အစီရင်ခံစာတွင် HSE training များ ပြုလုပ်မည်ဖြစ်ကြောင်း ဖော်ပြထားသော်လည်း training နှင့်ပတ်သက်၍ ဆောင်ရွက်မည့် အစီအစဉ် မပါရှိခြင်း၊	+ အလုပ်သမားများအတွက် training များကို မည်သည့်ပုံစံဖြင့် မည်ကဲ့သို့ ပြုလုပ်မည် ဖြစ်ကြောင်း ဖော်ပြသင့်ပါသည်။
၂။	Occupational Safety and Health နှင့်စပ်လျဉ်း၍ Safe Work Procedures (SWP) များ မပါရှိခြင်း၊ eg. Eliminating, Controlling, Minimizing .. and Providing PPE ဟု ဖော်ပြရာတွင် လုပ်ငန်းနေရာများ ဖော်ပြထားမှု မရှိဘဲ ခြုံငုံရေးသားထားခြင်း	* လုပ်ငန်းခွင်နေရာနှင့် SWP များ ထည့်သွင်းဖော်ပြပေးရန်ပါသည်။ + Safety Posters and signs should be put on workplaces.
၃။	Noise နှင့်စပ်လျဉ်း၍ ပတ်ဝန်းကျင်ရှိ ပြည်သူလူထု နှင့် ပြောဆိုရမှုများရှိသည် ဟု တွေ့ရခြင်း၊	* အလုပ်သမားများအတွက် ဆူညံသံနှင့်စပ်လျဉ်း၍ ဆောင်ရွက်ထားမှုများ ထည့်ရန်ပါသည်။ မိုးသူဇာလွင် 16/1/2020

ရန်ကုန်တိုင်းဒေသကြီး၊ သာကေတမြို့နယ်တွင် အကောင်အထည်ဖော်ဆောင်ရွက်မည့် (၁၀၆ မဂ္ဂါဝပ်) သဘာဝဓာတ်ငွေ့ နှင့် စွန့်ပစ်အပူသုံး ဓာတ်အားပေး စက်ရုံစီမံကိန်း၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ(EIA)အပေါ် အစီရင်ခံစာစိစစ်သုံးသပ်ရေးအဖွဲ့ဝင်များ၏ သဘောထားမှတ်ချက်များ

အမည် -

ရာထူး -

ဌာန -

စဉ်	စိစစ်တွေ့ရှိချက်	သဘောထားမှတ်ချက်
၄။	နိုင်ငံခြားသား အလုပ်သမားများအတွက်	* သက်ဆိုင်ရာ နယ်မြေ အလုပ်သမား ညွှန်ကြားရေး ဦးစီးဌာနတို့ နှင့် ဆက်သွယ်ဆောင်ရွက်ရန်ပါသည်။
၅။	Training	Training အတွက် သက်ဆိုင်ရာ နယ်မြေ အလုပ်ရုံနှင့် အလုပ်သမားဥပဒေစစ်ဆေးရေး ဦးစီးဌာန များနှင့် ဆက်သွယ်ဆောင်ရွက်သင့်ပါသည်။

ရန်ကုန်တိုင်းဒေသကြီး၊ သာကေတမြို့နယ်တွင် အကောင်အထည်ဖော်ဆောင်ရွက်မည့် (၁၀၆ မဂ္ဂါဝပ်) သဘာဝဓာတ်ငွေ့ နှင့် စွန့်ပစ်အပူသုံး ဓာတ်အားပေး စက်ရုံစီမံကိန်း၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ(EIA)အပေါ် အစီရင်ခံစာစိစစ်သုံးသပ်ရေးအဖွဲ့ဝင်များ၏ သဘောထားမှတ်ချက်များ

အမည် - [illegible]

ရာထူး - [illegible]

ဌာန - DICA

စဉ်	စိစစ်တွေ့ရှိချက်	သဘောထားမှတ်ချက်
	[illegible]	[illegible]
	[illegible]	[illegible]

