

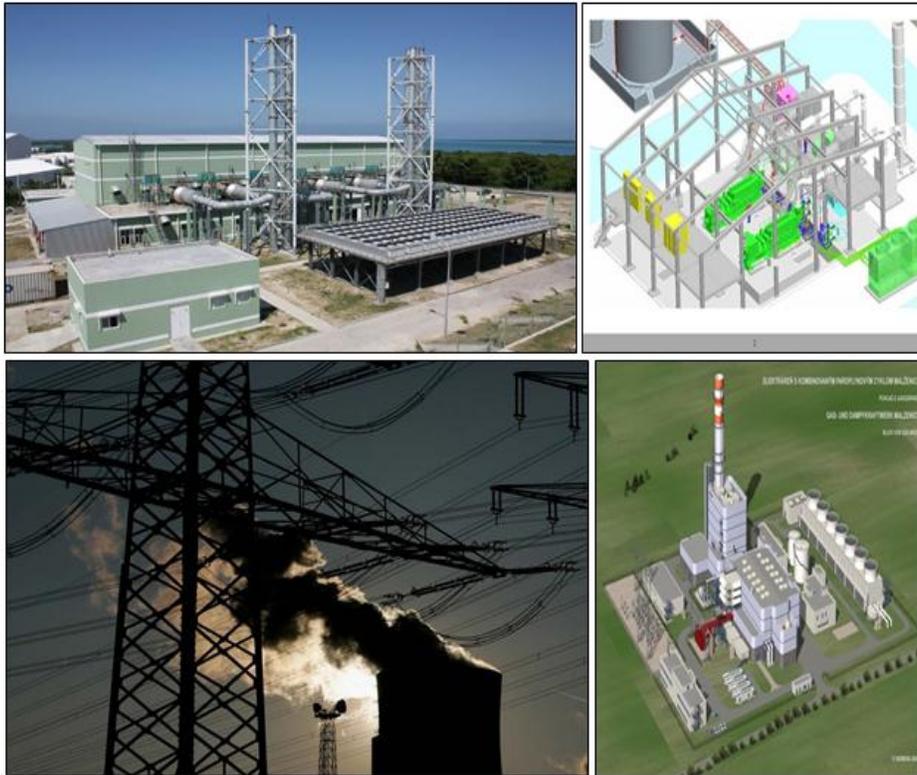
# Environmental Impact Assessment (EIA)

of

## Baraka Patenga Power Limited

at

South Patenga, Chittagong



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# *Abbreviation*

## ABBREVIATION

|                 |   |
|-----------------|---|
| ADB             | Asian Development Bank                      |
| AECL            | Adroit Environment Consultants Limited      |
| BBS             | Bangladesh Bureau of Statistics             |
| BEDL            | Barakatullah Electro Dynamics Limited       |
| BMD             | Bangladesh Meteorological Department        |
| BNBC            | Bangladesh National Building Code           |
| BPPL            | Baraka Patenga Power Ltd.                   |
| BPDB            | Bangladesh Power Development Board          |
| CCC             | Chittagong City Corporation                 |
| CDA             | Chittagong Development Authority            |
| CDMP            | Comprehensive Disaster Management Programme |
| CEPZ            | Chittagong Export Processing Zone           |
| CO <sub>2</sub> | Carbon Dioxide                              |
| DAE             | Department of Agricultural Extension        |
| DOE             | Department of Environment                   |
| DMB             | Disaster Management Bureau                  |
| DPZ             | Detailed Planning Zones                     |
| EAD             | Effective Aerodynamic Diameter              |
| ECA             | Environment Conservation Act 1995           |
| ECR             | Environment Conservation Rules 1997         |
| EIA             | Environmental Impact Assessment             |
| EMP             | Environmental Management Plan               |
| EMS             | Environmental Management System             |

|                   |  |
|-------------------|--|
| EPZ               | Export Processing Zone                             |
| ESMF              | Environmental and Social Management Framework      |
| ESSF              | Environmental and Social Safeguards Framework      |
| FGD               | Flue Gas Desulfurization                           |
| GSHAP             | Global Seismic Hazard Assessment Program           |
| GIS               | Geographic Information System                      |
| GOB               | Government of Bangladesh                           |
| GPS               | Global Positioning System                          |
| GRC               | Grievance Redress Committee                        |
| HFO               | Heavy Fuel Oil                                     |
| HYV               | High-yielding Varieties                            |
| IEE               | Initial Environmental Examination                  |
| IUCN              | International Union for Conservation of Nature     |
| MIM               | Management Information & Monitoring                |
| MoEF              | Ministry of Environment and Forests                |
| NAAQS             | National Ambient Air Quality Standards             |
| NEMAP             | National Environmental Management Action Plan      |
| NGO               | Non-Government Organization                        |
| NOx               | Oxides of Nitrogen                                 |
| PAPs              | Project Affected Persons                           |
| PGA               | Peak Ground Acceleration                           |
| PPIDF             | Private Public Infrastructure Development Facility |
| PM <sub>2.5</sub> | Particulate Matter < 2.5µm                         |
| PM <sub>10</sub>  | Particulate Matter < 10µm                          |

|                 |  |
|-----------------|--|
| REB             | Rural electrification Board                                  |
| SO <sub>2</sub> | Oxides of Sulfur   |
| SOP             | Standard Operating Procedure                                 |
| SPM             | Suspended Particulate Matter                                 |
| TOR             | Terms of Reference   |
| TSP             | Total Suspended Particulates                                 |
| TSS             | Total Suspended Solids                                       |
| UNDP            | United Nations Development Program                           |
| UNCED           | United Nations Conference on the Environment and Development |

## **WEIGHTS AND MEASURES**

|       |                    |
|-------|--------------------|
| °C    | degree Celsius     |
| dB(A) | decibel acoustic   |
| GWh   | giga watt hour     |
| ha    | hectare            |
| km    | kilometer          |
| km/h  | kilometer per hour |
| kWe   | kilowatt-electric  |
| KV    | kilovolt(s)        |
| KVA   | kilo Volt-Amps     |
| m     | meter              |
| mm    | millimeter         |

|                    |                           |
|--------------------|---------------------------|
| m <sup>3</sup>     | cubic meter               |
| m <sup>3</sup> /hr | cubic meters per hour     |
| mg/l               | milligrams per liter      |
| m/s                | meters per second         |
| MTPA               | metric tons per annum     |
| MW                 | megawatt                  |
| ppm                | parts per million         |
| ppt                | parts per thousand        |
| Rpm                | revolutions per minute    |
| TPD                | tons per day              |
| µg/m <sup>3</sup>  | microgram per cubic meter |

# *Glossary*

## GLOSSARY

**Adverse impact:** An impact that is considered undesirable.

**Ambient air:** Surrounding air.

**Aquatic:** Growing or living in or near water.

**Bangla:** Bengali language.

**Baseline (or existing) conditions:** The 'baseline' essentially comprises the factual understanding and interpretation of existing environmental, social and health conditions of where the business activity is proposed. Understanding the baseline shall also include those trends present within it, and especially how changes could occur regardless of the presence of the project, i.e. the 'No-development Option'.

**Bazar:** Market.

**Beel:** A 'back swamp' or depression. Can be either perennial or seasonal.

**Beneficial impacts:** Impacts, which are considered to be desirable and useful.

**Biological diversity:** The variety of life forms, the different plants, animals and micro organisms, genes they contain and the ecosystems they form. It is usually considered at three levels: genetic diversity, species diversity and ecological diversity.

**Char:** Newly accreted land: Land, sometimes islands, within main river channels and nearby mainland or in the estuary, subject to erosion and accretion.

**Ecosystem:** A dynamic complex of plant, animal, fungal and microorganism communities and associated non-living environment interacting as an ecological unit.

**Emission:** The total amount of solid, liquid or gaseous pollutant emitted into the atmosphere from a given source within a given time, as indicated, for e.g., in grams per cubic meter of gas or by a relative measure, upon discharge from the source.

**Endangered species:** Species in danger of extinction and whose survival is unlikely if the existing conditions continue to operate. Included among those are species whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to suffer from immediate danger of extinction.

**Environmental effects:** The measurable changes, in the natural system of productivity and environmental quality, resulting from a development activity.

**Environmental impact assessment (EIA) / Environmental assessment:** The systematic, reproducible and interdisciplinary identification, prediction and evaluation, mitigation and management of impacts from a proposed development and its reasonable alternatives, sometimes known as environmental assessment.

**Environmental Impact:** An estimate or judgment of the significance and value of environmental effects for natural, socio-economic and human receptors.

**Environment Management Plan (EMP):** A Plan to undertake an array of follow-up activities which provide for the sound environmental management of a project/ intervention so that adverse environmental impacts are minimized and mitigated; beneficial environmental effects are maximized; and sustainable development is ensured.

**Environmental Management:** Managing the productive use of natural resources without reducing their productivity and quality.

**Erosion:** Process in which wind and water removes materials from their original place; for instance, soil washed away from an agricultural field.

**Evaluation:** The process of looking back at what has been really done or accomplished.

**Fauna:** A collective term denoting the animals occurring in a particular region or period.

**Field Reconnaissance:** A field activity that confirms the information gathered through secondary sources. This field study is essentially a rapid appraisal.

**Flora:** All of the plants found in a given area.

**Habitat:** The natural home or environment for a plant or animal.

**Household:** A household is identified as a dwelling unit where one or more persons live and eat together with common cooking arrangement. Persons living in the same dwelling unit having separate cooking arrangements constitute separate household.

**Important Environmental Component (IEC):** These are environmental components of biophysical or socio-economic importance to one or more interested parties. The use of important environmental components helps to focus the environmental assessment.

**Initial Environmental Assessment / Evaluation:** Preliminary analysis undertaken to ascertain whether there are sufficient likely significant adverse impacts to warrant a 'full' EIA. In some countries, use of initial assessment forms a meaning of "screening" proposed projects.

**Khal:** Small Channel, canal.

**Land use:** Types include agriculture, horticulture, settlement, pisciculture and industries.

**Mauza:** A Bangla word for the smallest government administrative area corresponding to village revenue unit.

**Mitigation:** An action, which may prevent or minimize adverse impacts and enhance beneficial impacts.

**Negative Impact:** Negative change from the existing situation due to the project.

**Public involvement / Public consultation:** A range of techniques that can be used to inform, consult or interact with stakeholders' affected / to be affected by a proposal.

**Reversible impact:** An environmental impact that recovers either through natural process or with human assistance (e.g. cutting off fish migration by an embankment might be reversible at a later stage if a proper regulator is built).

**Stakeholders:** Those who may be potentially affected by a proposal, e.g. Local people, the proponent, government agencies, NGOs, donors and others, all parties who may be affected by the project or to take an interest in it.

**Taka:** Unit of Bangladeshi currency.

**Terrestrial:** Living on land.

**Thana:** Sub-district level of government administration, comprising several unions under district.

**Union:** Smallest unit of local self government comprising several villages.

**Upazila:** Sub-district name. Upozila introduced in 1982.

**Zila:** Bengali word of district.

# *Executive Summary*

## Executive Summary

### 1. Introduction

This report represents the results of Environmental Impact Assessment (EIA) of Baraka Patenga Power Plant (BPPL) being implemented by Barkatullah Electro Dynamic Ltd (BEDL). The company will install equipment to generate 59 (nominal) MWe power in the plant. The plant will consist of 8 units of highly efficient Rolls-Royce HFO Generator sets and a steam co-generation system operated with waste heat from the HFO engines to supply to the national grid at South Patenga, Chittagong. The plant will be equipped with a FGD (Flue gas desulfurization) system to reduce SO<sub>x</sub> emission by about 90%. The objective of this study is to provide an examination and assessment of the principal environmental impacts of the industry. The company has received the approval from Government of Bangladesh for establishment of this power plant. The Company has signed a Power Purchase Agreement with Bangladesh Power Development Board (BPDB) and Implementation Agreement with Government of Bangladesh and obtained Environmental Site Clearance Certificate from Department of Environment (DoE) vide letter No.PO/ChaBhi/Charpatra-17611/2011/147; Date: 13.10.2013. Baraka Patenga Power Plant is located in the heavy industrial and commercial setting of Patenga, Chittagong. There are no particularly sensitive ecological, cultural and archeological sites in the area. The plant will not involve any relocation of human settlement, as the project is situated on vacant land purchased from private individuals. The area enjoys necessary infrastructure facilities for years, which include communication, electricity, telecommunication etc. This EIA report comprises 12 sections and the contents of these sections are summarized below.

### 2. Policy and Legal Considerations

This EIA report has been prepared by following the methodology prescribed in the EIA guidelines for industries of DOE, ECA95 and ECR97, that are the main legislative documents relating to environment protection in Bangladesh. The report is also compliant with WB group's operational policies and guidelines. Steps to consult potentially affected people by the project and to disclose the EIA report to the public have been taken for compliance with the Bank's policy (OP 4.01) in the EIA preparation, although these are non-mandatory as per national legislations. The environmental classifications for industrial projects in Bangladesh are based on "inclusion lists" given in the ECR97 with 'RED' being the highest category. Power Plant is listed in the '**Red Category**' in ECR97 (i.e., serial no.6 in the ECR97 Red list in Schedule-1.). WB environmental categorization is based on potential impacts and according to WB criteria (OP/BP 4.01); and this project has been classified in the '**B**' category.

### 3. Description of the Project

The plant is to be powered by 8 reciprocating HFO internal combustion engines made by Rolls-Royce, each of capacity 6.985MW. Besides, the plant will have a co-generation unit consists of Superheated Steam boiler and steam turbine to produce

3.3MW electricity. The cogeneration Steam Turbine system will have a Cooling Tower to supply water to the steam condensation unit. The flue gas coming out from the waste heat boiler will be passed through the FGD plant to reduce the SOx emission through the stack by about 90%. With the FGD, the emission level for SO<sub>2</sub> will be equivalent to 0.3% Sulfur HFO which is in compliance of WB group's guidelines requirement of 0.5% sulfur content in fuel for internal combustion engine based power plants of 50 MWh or more in degraded airsheds. The basic information of the project are given below:

|                         |   |
|-------------------------|---|
| 1. Name of the Project  | Baraka Patenga Power Plant  |
| 2. Project Location     | Power Plant: South Patenga, Chittagong.<br>Dhaka Office: 6/A/1 (2nd Floor), Segunbagicha, Dhaka-1000.                               |
| 3. Type of Business     | Power Generation  |
| 4. Plant Description    | 8 engines, each of capacity 6.985MW and an additional 3.3MWe (Co-generation) unit   |
| 5. Net Plant Capacity   | 59 MWe nominal output capacity<br>50 MWh contractual net output capacity  |
| 6. Emission Control     | Wet FGD (Flue gas desulfurization) system to reduce SO <sub>x</sub> emission by about 90% (i.e., equivalent to 0.3% sulfur in HFO). |
| 7. Project Cost         | BDT. 3,350.Million  |
| 8. Total Area of Land   | 3 Acres / 11,838 m <sup>2</sup> (approximately)   |
| 9. Total Area Developed | 11,838 m <sup>2</sup> (approximately)   |
| 10. Total Covered Land  | 1208 m <sup>2</sup>   |
| 11. Employment          | 98 persons  |
| 12. Fuel Requirement    | Heavy Fuel Oil: 6500 M.Tons/Month   |
| 13. Source of Water     | Deep Tube well  |
| 14. Water Requirement   | Household/Domestic: 1 cubic meter/hour<br>Industrial: 32 cubic meter/hour   |

The installed capacity of the project is 59MWe (nominal). However, the declared capacity of the power plant is 50MW as per the PPA with the Bangladesh Power Development Board.

The project will have some ancillary other facilities, as water treatment plant, demineralized water treatment (reverse osmosis), oily water separation plant, gypsum dewatering plant etc to support the main equipment of the project.