ရန်ကုန်တိုင်းဒေသကြီး၊ သာကေတမြို့နယ်တွင် အကောင်အထည်ဖော်ဆောင်ရွက်မည့် (၁၀၆ မဂ္ဂါဝပ်) သဘာဝဓာတ်ငွေ့ နှင့် စွန့်ပစ်အပူသုံး ဓာတ်အားပေး စက်ရုံစီမံကိန်း၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ(EIA)အပေါ် အစီရင်ခံစာစိစစ်သုံးသပ်ရေးအဖွဲ့ဝင်များ၏ သဘောထားမှတ်ချက်များ

အမည် - Dr. NYEIN THU

ရာထူး - ဒုညွှန်ချုပ်

ဌာန - လုပ်ငန်းခွင်နှင့် ပတ်ဝန်းကျင် ကျန်းမာရေးဌာန

စဉ်	စိစစ်တွေ့ရှိချက်	သဘောထားမှတ်ချက်
၁။	Occupational safety & health law.	- မပါရှိ၊ ထပ်မံဖြည့်စွက်ရန်လိုပါသည်.
၂။	Occupational health - Pre / Periodic medical examination - Occupational hearing Con. - Heat Stress Index.	- အလုပ်သမားများအတွက် medical examination (Pre employment & periodic examination) များလုပ်ရန်. - Hearing test စစ်ရန် (အလုပ်သမား) - Heat stress index တိုင်းတာ၍ Work-rest regime ချရန်.
၃။	Clinic. - Emergency plan. - Community health. -	- မရှိသေး ၊ မတည်ထောင်ရသေး. အလုပ်သမားများကျန်းမာရေးအတွက် - / SSB နှင့် အဆက်အသွယ်ထားရှိပါ. - community health အနီးအနား၌ regularly monitoring လုပ်ပေးပါ.

ရန်ကုန်တိုင်းဒေသကြီး၊ သာကေတမြို့နယ်တွင် အကောင်အထည်ဖော်ဆောင်ရွက်မည့် (၁၀၆ မဂ္ဂါဝပ်) သဘာဝဓာတ်ငွေ့ နှင့် စွန့်ပစ်အပူသုံး ဓာတ်အားပေး စက်ရုံစီမံကိန်း၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ(EIA)အပေါ် အစီရင်ခံစာစိစစ်သုံးသပ်ရေးအဖွဲ့ဝင်များ၏ သဘောထားမှတ်ချက်များ

အမည် - ဒေါက်တာမျိုးမြင့်

ရာထူး - ပါမောက္ခ

ဌာန - မန္တလေးနည်းပညာတက္ကသိုလ်

စဉ်	စိစစ်တွေ့ရှိချက်	သဘောထားမှတ်ချက်
၁။	Waste water treatment system	Technology ပေါ်မူတည် / O&M System (Inspection & monitoring system) Influent Quanty / Eff: Quality
၂။	Risk Assessment & management for Gas turbile Energy Plant	Risk management (Flood, Fire, Earthquicke) / Stream [illegible]
၃။	CSR Program	CSR . [illegible]

Safety System

✓ (Reguard check) [illegible]

[illegible]

ရန်ကုန်တိုင်းဒေသကြီး၊ သာကေတမြို့နယ်တွင် အကောင်အထည်ဖော်ဆောင်ရွက်မည့် (၁၀၆ မဂ္ဂါဝပ်) သဘာဝဓာတ်ငွေ့ နှင့် စွန့်ပစ်အပူသုံး ဓာတ်အားပေး စက်ရုံစီမံကိန်း၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ(EIA)အပေါ် အစီရင်ခံစာစိစစ်သုံးသပ်ရေးအဖွဲ့ဝင်များ၏ သဘောထားမှတ်ချက်များ

အမည် - Dr. Myo Myint

ရာထူး - Prof.