The plant is located at Patenga, Chittagong (22°14'17.25" N: 91°48'48.49"E) having an area of about 12,000 square meters. The plant will not involve any relocation of human settlement, as the project is situated on the purchased vacant land of private individuals based on willing sellers and buyer negotiations without any undue influence from the buyer. The land ownership documents (referred to as Khatians) are given in the annex-14. The distance of the existing plant is about 10 km from the zero point (i.e. city center) of Chittagong and about 1 Km from the sea shore. The ground elevation at the site is

about 7 meters above AMSL and above the 100 years' flood level. The project site is located in a heavy industrial area with different large industrial units within the 10km radius of the project. These industries produce around 1993 MWe power. The site has all the infrastructural facilities like road communication, electrical grid lines, telecommunications etc. The fuel (HFO) required for the plant will be transported by road to the plant's storage facility using 25MT capacity Tank Lorry from the storage facility at Chittagong Port area at a distance of approximately 3-4 km from the power plant.

#### **4. Baseline Environment**

Baseline environment is concerned with existing physical, chemical and biological conditions of the area where the plant is going to be set up. The surface water, ground water, ambient air quality and noise level have been analyzed to evaluate the primary baseline of the area. The data from Continuous Air Monitoring Station (CAMS) of DOE at Agrabad have been used to evaluate the monthly concentrations of PM<sub>2.5</sub> and PM<sub>10</sub> in the project area.

In the vicinity of the plant, there is no permanent fresh water body but the river Karnafully is nearby. Ground water exists at a shallow depth (generally below 5.0 m) in the area. Ground water is a stable source of water for industrial use in this area. Salinity, hardness and iron content for the ground water are high and groundwater will be appropriately treated for use in the plant. In common with other peri-urban areas; birds like Crow, Salik, Kokil, etc are seen at times at the project site. There are no wildlife, natural forest and vegetation, endangered species of present in and around the plant site. There are a number of different types of trees like coconut, jack fruit, mango trees etc. around the plant site.

The climate of the region is of tropical monsoon type. According to Bangladesh Meteorological Department, the maximum temperature at Chittagong is 32.3° C in May and minimum temperature is 13.9 °C in January. Mean relative humidity for an average year is recorded as 73.7% and on a monthly basis; it ranges from 58% in January & February to 86% in August. At normal times, the maximum and minimum wind speeds at Chittagong are 24.6 km/hr and 4.0 km/hr respectively. The prevailing wind direction is from south-southwest during the monsoon period and north/north-west during winter. The rainfall is mostly confined in the monsoon season i.e., between May to October. Maximum and minimum rainfalls are 727 mm and 5.6 mm in July and January respectively with a yearly average of around 2700 mm.

Chittagong City center is about 10 km away from the plant site and the area belongs to the same airshed as the Chittagong City. The air quality parameter values in the airshed exceed national Air Quality Standards during dry season (i.e., November-May). The poor air Quality of Chittagong City is due to extensive industrial and urban activities including vehicular emission. The data from the DOE CAMS (continuous air quality

monitoring stations) show that the airshed is degraded and NAAQS (National Ambient Air Quality Standards) can't be met for PM10 and PM2.5. The baseline levels for other criteria pollutant i.e., CO, SO<sub>2</sub>, NO<sub>2</sub> and O<sub>3</sub> are compliant with NAAQS. Baseline noise levels were measured during the study period in four locations around the plant site and were found to be below 70dBA.

## 5. Potential Impacts of the Proposed Project

The purpose of impact evaluation is to assign relative significance to the predicted impacts associated with the project, and thus determine the order in which impacts are to be avoided or mitigated. It should be noted that impact evaluation are somewhat subjective as the impacts can't always be quantified before the event. The following are the main objectives of impact evaluation: (i) Distinguish between impacts that are of most concern (need to be avoided/ mitigated) and those that are considered to be less important; (ii) Organize measures of significance in a way that allows a comparison of alternative project proposals; and (iii) Facilitate the communication of results to the concerned public and to decision makers. Key elements for assessing impact significance are: (i) Scientific and professional judgment; (ii) Disturbance/disruption of valued ecological systems; (iii) Degree of negative impact on social values and quality of life; and (iv) Public perception versus the scientific/professional opinion of the risks/benefits involved.

The construction of the plant can create some adverse impact on the existing environment. The acoustic impacts, dust emission, traffic congestion and sanitation during the construction period would be limited to construction of building and site preparation and due to installation of power plant itself. Since the plant would be set up on BPPL's own land, the resettlement would not be an issue here. During construction, the plant authority will adopt all necessary measures to reduce the probable environmental impacts from different aspects.

Identification of potential impacts due to the plant location and operation of the plant has been done using a checklist. The checklist contains the environmental effects and impacts designated to stimulate the analysis and to consider broadly the possible consequence of contemplated actions. The significant impacts in different phases i.e., (i) due project location and design, (ii) construction phase and (ii) operation phase have been identified using the process. As the construction of the plant is now nearing completion, the impacts due to operation are most important now. These are: (i) Air Emissions especially SO<sub>x</sub>, (ii) Noise, (iii) Water pollution, (iv) Occupational health, and (iv) Emergency/disaster impact.

## 6. Prediction and Evaluation of Impacts

As the proposed power plant will utilize Heavy Fuel Oil (HFO) as fuel, the pollutants of potential concern are Particulates, sulfur dioxide, oxides of nitrogen, carbon dioxide and carbon monoxide during the operation period of the project. Each of these

pollutants has been examined to ensure the Bangladesh emission limit standard as well as IFC/WB, where appropriate, the required emission control techniques would be incorporated into the mitigation measures. The ground concentration of NO<sub>x</sub> and SO<sub>2</sub> emission have been determined by air emission dispersion modeling by using USEPA approved AERMOD model up to a distance of 10km radius to the project site.

As explained above, the main potential environmental impacts, which may arise as a result of construction of the power plant, can be grouped as follows: (i) Atmospheric emissions and Air quality, (ii) Noise generation, (iii) Oil spillage, and (iv) Water pollution and waste water disposal. These aspects have been examined and the findings are summarized below.

**Atmospheric Emission and Air Quality:** Emission of Particulates (PM 10 and PM 2.5), sulfur dioxide, Nitrogen Oxides and Carbon dioxides are the major concern of air pollution for the project. The Co-generation system which produce steam by using the waste heat from the HFO Engines, will reduce the exhaust heat temperature from 315<sup>0</sup>C to 174<sup>0</sup>C. In addition to that, the project authority will also install a flue gas de-sulfurization (FGD) plant to reduce the Sulfur content from the exhaust which will remove approximately 90% Sulfur from the exhaust. With the FDG the SO<sub>2</sub> emission will be equivalent to HFO with 0.3% Sulfur which is compliant with the Bank group's (i.e., IFC) thermal power guidelines value of 0.5% for degraded air shed. To evaluate the ground concentration of the above emissions to the surrounding environment, an emission dispersion modeling (USEPA approved AERMOD model) has been done and the result shows that except for PM (for which baseline is non-compliant), concentration of all the criteria pollutants (i.e., CO, SO<sub>2</sub>, NO<sub>2</sub> and O<sub>3</sub>) will be within the Bangladesh NAAQS at 100m from the plant. The PM emission from the plant is approximately 2.5% of the cumulative emissions in the airshed. Thus, the plant will have only a marginal impact on the PM level in the airshed.

**Noise:** The project will generate 108 dBA noise in the engine room, 90 dBA in the steam turbine room and 85 dBA from the stack after silencer. The project authority will take necessary noise abatement measures (brick wall + Styrofoam + brock wall = 150mm + 100mm + 150mm) to prevent the engine room noise emitted outside the project boundary. The stack noise emission has been predicted by means of noise impact modeling. The maximum result has been predicted as 38.47 dBA at 50m distance and 6.41 dBA at 500m radius from the project site.

**Oil spillage:** The plant management will transport the HFO from the Chittagong port by oil tanker and unload the tanker to the HFO storage tanks. The HFO unloading area would be well protected with hard standing floor so that there is no scope of oil spillage. The HFO storage tank will have secondary containment with 110% capacity of the storage tanks; so that the oil could be retained in the containment in case of any accidental spillage or disaster. Appropriate lubricant spillage prevention and management measures will also be undertaken.

**Liquid Discharge:** The power plant will produce only a small quantity of wastewater since it has mainly air cooling and close looped water cooling system. The steam turbine will have a condensation cooling system by a close loop cooling tower. Only small amount of make-up water (21 cu.m/hour) will be needed in the system. The project would have a water treatment plant with a capacity of 34 cu.m/hour with a facility of multimedia and Iron filter followed by 1st stage Reverse Osmosis (RO) and the water would be collected in a storage tank. The make-up water for the condenser cooling tower will be supplied from this storage tank and remaining water would be pumped to the 2nd stage RO for producing de-mineralized (DI) water which would be fed to the waste heat steam boiler. The domestic liquid wastes would be disposed through a septic tank system. The surface drainage network would be connected with an interceptor prior to discharge to surface drainage system. The interceptor will trap the oily matter present in the water for appropriate disposal.

## 7. Environmental Management Plan (EMP)

In the context of a project, Environmental Management Plan (EMP) is concerned with the implementation of the measures necessary to minimize and offset the adverse impacts and to enhance beneficial impacts. Unless the mitigation and benefit enhancement measures are identified in EIA and fully implemented, the prime function of the EIA cannot be achieved. Thus, the objectives of EMP for the present project are: (i) Identification of Monitoring requirements and Monitoring indicators; (ii) Mitigation measures to reduce or eliminate negative impacts; and (iii) Enhancement measures to maximize positive impacts. Environmental management plan has to be considered as part of the plant's overall management and it would be part of the plant operational manual.

Monitoring of the performance of a plant is very important and sometimes vital. Industrial units in Bangladesh generally do not monitor the environmental parameters related to plant operation, thereby neglecting the environment. For surveillance of the environmental performance of an industry, and monitoring of the quality of the local environment, environment in the work-zone and the general impact zone have to be performed on a regular basis. A management set up has to be created for the environmental monitoring program which can ensure compliance with national environmental standards. To this end a committee (Environmental Management and Safety Committee) will be created with plant manager as head and with 2-4 other members. The committee must meet at least once in a quarter and take stock of the environmental status of the plant. The main emission from the plants (i.e., air emissions, noise and any other ) are to be analyzed as per SOP for the plant. Any additional monitoring required should be defined and resources allocated for the purpose. The proceeding of the committee should be recorded and used to produce quarterly and annual environmental reports indicating compliance or otherwise of the environmental regulations. These reports should be submitted to the DOE and shared

with the World Bank. The quarterly and annual monitoring reports will also be placed on the company website for public scrutiny.

The cost of the Environmental Management Plan (EMP) is divided into several parts to reflect the different phases of the project and the requirements of each phase. The cost of EMP must include the costs of the capacity building, public consultation and the quality control requirements for a period of 5 years of operation. An allocation will be made for EMP every year in budget estimated for the BPPL.

## **8. Emergency Response and Occupational Health & Safety**

Under the supervision of the 'Environment Management and Safety Committee', all plant personnel will have responsibilities assigned to them during emergency. The documented responsibility will be included in a program manual which can constitute a part of the plants operation manual. Compliance with the responsibilities should be monitored and if these are not carried out for any reason, corrective measures should be taken.

The plant management will prepare an occupational health safety policy manual which should be updated from time to time. The policy should be signed and dated by the Chief Safety Officer who may be the Plant Manager. The policy should be discussed with all the plant personnel. The Chief Safety Officer should periodically review the policy and re-issue the policy.

## **9. Alternative Analysis**

The 'No Build' alternative in the present case would mean continued power deficiency, in the face increasing demand for industrial and economic growth which leads to poverty reduction. So, the 'No build' alternative is unacceptable, and the potential socio-economic benefits of implementation of such a project far outweigh the adverse impacts, all of which can be controlled and minimized to an acceptable level.

Vacant land above flood level is a scarce commodity in the Bangladesh and most of land in the south Patenga belong to restricted areas by different government agencies. The project site was a privately owned vacant land thus involved no resettlement issues. Being located in the heavy industrial zone and being near to load centers, the site was considered for construction of the plant. After analysis various possible alternatives, this EIA finds the plant's environmental impacts at the selected site are acceptable if the management procedures delineated are properly implemented. Therefore, the site has been considered suitable for the plant.

## **10. Stakeholder Consultation and disclosure**

Stakeholder consultations are very important and sensitive issues for setting up a new industry in any area of Bangladesh. The process was initiated with an open objective to ensure people's participation right from the planning stage of the project. More specially, this was aimed at improving the study taking into account opinions from the people of the impacted area. Primary stakeholders were consulted during informal and formal meetings held in the project area during August, 2012 to February, 2013; the deliberations and attendance in these meetings have been documented. The consultation process was carried out in the Bangla languages. During these meetings a simple, non-technical, description of the project was given, with an overview of the project's likely human and environmental impact. The community consultations demonstrated that goodwill towards the project proponents indeed exists; approval for project activities by the communities was evident. The consultations were considered as a good gesture and appreciated, by the men and women. The stakeholders' consultation process will be continued in the operation phase of the plant, so that issues of public concern can be addressed.

The draft EIA report has already been uploaded in the Company's website and a copy of EIA is kept at the plant for public review. The executive summary will be translated into Bangla and will also be made available to the public.

## **11. Grievance Redress Mechanism**

The Project Management has established a procedure to answer to project-related queries and address complaints and grievances about any irregularities in application of the guidelines adopted for assessment and mitigation of environmental safeguards impacts. The complaints related to plant operation that may create inconveniences to agency/individual should be addressed based on consensus, the procedure will help to resolve issues/conflicts amicably and quickly without resorting to expensive, time-consuming legal actions. BPPL has constituted a grievance redress committee (GRC) headed by a retired Ward Commissioner of Chittagong City Corporation with project manager as the member-secretary of GRC. To ensure impartiality and transparency, hearings on complaints will remain open to the public. The GRC will record the details of the complaints and the reasons that led to acceptance or rejection of the particular cases. The GRC will keep records of all resolved and unresolved complaints and grievances and make them available for review as and when asked for by appropriate authority, WB and any organizations known to be working with urban development issues. However, it should be noted that the GRC process will not pre-empt and aggrieved person's right to seek redress in the courts of law.

## **12. Conclusion and Recommendations**

The present EIA report finds that though there are certain adverse environmental impacts associated with the industrial unit under consideration, these are manageable.

The project is indispensable in view of the current energy shortage scenario in Bangladesh. The impact on the social environment is positive given the job and business opportunities created for local residents from the project. The project will help in the industrialization, accelerating socioeconomic growth, and improving quality of life. One of the most critical issues for the project is safety. This has been adequately addressed through compliance with national building code (BNBC) in the construction to ensure safety during natural disasters like earthquake and cyclone and a full-containment for the HFO storage tank.

The project has been designed to comply with the country's environmental laws and regulations, especially on air emissions, ambient air quality, wastewater effluent, and noise. The project management has taken steps to ensure that the plant meets the World Bank's environmental standards. To mitigate the impact of the use of high sulfur HFO in the plant, a FDG is being installed to reduce sulfur-di-oxide emission by 90%. Given the management measures and monitoring commitments by the BPPL for the project, environmental impact of the project will be manageable.

Given the proponent's commitments, actions undertaken for further measures to be adopted in due course of time as required, the Baraka Patenga Power Plant is going to be a nationally important and environmentally sustainable industrial venture.