ဌာန - Mandalay Technological university

စဉ်	စိစစ်တွေ့ရှိချက်	သဘောထားမှတ်ချက်
၁။	Intake water	Treatment system အသေးစိတ်ဖော်ပြရန် (sedimentation) How to dispose the sediment (water quality / Process water)
၂။	O & M (operation & maintance system)	ရေးဆွဲရာ (အသေးစိတ် ဝန်အမျိုးအစား များ)၊ Budject [illegible] ဖော်ပြရန်
၃။	Air Pollution Ground water (Natural Source) / Natural Gas	Automatic Scheme .. [illegible] Emission Quality. Alternative Way.

အသုံးပြု ပမာဏများ [illegible] ဖော်ပြရန်

[signature]

ရန်ကုန်တိုင်းဒေသကြီး၊ သာကေတမြို့နယ်တွင် အကောင်အထည်ဖော်ဆောင်ရွက်မည့် (၁၀၆ မဂ္ဂါဝပ်) သဘာဝဓာတ်ငွေ့ နှင့် စွန့်ပစ်အပူသုံး ဓာတ်အားပေး စက်ရုံစီမံကိန်း၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ(EIA)အပေါ် အစီရင်ခံစာစိစစ်သုံးသပ်ရေးအဖွဲ့ဝင်များ၏ သဘောထားမှတ်ချက်များ

အမည် - ဦးဆွေ ထွန်း သက်ကျော်

ရာထူး - AD

ဌာန - R.E section , [illegible] , MOEE

စဉ်	စိစစ်တွေ့ရှိချက်	သဘောထားမှတ်ချက်
1.	Emergency response program အား ဖြည့်သွင်းထား ခြင်းမရှိသည်ကိုတွေ့	Human or Natural disaster ကြောင့် ဖြစ်လာသည့် emergency အတွက် industry အတွင်း စီမံဆောင်ရွက် ချက်၊ ဖြည့်သွင်းရမည့်အား early warning system ထားရှိရန် လိုအပ်သည် ပါသည်။
2.	Sulfur emission မရှိကြောင်း တွေ့ရှိရ	desulfurisation equipment မပါဝင်ဆောင်ရွက်သည်။ အဆိုပါ sulphur content ပါဝင်မှုသည် fuel quality အပေါ် မူတည်ပါသဖြင့် စက်ရုံလည်ပတ် နိုင်းတာင်းများ အတွင်း sulphur gas အား detection/GLMS သင့်ပါသည်။
3.	Public communication သည် ၎ Yangon ကဲ့သို့သော highly populated area တွင်အရေးကြီး ပါသည်။	Proper ကောင်းမွန်သော / public complaint or communication ထားရှိသင့်ပါသည်။

ရန်ကုန်တိုင်းဒေသကြီး၊ သာကေတမြို့နယ်တွင် အကောင်အထည်ဖော်ဆောင်ရွက်မည့် (၁၀၆ မဂ္ဂါဝပ်) သဘာဝဓာတ်ငွေ့ နှင့် စွန့်ပစ်အပူသုံး ဓာတ်အားပေး စက်ရုံစီမံကိန်း၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ(EIA)အပေါ် အစီရင်ခံစာစိစစ်သုံးသပ်ရေးအဖွဲ့ဝင်များ၏ သဘောထားမှတ်ချက်များ