*Chapter -1*  
*Introduction*

# Chapter-1

## INTRODUCTION

### 1.1 PROJECT BACKGROUND:

Electricity is the major source of power for country's most of the economic activities. It is the key ingredient of socio-economic development of the country. Adequate and reliable supply of electricity is an important pre-requisite for attracting both domestic and foreign investment. Reliable supply of electricity is a pre-condition for poverty reduction and economic development. In Bangladesh, 47% of total populations have access to electricity but reliable and quality power is still a faraway. To alleviate poverty in the face of resource limitations and high population density, Bangladesh requires an economic growth rate of more than 7% p.a. In order to achieve this growth rate, electricity growth rate needs to be 10%. By utilizing the natural, human and agricultural resources optimally, the desired pace of GDP growth could be attained by increasing electricity generation at much higher rate, which is the key target for development.

According to Ministry of Power, Energy & Mineral Resources, Bangladesh presently total electricity generation capacity is 5376 MW. Of this capacity 3331 MW is from public sector and 2045 MW is from the private sector, which is 62% and 38% respectively of the total generation capacity. Considering 10 - 15 % maintenance and forced outages, available Generation Capacity is in the range of 4500 – 4800 MW without fuel constraint.

Problems in the Bangladesh's electric power sector include poor governance, high system losses, delay in completion of new plants, low plant efficiencies, erratic power supply, electricity theft, blackouts and shortages of funds for power plant maintenance among others. Overall, the country's generation plants have been unable to meet system demand over the past decade.

A recent survey reveals that power outages result in a loss of industrial output worth \$1 billion a year which reduces the GDP growth by about half a percentage point in Bangladesh. A major hurdle in efficiently delivering power is caused by the inefficient distribution system. It is estimated that the total transmission and distribution losses in Bangladesh amount to one-third of the total generation, the value of which is equal to US \$247 million per year.

Recognizing the need to improve the performance of the power sector, the government adopted a policy paper titled 'Power Sector Reforms in Bangladesh' (PSRB) in 2001. PSRB outlined the reform process to gradually remove constraints in the sector through improvements in the sector and corporate governance, introduction of competition, and public private partnerships. The PSRB envisioned in the long term a structure of the power sector based on: (i) separation of sector regulation and operation; (ii) autonomy and

commercial orientation of the sector entities; (iii) separation of generation, transmission, and distribution; and (iv) increased private sector participation. Transmission assets would remain in the public sector, while generation and distribution assets would have both public and private ownership.

The government has approved proposals for setting up 49 power plants (RPPs) with a total capacity of 5319 megawatt to improve the power situation during the past three years. According to news “**Biddut Barta**” published in different national dailies including the daily **Prothom Alo** and the daily **Ittefaq** on January 02, 2012 that 5036.5 MW of electricity was produced on 1<sup>st</sup> January, 2012 whereas on the same day of the previous year total electricity generation was 3749.5 MW.

It is a well-recognized fact that each development activity has an impact on the natural molding of the environment. As development activities are of prime importance for the economic growth and fulfillment of basic needs of the society, the environmental aspects of development activities must be taken into account and due attention must be paid to protect the environment. The first step in this direction is to evaluate the probable impacts of the project on the surrounding environment; so that suitable measures could be taken during early stages of the project to minimize negative impacts.

The socio-cultural roots of our present environmental crisis lie in the paradigms of scientific materialism and economic determinism, which fail to recognize the physical limits, imposed by ecological systems on economic activity. The economies must expand within ecosystems, which have limited regenerative capacities. Contrary to the neoclassical theory of continuous material growth, economic activities directly undermine the potential for development through over-exploitation of natural resources, and indirectly compromise future production through the discharge of residuals. The entrenchment with quantitative growth as a major instrument of social policy is thus quite paradoxical.

The emergence of the concept of sustainable development in recent years has brought in the general realization that societal perceptions must shift towards ecological determinism so as to achieve qualitative growth within the limits of ecosystem carrying capacity. The carrying capacity based planning process, innovative technologies for enhanced material and energy effectively of production and consumption, structural economic change towards less resource-intensive sectors, and preventive environmental management through increasingly interventionist policies are some of the strategies for reconciling developmental goals with ecological capabilities.

Proper location / sitting, its process and waste abatement and control are very important for a development activity to be environmentally sound. To ensure this, an **Environmental Impact Assessment (EIA)** is a very effective tool, which delineates what needs to be done to make a development activity suitably located and operate in an environment friendly way.

The EIA will, therefore, examine the technical aspects of the project activities, which are likely to interact with the surrounding environment. This EIA study will cover possible activities and impacts with the environment and community. The report will also provide a suggestive EMP along with certain mitigation measures plan with a view to reduce effect of the adverse impacts.

**Baraka Patenga Power Ltd.** has made Power Purchase Agreement with its buyer, Bangladesh Power Development Board (BPDB) on 31 July, 2011 and Implementation Agreement with Government of Bangladesh on 31 July, 2011. and obtained Environmental Site Clearance Certificate from Department of Environment (DoE) vide letter No.PO/ChaBhi/Charpatra-17611/2011/147; Date: 13.10.2013.

It is located in a commercial setting at South Patenga, Chittagong. There are no particularly sensitive ecological, cultural and archeological assets. The plant will not need to relocate any human settlement, as the project is situated on purchased nonagricultural land. The area has necessary infrastructures, which include communication, electrical grid connection, telecommunication etc.

Proper location, its process and waste abatement and control are very important for a development activity. To ensure this, an **Environmental Impact Assessment (EIA)** is a very effective tool, which delineates what needs to be done to make a development activity suitably located and operated in an environment friendly way.

## 1.2 OBJECTIVE

This report presents the findings of an **Environmental Impact Assessment (EIA)** of the project of **Baraka Patenga Power Ltd.** A total of 8 units of highly efficient Rolls Royce HFO Generator sets with combined capacity of 56 (nominal) MWe will be installed at the plant to supply power to the national grid at **South Patenga, Chittagong**. The objective of the study is to provide an examination and assessment of the principal environmental impacts of the plant. The outline of an environmental management plan also suggested with an indication of the extent of work to be done to keep the development and environment compatible. In this context, it should be noted that the term “environment” and its derivatives have been used in a wide sense, which covers not only physical and chemical aspect, but also the human dimension. The specific objectives of this EIA are to:

- Present a brief discussion on the EIA process and its role in the planning and implementation of development projects;
- Present a general description of the project and the process;
- Present a description of the pre-project environment;

- Delineate the significant environmental issues found and believed to be involved;
- Identify the environmental impacts of the project and quantify them to the extent possible;
- Suggest the plan for management of the environment, during the implementation and operation of the plant.

### 1.3 STUDY AREA

The proposed **Baraka Patenga Power Limited** plant will be set up at South Patenga, Chittagong. The site of the project falls under Patenga Heavy Industrial Zone where there are fuel depots of Padma Oil Company Ltd., Jamuna Oil Company Ltd., Meghna Oil Company Ltd., International Oil Tankers Ltd., Food Silo, TSP Complex, Heidelberg cement Bangladesh Ltd., CEPZ Area and the Shah Amanat International Airport. The project is situated on the West Side of the river Karnaphuli and at about 1km distance from the Shah Amanat International Airport Road. The location is well connected by road and river ways. The site covers an area of 3.0 acres of land.

### 1.4 SCOPE OF WORK

The description of the environment and social baseline conditions are made encompassing all relevant current baseline data on the environmental and social characteristics of the study area including physical, biological, ecological and social environments. In the backdrop of the above scenarios, the relevant regulations and standards governing environmental quality, health and safety, protection of sensitive areas, protection of endangered species, land use control, land acquisition, compensation, etc. at every level are described.

In action to the above, an analysis was conducted of reasonable alternatives in meeting the ultimate objects of the project including the 'no action' alternative, alternative means of meeting the energy requirements, alternative means of delivering gas, alternative methods of construction including cost and reliability factors.

Viewed against these, all significant impacts were identified and evaluated including atmospheric emissions and changes in ambient air quality, discharge of effluent and ambient water quality impacts, changes in ambient noise and local land use patterns, impacts due to land acquisition, impacts of the project and its activates on the community's access to social infrastructure (e .g. potable water, health centers, school, irrigation and extension services), and local developments.

Following identification of potential impacts, efforts have been taken to distinguish between positive and negative impacts, direct and indirect impacts including impacts from possible accidents and long-term impacts. Attempts are made to describe the

impacts quantitatively in terms of environmental and social cost and benefits and assigning economic values where feasible.

Finally, an Environmental, Safety and Social Management Plan to mitigate negative impacts has been developed, including a detailed Environmental and Social Management Plan with feasible and cost-effective measures to prevent or reduce significant negative impacts to an acceptable level, and containing detailed implementation plans, monitoring indicators and clear allocation of responsibility among project sponsors construction contractors, government agencies, and community-based organization. Also, an Environmental and Safety Management Plan, focusing on mitigation measures to address the environmental and safety consequences associated with the project for both construction and operational phases has been prepared. Also, a Social Management Plan is developed which includes a Resettlement Action Plan to address the adverse impacts on project-affected persons displaced by the power plant construction. It is to be mentioned that before preparation on the above, construction and participation with the affected persons were undertaken formally.

## 1.5 THE EIA TEAM

**Adroit Environment Consultants Ltd. (AECL)** has prepared this report under the guidance and supervision of Dr. Nasir Uddin Khan. The total team composition and their expertise have been given in the table below:

| Professional                        | Name   | Expertise/Assignment   |
|-------------------------------------|--|--|
| EIA & Emission Modeling Expert      | Dr. Nasir Uddin Khan   | Highly experienced on conducting EIA of various nature in home and abroad. Have vast experience on identifying different environmental impacts and suggesting mitigation measures for any project. Experienced on emission and noise modeling of various projects. Experienced on Project stakeholder engagement - Public consultation and Disclosure Plans. |
| Legal & Policy experts, EIA analyst | Mohammad Reazuddin, A former Director (Technical) & former Chair, Environmental Clearance Technical Committee, Department of Environment (DoE) | Experienced on environmental issues, Legislative bindings, legal and policy framework in conjunction with the Department of Environment, ADB, World Bank/IFC or other donor agencies. Have vast knowledge on EIA report review and analysis.   |

|                                    |                          |   |
|------------------------------------|--------------------------|---|
| Power Plant Engineer               | Engr. Zahurul Islam Khan | Expert on power plant operation and EIA report.   |
| Socio-economist                    | Mukul Ashraf             | Experienced on Social baseline studies, community needs assessment, Social and Community Health Impact Studies/Assessments etc.   |
| Field Investigator/ co-coordinator | Engr. Irfan Ullah        | Make liaison with all field staff and Consultants; allocate staff & resources to different places when necessary. Background of organizing site visits, surveys, liaison with community, public and govt. organizations, etc. |
|                                    | Md. Akter-uz-Zaman       | Background of organizing site visits, surveys, liaison with community, public and govt. organizations, Base line data collection etc.   |
|                                    | Mr. Golam Mostafa        | Base line data collection, sample collection from site, sample preservation and laboratory analysis.  |
|                                    | Mr. Ratan Biswas         | Baseline data collection, secondary data collection, sample collection and site survey  |

## 1.6 LIMITATIONS

An IEE/EIA is generally carried out as an integral part of the Feasibility Study (FS) or together with it and before going into the final design phase and into the construction phase of a particular development project. This is because, the findings of the EIA can be incorporated in the project design, overall planning and budgeting for project implementation. When an EIA is conducted separately as just an add-on, often it does not get due importance in the overall implementation of the project, which undermines the role of the EIAs and can contribute to environmental damages.

In case of **Baraka Patenga Power Limited**, an IEE has been prepared at the initial stage of the project. Though the IEE was prepared as a separate document of the Feasibility Study (FS), but all the Significant Environmental Impacts (SEIs) were identified in IEE for the above project and conclusions for site clearance were made accordingly. DoE has cleared the present site subject to undertaking an EIA and adoption of necessary and effective pollution control measures. So, this report has been prepared to fulfill the requirement of DoE and emphasizes have been on the issues which has been considered to be significant in IEE and the conditions imposed in site clearance by DoE. As there is potential financing of the plant by international development agencies, the requirements of these agencies will also be kept in view. Taking all these issues into consideration the

present report delineates the environmental factors and conclusions are made accordingly.

Services performed by the consultant are conducted in a manner consistent with that level of care and skill generally exercised by members of the engineering and consulting profession. The report may not exhaustively cover an investigation of all possible aspects and circumstances that may exist. However, an effort is made to discover all meaningful areas under the stipulated time available.

In evaluating subject site, consultant relies in good faith on information provided by client's management or employees. The Consultant assume that the information provided is factual, accurate and accepts no responsibility for any deficiency, misstatement or inaccuracies contained in this report as a result of omission or misrepresentation of any person interviewed or contacted. However, the consultant notifies the contradictions and errors in the data, where it seems appropriate.

It should be recognized that the information given in the report is time specific and with the passage of time the relevancy of data and analysis may suffer. Specific circumstances and condition of site can change due to which conclusion and opinions may also change

## 1.7 ACKNOWLEDGEMENT

In this EIA study many individuals and agencies helped in gathering data and providing information & services. Almost all of them were most helpful & cooperative to provide data & related information and discuss with them surrounding environmental issues. We also are thankful to the DoE personnel of **Chittagong Division** for their Co-operation in various aspects of this study.

***Chapter -2***  
***Policy and Legal***  
***Considerations***

## Chapter-2

# POLICY AND LEGAL CONSIDERATION

## 2.0 POLICY AND LEGAL CONSIDERATION

### 2.1 BACKGROUND

For protecting the environment from industrial pollution and environmental degradation, Government of Bangladesh has promulgated some policies, strategies, laws, rules & regulations and action plans. The clauses and requirements of these regulatory legislations and policy imperatives must be taken in to consideration for compliance by the proponents/operators of any industrial establishment in the country.

As an institutional arrangement, Government of Bangladesh has designated the "Department of Environment" (DOE) with the sole responsibility for the regulatory functions to enforce of the provisions of environmental laws, rules and regulations to prevent environmental degradation in the country. Under these legal provisions, the industrial entrepreneurs must take mitigation measures for protecting the environment from pollution impacts and must get 'Environmental Clearance' from DOE before setting up and running their industries. These rules are equally applicable to both new and the existing industries. There are some other sectoral rules related to the industrial projects, which predate environmental legislations. These legislations have become effectively obsolete with the promulgation of the ECA,1995 and the ECR, 1997 and their subsequent amended versions.

BEDL, the sponsoring agency of the Baraka Patenga Power Plant (BPPL), is committed to the protection of the environment through compliance of the existing environmental laws, rules and regulations of Bangladesh. The sponsor is also keen to abide by the international conventions and standards for making the industry environment friendly. The environmental classifications for industrial projects in Bangladesh are based on "inclusion lists" given in the ECR97 with 'RED' being the highest. Power Plant is listed in the '**Red Category**' in ECR97 (i.e., serial no.6 in the ECR97 Red list in Schedule-1.). WB environmental categorization is based on potential impacts and according to WB criteria (OP/BP 4.01), this project has been classified in the '**B**' category.

The prevailing national policies, strategies, laws, rules, action plans etc. on environment are discussed briefly in the following. The WB group's operational policies and guidelines are also briefly discussed as the project is likely to be co-financed by the WB through the IPFF project.

## 2.2 POLICIES

### 2.2.1 Industrial Policy 1991

The Industrial policy of 1991 contains the following clauses in respect of environmental protection

- To conserve ecological balance and prevent pollution during industrialization
- To take effective steps for pollution control and conservation of environment during industrialization

To ensure embodying of necessary pollution control and preventive measures by industrial investment project endangering environment.