အမည် - Dr. မြင့်သန်းဦး

ရာထူး - လက်ထောက်ညွှန်ကြားရေးမှူး

ဌာန - ငါးလုပ်ငန်းဦးစီးဌာန

စဉ်	စိစစ်တွေ့ရှိချက်	သဘောထားမှတ်ချက်
၁။	ဒေသခံများ၏ ပြောကြားချက် (Consultation) အရ ဆိပ်ပစ်ရေကြောင့် ငါးများ သေကြေပျက်စီးမှု ကလော ဖြစ်ကြောင်း သုံးသပ်ရန်	- ဆိပ်ပစ်ရေကြောင့် (ငမိုးရိပ် ၁ ချောင်းထဲတွင် ရှိသော ရေနေသတ္တဝါ (ငါးများ) သေကြေမှုရှိ/မရှိ ကို မြန်မာဥပဒေ ဆန်းစစ်ရန်၊ Impact (ထိခိုက်မှု)
		ရှိပါက Minimum Impact (ထိခိုက်မှုအနည်းဆုံး) Medium Impact (ထိခိုက်မှုအလယ်အလတ်) High Impact (ထိခိုက်မှုအမြင့်ဆုံး) အဆင့် ဟူ၍ ~~သုံးခွဲ~~ သုံးပိုင်းခွဲ၍ ဖော်ပြရန်၊ နှင့်
		ဖော်ပြမှုတွင် Mitigation measure ပါ ထည့်သွင်းဖော်ပြရန်၊ ဆိပ်ပစ်ရေ၏ temperature အား Control လုပ်နိုင်မည့် cooling system များ အကောင်အထည်ဖော်မှု အစီအစဉ်များ ထည့်သွင်းဖော်ပြရန်

- To prevent higher temperature to protect fish habitats in this area

ရန်ကုန်တိုင်းဒေသကြီး၊ သာကေတမြို့နယ်တွင် အကောင်အထည်ဖော်ဆောင်ရွက်မည့် (၁၀၆ မဂ္ဂါဝပ်) သဘာဝဓာတ်ငွေ့ နှင့် စွန့်ပစ်အပူသုံး ဓာတ်အားပေး စက်ရုံစီမံကိန်း၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ(EIA)အပေါ် အစီရင်ခံစာစိစစ်သုံးသပ်ရေးအဖွဲ့ဝင်များ၏ သဘောထားမှတ်ချက်များ

အမည် - ဒေါက်တာ [illegible]

ရာထူး - [illegible]

ဌာန - [illegible]

စဉ်	စိစစ်တွေ့ရှိချက်	သဘောထားမှတ်ချက်
	၁။ [illegible] EC law [illegible]	[illegible]
	[illegible] comply [illegible] " Project ~~Proponent~~ Company commits to comply section 7(c) [illegible] Legal commitment [illegible] ၂။ [illegible]	[illegible]
	[illegible] ၃။ [illegible] (က) [illegible]	[illegible]

ရန်ကုန်တိုင်းဒေသကြီး၊ သာကေတမြို့နယ်တွင် အကောင်အထည်ဖော်ဆောင်ရွက်မည့် (၁၀၆ မဂ္ဂါဝပ်) သဘာဝဓာတ်ငွေ့ နှင့် စွန့်ပစ်အပူသုံး ဓာတ်အားပေး စက်ရုံစီမံကိန်း၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ(EIA)အပေါ် အစီရင်ခံစာစိစစ်သုံးသပ်ရေးအဖွဲ့ဝင်များ၏ သဘောထားမှတ်ချက်များ

အမည် -

ရာထူး -

ဌာန -

စဉ်	စိစစ်တွေ့ရှိချက်	သဘောထားမှတ်ချက်
	ထပ်မံဖြည့်စွက်ရမည့် ဥပဒေများ - အောက်ပါ (ခ) လုပ်ငန်းခွင်ဘေးအန္တရာယ်ကင်းရှင်းရေးနှင့် ကျန်းမာရေးဆိုင်ရာ ဥပဒေ (၂၀၁၉) (ပုဒ်မ ၁၂၊ ၁၆၊ ၁၇၊ ၁၈၊ ၂၆(က) မှ (ဆ) ထိ၊ (က) (ဃ) (င)၊ ၂၇၊ ၃၄၊ ၃၅) (ဂ) သယံဇာတ ဥပဒေ၊ ၂၀၁၂ (ပုဒ်မ ၃၀၊ ၂၆) (ဃ) မြေလွတ်၊ မြေလပ်နှင့် မြေရိုင်းများစီမံခန့်ခွဲရေးဥပဒေ ၊ ၂၀၁၂ (၁၀(ဃ) ၊ ၁၉(က) (ဃ))	
	(င) ရေအရင်းအမြစ်နှင့် မြစ်ချောင်းများ ~~[illegible]~~ ထိန်းသိမ်းစောင့်ရှောက်ရေးဥပဒေ ၊ ၂၀၀၆ (ပုဒ်မ ၈(က)၊ ၁၁၊ ၁၉၊ ၂၁(ခ)၊ ၂၂၊ ၂၄(ခ)၊ ၃၀၊ ၃၁(က)) (Conservation of Water Resources and Rivers Law (2016)	

ရန်ကုန်တိုင်းဒေသကြီး၊ သာကေတမြို့နယ်တွင် အကောင်အထည်ဖော်ဆောင်ရွက်မည့် (၁၀၆ မဂ္ဂါဝပ်) သဘာဝဓာတ်ငွေ့ နှင့် စွန့်ပစ်အပူသုံး ဓာတ်အားပေး စက်ရုံစီမံကိန်း၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ(EIA)အပေါ် အစီရင်ခံစာစိစစ်သုံးသပ်ရေးအဖွဲ့ဝင်များ၏ သဘောထားမှတ်ချက်များ

အမည် - ဦးစိုးကော်

ရာထူး - အငယ်တန်းအင်ဂျင်နီယာ-၂

ဌာန - မြို့ပြပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနှင့်သန့်ရှင်းရေး

စဉ်	စိစစ်တွေ့ရှိချက်	သဘောထားမှတ်ချက်
၁	မူဝါဒ၊ ဥပဒေနှင့် လုပ်ငန်းဆိုင်ရာမူဘောင်	- မူဝါဒ၊ ဥပဒေများတွင် YCDC 2018 ဥပဒေ ထည့်သွင်း ဖော်ပြထားမှုမရှိကြောင်းတွေ့ရှိရပါသဖြင့် ထည့်သွင်း ဖော်ပြရန်လိုအပ်ပါသည်။
၂	H2 waste နှင့် waste disposal	- Solid waste နှင့် H2 waste များကို PCCD, YCDC နှင့်ချိတ်ဆက်စွန့်ပစ်ရန် ရှင်းလင်းလိုအပ်ကြောင်းနှင့် စွန့်ပစ်ပုံအဆင့်ကြောင်းဖော်ပြရန်။
၃	AQM တိုင်းတာခြင်း	- AQM တိုင်းတာရာတွင် CO_2 parameter ပါဝင်ရန် ထပ်မံတိုင်းတာရန်လိုအပ်ပါသည်။

16 / 11 2020

ရန်ကုန်တိုင်းဒေသကြီး၊ သာကေတမြို့နယ်တွင် အကောင်အထည်ဖော်ဆောင်ရွက်မည့် (၁၀၆ မဂ္ဂါဝပ်) သဘာဝဓာတ်ငွေ့ နှင့် စွန့်ပစ်အပူသုံး ဓာတ်အားပေး စက်ရုံစီမံကိန်း၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ(EIA)အပေါ် အစီရင်ခံစာစိစစ်သုံးသပ်ရေးအဖွဲ့ဝင်များ၏ သဘောထားမှတ်ချက်များ

အမည် - ဒေါ်သက်နှင်းနှင်းစု

ရာထူး - ဦးစီးအရာရှိ

ဌာန - ECD, Ygn (EIA - section)