### 2.2.2 National Environmental Policy 1992

Bangladesh National Environmental Policy (*GoB, 1992*) was approved in May 1992, and sets out the basic framework for environmental action, together with a set of broad sectoral action guidelines. Key elements of the policy are:

- Maintenance of the ecological balance and overall progress and development of the country through protection and improvement of the environment.
- Protection of the country against natural disasters
- Identification the regulation of all types of activities which pollute and degrade the environment
- Ensuring sustainable utilization of all natural resources
- Active association with all environmentally-related international initiatives

Environmental policy contains the following specific objectives with respect to the industrial sector:

- To adopt corrective measures in phases in industries that causes pollution.
- To conduct Environmental Impact Assessments for all new public & private industries.
- To ban the establishment of any industry that produces goods cause environmental pollution, closure of such existing industries in phases and discouragement of the use

of such goods through the development and/or introduction of environmentally sound substitutes.

- To ensure sustainable use of raw materials in the industries to prevent their wastage.

### **2.2.3 National Conservation Strategy**

National Conservation Strategy (GoB/IUCN, 1992) was drafted in late 1991 and submitted to the Government in early 1992. This was approved in principle; however the final approval of the document is yet to be made by the cabinet. It underwent a number of modifications over the last five years, and is waiting to be placed before the cabinet finally sometime in late September 1997. For sustainable development in industrial sector, the report offered various recommendations; some of those are as follows:

- Industries based on nonrenewable resources should be made to adopt technology which conserves raw materials, and existing industries should be given incentives to install technical fixes to reduce wastage rate
- All industries, especially those based on imported raw materials, should be subjected to EIA and adoption of pollution prevention/control technologies should be enforced.
- No hazardous or toxic materials/wastes should be imported for use as raw material.
- Import of appropriate and environmentally sound technology should be ensured.
- Complete dependence on imported technology & machinery for industrial development should gradually be reduced so that industrial development is sustainable with local skills and resources.

### **2.2.4 National Environmental Management Action Plan (NEMAP), 1995**

National Environmental Management Action Plan, also referred to as NEMAP (GoB, 1995) is a wide-ranging and multi-faceted plan, which builds on and extends the statements set out in the National Environmental Policy. NEMAP was developed to address issues and management requirements during the period 1995 to 2005, and sets out the framework within which the recommendations of the National Conservation Strategy are to be implemented.

NEMAP has the broad objectives of:

- Identification of key environmental issues affecting Bangladesh;

- Identification of actions necessary to halt or reduce the rate of environmental degradation;
- Improvement of the natural and built environment;
- Conservation of habitats and biodiversity;
- Promotion of sustainable development;
- Improvement in the quality of life of the people.

One of the key elements of NEMAP is that sectoral environmental concerns are identified. In outline, the environmental issues of the industrial sector include the following:

- Pollution arising from various industrial processes and plants throughout the country causing varying degrees of degradation of the receiving environment (Air, Water, and Land).
- There is a general absence of pollution abatement in terms of waste minimization and treatment.
- Low level of environmental awareness amongst industrialists and entrepreneurs.
- Lack of technology, appropriate to efficient use of resources and waste minimization leading to unnecessary pollution loading in the environment.
- Economic constraints on pollution abatement and waste minimization such as the cost of new technology, the competitiveness of labor, and intensive production methods as compared to more modern methods.
- Concentration of industry and hence pollution in specific areas which exacerbate localized environmental degradation and exceed the carrying capacity of the receiving bodies.
- Unplanned industrial development has resulted in several industries located within or close to residential areas, which adversely affects human health and quality of human environment.
- Establishment of industries at the cost of good agricultural lands and in the residential areas.
- Lack of incentives to industrialists to incorporate emission/discharge treatment plant in their industries.

## 2.3 NATIONAL LEGISLATION

### 2.3.1 Environment Conservation Act 1995 (ECA 1995)

Formal concern at the national level, for the state of environment in Bangladesh can be traced back to at least Independence and passing of the Water Pollution Control Act in 1973. Under this a small unit was established in the Directorate of Public Health Engineering (DPHE) to monitor pollution of ground water and surface water.

In order to expand the scope of environmental management and to strengthen the powers for achieving it, the Government issued the Environmental Pollution Control Ordinance in 1977. The ordinance provided for the establishment of an Environmental Pollution Control Board, which was charged with formulating policies and proposing measures for their implementation. In 1982, the board was renamed as Department of Environmental Pollution Control (DEPC). Four divisional offices were established in Dhaka, Chittagong, Khulna and Bogra. A special presidential order again renamed the DEPC to the Department of Environment (DOE) and placed under newly formed ministry of Environment and Forest (MoEF) in 1989.

The national environmental legislation known as **Environmental Conservation Act, 1995 (ECA'95)** is currently the main legislative document relating to environmental protection in Bangladesh, which repealed the earlier environment pollution control ordinance of 1997 and has been promulgated in 1995. The main objectives of ECA'95 are:

- Conservation and improvement of environment, and
- Control and mitigation of pollution of environment.

The main strategies of the act can be summarized as:

- Declaration of ecologically critical areas, and restriction on the operation and process, which can be carried, out or cannot be initiated in the ecologically critical areas.
- Regulation in respect of vehicles emitting smoke harmful for the environment.
- Environmental clearance
- Regulation of the industries and other development activities - discharge permit.
- Promulgation of standards for quality of air, water, noise and soil for different areas for different purposes.

- Promulgation of standard limit for discharging and emitting waste.
- Formulation and declaration of environmental guidelines.

### 2.3.2 Environment Conservation Rules, 1997 (subsequent amendments in 2002 and 2003)

A set of the relevant rules to implement the ECA' 95 has been promulgated (August 1997). The rules mainly consist of:

- The national Environmental Quality Standards (EQS) for ambient air, surface water, groundwater, drinking water, industrial effluents, emissions, noise and vehicular exhaust;
- Categorization of industries, development projects and other activities on the basis of pollution activities of the existing or proposed industries/development projects/activities.
- Procedure for obtaining environmental clearance;
- Requirement for undertaking IEE and EIA as well as formulating EMP according to categories of industries/development projects/activities;
- Procedure for damage-claim by persons affected or likely to be affected due to polluting activities or activities causing hindrance to normal civic life.

The Rules incorporate "inclusion lists" of projects requiring varying degrees of environmental investigation.

**Green:** Industries/development projects/activities are considered relatively pollution-free and therefore do not require an environmental clearance certificate from the DOE and no environmental study.

**Orange:** Industries/development projects/activities fall into two categories. Orange "A" are less polluted and Orange "B" are moderately polluted required to submit general information, a process flow diagram and schematic diagrams of waste treatment facilities along with their application to DOE for obtaining environmental site clearance and environmental clearance.

**Red:** Industries/development projects/activities are those which may cause 'significant adverse' environmental impacts and are therefore required to submit an EIA report. It should be noted that they might obtain an environmental site clearance on the basis of

an IEE report, and subsequently submit an EIA report for obtaining environmental clearance along with other necessary papers.

**Environmental standards** in operation in Bangladesh also Promulgated under the Environment Conservation Rules 1997. There are standards prescribed for varying water sources, ambient air, noise, odor, industrial effluent and emission discharges, vehicular emission etc.

The Bangladesh standards intend to impose restrictions on the volume and concentrations of wastewater/solid waste/gaseous emission etc. discharged into the environment. In addition a number of surrogate pollution parameters like Biochemical Oxygen Demand, or Chemical Oxygen Demand; Total Suspended Solids, etc. are specified in terms of concentration and/or total allowable quality discharged in case of waste water/solid waste. Additionally specific parameters depending on the manufacturing process are specified such as phenol, cyanide, copper, zinc, chromium etc. Air emission quality standards refer mostly to concentration of mass emission of various types of particulate, sulfur dioxide, and oxides of nitrogen and in some cases volatile organic compounds and other substances.

The Bangladesh standards in general are less stringent compared to the developed countries. This is in view to promote and encourage industrialization in the country. The Bangladesh standards are not for any specific period of time. There is no provision for partial compliance too.

The ambient standard of water quality, air quality and noise are presented in Table 2.1 to Table 2.5 in the following page. Standards refer to discharges to freshwater bodies with values in parentheses referring to direct discharges to agricultural land.