စဉ်	စိစစ်တွေ့ရှိချက်	သဘောထားမှတ်ချက်
①	စာမျက်နှာ (၁၈၅) - ပုံ (7.3-1) တွင် location အရ ဖော်ပြထားပြီး လူနေအိမ်များတွင် ထားရှိသော Gas Pipe Line နေရာတွင် လည်ပတ်နေသော စက်သည် (၂၄) နာရီ လည်ပတ်လျက်ရှိသည်ကို On ground site တွင် တွေ့ရှိရပါသည်။	- Noise Monitoring လုပ်ဆောင်သည့်အခါတွင် [illegible]ပြီး တိုင်းတာသင့်ကြောင်း။ လူနေရပ်ကွက်နှင့် နီးကပ်နေသည့်နေရာတွင် ထားရှိသည့် Gas Pipe Line မှ ထွက်ရှိမည့် ဆူညံသံအား လျော့ချနိုင်သည့် နည်းလမ်းများ ထည့်သွင်းရေးသားရန်။
②	ရေငွေ့ လိုင်းများသည် Temperature မြင့်မား လျက်ရှိကြောင်း ကွင်းဆင်း စစ်ဆေးစဉ် တွေ့ရှိရပါသည်။	- ~~Keep~~ Temperature မြင့်မားသည့် steam line အား အကာအကွယ်များဖြင့် ထားရှိရန်။
③	လုပ်ငန်းခွင်အတွင်း ဝင်ရောက်လုပ်ကိုင်သော ဝန်ထမ်းတွေ၏ PPE ပေးမှုအား မတွေ့ရှိရပါ။	- ဝန်ထမ်းတွေ လုပ်ကိုင်ဆောင်ရွက်သော လုပ်ငန်းခွင်အတွင်း PPE ထားရှိရန် - duration, (working hrs.) ဖော်ပြရန်။

Appendix 11

CORPORATE SOCIAL RESPONSIBILITY

Expecting part of the profit of the project to share the social benefit of the community, other than contributing electricity to National Power Grid, a corporate social responsibility programme has to implement for the people in surrounding areas. According to socioeconomic and health survey, stakeholder meetings and public consultation results, the following needs by the community are considered for CSR programme of the project.

- To be free of charge in the health services
- To develop primary level education of the surrounding wards
- Canal system
- Religious Affairs

In line with the survey results, health service is necessary for the people both in two wards in Thaketa Township and expected cost both for capital (one-time) and for annual budget. (TABLE 7-14)

TABLE 7-14 Estimated Cost for Corporate Social Responsibility

No.	Theme	Capital Cost (USD)	Annual Budget (USD)
1.	Upgrading Local Health (2 Clinics in No. 9 and No. 10 Wards of Thaketa Township)	47,060.0	70,000.0
2.	Upgrading Education (maintenance of three schools)	23,600.0	7,000.0
3.	Religious Affairs (donation/upgrading monasteries closed to the project area)	60,000.0	10,000.0
4.	Upgrading Roadside Drainage and canal between Railroad and Project Site (2 kilometer for capital, and regular maintenance)	150,000.0	3,000.0
5.	Other CSR activities (athletics, education prizes, charities etc.)	0	235,200.0
	Total Cost in **USD**	280,660.0	325,200.0
	Total Cost in **Kyats** (Rate average of 2013 May)	266,627,000.0	308,940,000.0
	Static Investment of Power Generation Project	459,054,100	459,054,100
	Proportion (percentage) to total investment	0.06	0.07

3rd June , 2015

Chairman
Myanmar Investment Commission

Subject: **Undertaking regarding Corporate Social Responsibilities (CSR) of U Energy Thaketa Power Company Limited.**

Your Excellency,

Our Company, U Energy Thaketa Power Company Limited, undertakes that 1% of Net Profit earned from our business will be contributed towards Corporate Social Responsibilities (CSR) in the Republic of the Union of Myanmar.

Signature :
Name : Mr. Guan Yukun
Designation : Promoter of the Proposal

175 BEIJING ROAD YUNNAN FOREIGN TRADE BUILDING Kunming Yunnan P. R. China
TEL: +86-871-63164879 FAX: +86-871-63136829
Site: www.urec.com.cn P.C: 650011

Appendix 13

Reference

References

Ali, S. 1979. The book of Indian birds. Bombay Natural History Society, Oxford University Press. pp187

Backer, C. A. & Van Den Brink, R. C. B. (1963). **Flora of Java (Vol. I)**. N.V.P. Noordhoff Groningen, The Netherlands.

Backer, C. A. & Van Den Brink, R. C. B. (1965). **Flora of Java (Vol. II)**. N.V.P. Noordhoff Groningen, The Netherlands.

Backer, C. A. & Van Den Brink, R. C. B. (1968). **Flora of Java (Vol. III)**. N.V.P. Noordhoff Groningen, The Netherlands.

Backer, C.A. *et.al.* 1963. Flora of Java. Vol.I, II, III, N.V.P. Noordhoff-Groningen, The Netherlands.

Birdlife International*,* 2004. Sourcebook of existing and proposed protected areas in Vietnam. 2nd Edition. Hanoi: Birdlife International in Indochina and the Ministry of agriculture and Rural Development

Collar, N.J. (Editor-in-Chief) 2000. Threatened Birds of Asia. The Birdlife International Red Data Book. CD-ROM Edition Version 1.0.

Curtis, J. T. and McIntosh, R. P. (1950). **An Upland Forest Continuum in the Prairie-forest Border Region of Wiscosin. Ecology 32**, 3.

Curtis, J. T. and R. P. McIntosh, 1950**.** Ecology, The interrelations of certain analytic and synthetic phytosociological characters.

Decker, D.J., Krasny,M.E., Goff,G.R., Smith,C.R., Gross,D.W. (Eds.) 1991. Challenges in the Conservation of Biological Resources: A Practitioner's Guide Westview Press, Boulder

Department of Botany, Yangon University **(**1994) **Key to the Families of the Flowering Plants.**

Eve, R. and Guigue, A. 1996. Birds of Thailand. Selangor Darul Ehsan, Malaysia

Francis, C. M. 2001. Mammals of Thailand and Southeast Asia. Published and Distributed in Thailand by Asia Books Ltd.

Grumbine, E.R. 1994. What is Ecosystem Management Conservation Biology, 8:27-38.

Harrison, C. and Greensmith, A. 1993. Birds of the world. A Dorling Kindersley Book, Singapore

Hilton-Taylor, C. 2000. IUCN Red List of Threatened Species. The IUCN Species Survival Commission, U.K.

Hooker, J. D. (1897). **Flora of British India (Vol. 1-7)**. L. Reeve and Company, London.

Hundley, H. G. & Chit Ko Ko (1961). **List of trees, shrubs, herbs and principal climbers, etc.,** Forest Department, Yangon, Myanmar.

IUCN (2000), 2000. IUCN red list of threatened species. Downloaded from http:// www. Redlist.org

IUCN (2009), 2009. IUCN red list of threatened species. Downloaded from http:// www. Redlist.org

Jayaram, K.C. 1981. The freshwater fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka. A handbook of Zoological Survey of India, CalcuttaVolume I and II

Kempton, R.A. (1979). **Sturcture of species abundance and measurement of diversity.**

Biometrics. 35:307-322.

King, B.F.; Woodcock, M. and Dickinson, E.C. 1975. Collins Field Guide Birds of South-east Asia. Harper Collins Publisher. pp480

Krebs, C. J. (1985). **Ecology, The Experimental Analysis of Distribution and Abundance**. 3rd edition, Harper & Row, New York.

Krebs, Charles J. 1985. Ecology, the experimental analysis of distribution and abundance 3rd. edition. Harper & Row, New York.

Kress J. W., Robert A. DeFilipps, Ellen Far and Yin Yin Kyi 2003. A Checklist of the Trees, Shrubs, Herbs, and Climbers of Myanmar.

Kress, W. J., De Filipps R. A., Ellen, F. & Daw Yin Yin Kyi (2003**). A checklist of trees, shrubs, herbs and climbers of Myanmar**. Washington DC.

Lamprecht, H. (1989). **Silviculture in the tropics: Tropical forest ecosystems and their long-term utilization**. (GTZ) GmbH, Eschborn, Germany.

Lamprecht, H., 1989. *Silviculture in the tropics*: *Tropical forest ecosystems and their long-term utilization*. (GTZ) GmbH, Eschborn, Germany.

Lekagul, B. and J. McNeely 1988. Mammals of Thailand. Bangkok, Thailand and Mont-sur-Rolle, Switzerland.

Lekagul, B. and Round, P.D. 1991. A guide to the Birds of Thailand. Published by Saha Karn Bhaet, Co. Ltd. and M.Pearl (eds), Conservation for the twenty-first century, pp109-120. Oxford University Press, New York.

Mueller, D. & Ellenberg, D.E. (1974). **Aims and Methods of Vegetation Ecology**. John Wiley and sons, New York.

Mueller-Dombois, D. and H. Ellenberg, 1974. Aims and Methods of Vegetation Ecology. John Wiley and Sons, New York, USA. 237 pp.

Naw, L.B., 2007. Traditions, Beliefs and Practices: Links with Nature Conservation in Kachin State

Peet, R. K. (1974). **The measurement of diversity**. Ann. Rev. Ecol. Syst. 5: 285-307.

Primak, R.B. 199.5 Dispersal, establishment and population structure: Lessions from ecology theory rare plant reintroduction. In: P.Olwell, C. Millar and D.Falk (eds) Ecological Restorations and Endangered species. Island Press, Washing, D. C.

Reid, W.V. 1992. The United State needs a National Biodiversity Policy. Issues and Ideas Brief. World Resources Institute, Washington, D.C.

Santra, S.C. *et al*., (1999). **College Botany Practical, Vol. I**. 2nd ed. New Central Book Agency Ltd., Calcutta, India.

Scott, J.M.; B.Csuti and F.Davis 1991. Gap Analysis: An application of Geographic Information Systems for Wildlife species. In: D. J. Decker, M. E. Krasny; G. R. Goff; C.R.Smith and

Shannon, C. E. & Wiener, W. (1963). **The mathematical theory of communication**. University of

Illinois Press, Urbana, USA.

Simpson, E. H. (1949). **Measurement of diversity. Nature, 163**, 688.

Smith, B. & Wilson, J.B. (1996). **A consumer's guide to evenness idices**. *Oikos* 76: 70- 82.

Smith, R. L and T. M. Smith, 2001. Ecology and Field Biology, 6th edition. Addison Wesley

Smythies, B.E. 1953. The Birds of Burma. Oliver and Boyd, Published in Great Britain

Smythies, B.E. 2001. The Birds of Burma. Fourth Edition. Natural History Publications (Borneo), Kota Kinabalu, Malaysia.

Talwar, P.K. and A.G. Jhingram 1991. Inland fishes of India and Adjacent Countries. Volume I and II. Oxford & IBH Publishing Co. PT Ltd. New Delhi, Bombay, Calcutta. 1158pp

Tun Yin 1993. Wild mammals of Myanmar. Published by Forest Department, Myanmar.

USEPA (1992), Screening procedure for estimating the air quality impact of stationary sources, Revised, October 1992, EPA-454/R-92-019. U.S. Environmental Protection Agency, Research Triangle Park, NC.

USEPA (1983) Office of Solid Waste & Emergency Response, Hazardous Waste Land Treatment, SW-874

Webster, M. and Fook, C. Y. 1997. A Photographic Guide to Birds of Thailand. Published and distributed in Thailand by Asia Books Co. Ltd.

Win Maung and Win Ko Ko 2000. Turtles and tortoises of Myanmar. Published by Wildlife

Conservation Society (Myanmar).

World Bank (1998), Pollution Prevention and Abatement Handbook, World Bank, Washington.

World Bank Group and IFC (2007), Environmental Health and Safety Guidelines, International Finance Corporation and the World Bank.

World Bank (1999a), Operational Manual –OP 4.01, The World Bank operation manual for environmental assessment, Washington.