**Table 2.1: Inland Surface Water Quality Standards**

| Best practice based Classification                               | P <sup>H</sup> | BOD mg/l   | DO mg/l    | Total Coliform No./100 |
|--|----------------|------------|------------|------------------------|
| Source of drinking water for supply only after disinfecting      | 6.5-8.5        | 2 or less  | 6 or above | 50 or less             |
| Water usable for recreational activity                           | 6.5-8.5        | 3 or less  | 5 or above | 200 or less            |
| Source of drinking water for supply after conventional treatment | 6.5-8.5        | 6 or less  | 6 or above | 5,000 or less          |
| Water usable by fisheries  | 6.5-8.5        | 6 or less  | 5 or above | -                      |
| Water usable by various process and cooling industries           | 6.5-8.5        | 10 or less | 5 or above | 5,000 or less          |
| Water usable for irrigation                                      | 6.5-8.5        | 10 or less | 5 or above | 1,000 or less          |

Source: ECR- Schedule 3

**Table 2.2:** Standards for Waste from Industrial Units

| Parameters  | Unit    | Inland Surface Water | Irrigated Land |
|---|---------|----------------------|----------------|
| Biological Oxygen Demand (BOD <sub>5</sub> ) at 20° C | mg/l    | 50                   | 100            |
| Chemical Oxygen Demand (COD)                          | mg/l    | 200                  | 400            |
| Dissolve Oxygen (DO)                                  | mg/l    | 4.5-8                | 4.5-8          |
| Total Dissolved Solids (TDS)                          | µmho/cm | 2,100                | 2,100          |
| P <sup>H</sup>  |         | 6-9                  | 6-9            |
| Suspended Solid (SS)                                  | mg/l    | 150                  | 200            |
| Chloride  | mg/l    | 600                  | 600            |
| Iron  | µmho/cm | 2                    | 2              |

Source: ECR- Schedule 10

**Table 2.3:** Ambient Air Quality Standards

| AIR POLLUTANT                         | STANDARDS  | AVERAGE TIME |
|---------------------------------------|--|--------------|
| 1                                     | 2  | 3            |
| Carbon Monoxide (CO)                  | 10 mg/m <sup>3</sup><br>(9 ppm) <sup>(Ka)</sup>      | 8-hour       |
|                                       | 40 mg/m <sup>3</sup><br>(35 ppm) <sup>(Ka)</sup>     | 1-hour       |
| Lead (Pb)                             | 0.5 µg/m <sup>3</sup>                                | Annual       |
| Oxides of Nitrogen (NO <sub>x</sub> ) | 100 µg/m <sup>3</sup><br>(0.053 ppm)                 | Annual       |
| Suspended Particulate Matter (SPM)    | 200 µg/m <sup>3</sup>                                | 8-hour       |
| PM <sub>10</sub>                      | 50 µg/m <sup>3</sup> <sup>(Kha)</sup>                | Annual       |
|                                       | 150 µg/m <sup>3</sup> <sup>(Ga)</sup>                | 24-hour      |
| PM <sub>2.5</sub>                     | 15 µg/m <sup>3</sup>                                 | Annual       |
|                                       | 65 µg/m <sup>3</sup>                                 | 24-hour      |
| Ozone (O <sub>3</sub> )               | 235 µg/m <sup>3</sup><br>(0.12 ppm) <sup>(Gha)</sup> | 1-hour       |
|                                       | 157 µg/m <sup>3</sup><br>(0.08 ppm)                  | 8-hour       |
| Sulfur di Oxide (SO <sub>2</sub> )    | 80 µg/m <sup>3</sup><br>(0.03 ppm)                   | Annual       |
|                                       | 365 µg/m <sup>3</sup><br>(0.14 ppm) <sup>(Ka)</sup>  | 24-hour      |

Source: ECR- Schedule 2 (Amended in 2005)

Abbreviation: ppm: Parts Per Million

Notes:

(Ka) Not to be exceeded more than once per year

(Kha) Annual average value will be less than or equal to 50 microgram/cubic meter

(Ga) Average value of 24 hours will be less or equal to 150 microgram/cubic meter for one day each year.

(Gha) Maximum average value for every one hour each year will be equal or less than 0.12 ppm.

At national level, sensitive areas include national monuments, health resorts, hospitals, archaeological sites and educational establishments.

**Table 2.4: Standards for Gaseous Emission from Industries**

| Parameters for power plant (<200 MW) | Standard present       |
|--------------------------------------|------------------------|
| Particulate                          | 350 mg/Nm <sup>3</sup> |
| Oxides of Nitrogen                   | 30 ppm                 |

Source: ECR- Schedule 11

**Table 2.5: Ambient Noise Standards**

| Areas                       | Day Time<br>dBa | Night Time<br>dBa |
|-----------------------------|-----------------|-------------------|
| Silence Zone: Zone A        | 50              | 40                |
| Residential Area: Zone B    | 55              | 45                |
| Mixed Activity Area: Zone C | 60              | 50                |
| Commercial Area: Zone D     | 70              | 60                |
| Industrial Area             | 75              | 70                |

Source: ECR- Schedule 1 (Amendment in 2006)

The second column of limits values refer to day time (06.00 to 21:00) and the third column to night time (21.00 to 06.00). A silence zone is defined as an area within 100m, around hospitals or educational institutions.

## **2.4 World Bank Group's Operation Policies, Guidelines and Performance Standards**

### **2.4.1 Environmental and Social Guidelines of the World Bank Group**

The World Bank procedures for EA study cover policies, guidelines and good practices. Such guidelines therefore follow the national best practices in undertaking any development project in Bangladesh. The environment safeguards policies applicable to the proposed project are the following:

- *Environmental Assessment (EA) (OP 4.01/BP/GP 4.01)*: An Environmental Assessment is conducted to ensure that WB financed projects are environmentally

sound and sustainable, and that decision-making is improved through appropriate analysis of actions and of their likely environmental impacts. Any IFC-funded project that is likely to have potential adverse environmental risks and impacts in its area of influence requires an EA indicating the potential risks, mitigation measures and environmental management framework or plan.

- *Natural Habitats (OP/BP 4.04)*: Natural habitats are land and water areas where most of the original native plant and animal species are still present. Natural habitats comprise many types of terrestrial, freshwater, coastal, and marine ecosystems. They include areas lightly modified by human activities, but retaining their ecological functions and native species. The Natural habitats policy is triggered by any project (including any subproject under a sector investment or financial intermediary loan) with the potential to cause significant conversion (loss) or degradation of natural habitats, whether directly (through construction) or indirectly (through human activities induced by the project). The policy has separate requirements for critical (either legally or proposed to be protected or high ecological value) and non-critical natural habitats. World Bank's interpretation of "significant conversion or degradation" is on a case-by-case basis for each project, based on the information obtained through the EA.

- *Forestry (OP/GP 4.36)*: This policy is triggered by forest sector activities and World Bank sponsored other interventions, which have the potential to impact significantly upon forested areas. The World Bank does not finance commercial logging operations but aims to reduce deforestation, enhance the environmental contribution of forested areas, promote afforestation, reduce poverty and encourage economic development.

- *Cultural Property (OPN 4.11)*: Physical cultural resources are defined as movable or immovable objects, sites, structures, groups of structures, natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings, and may be above ground, underground, or underwater. The Bank seeks to assist countries to manage their physical cultural resources and to avoid or mitigate adverse impact of development projects on these resources. This policy is triggered for any project that requires an EA.

- *Policy on Disclosure of Information, 2002*: There are disclosure requirements at every part of the project preparation and implementation process. Consultation with affected groups and local community should take place during scoping and before Terms of references (ToRs) are prepared; when the draft EA is prepared; and throughout project implementation as necessary. The Borrower makes the draft EA and any separate EA report available in country in a local language and at a public place accessible to project-affected groups and local community prior to appraisal.

## **2.4.2 IFC Performance Standards**

IFC has set out 8 (eight) performance standards in respect of various parameters pertaining to a proposed project. These eight performance standards of IFC with their corresponding parameters as under:

- Performance Standard 1: Social and Environmental Assessment and Management System
- Performance Standard 2: Labour and Working Conditions
- Performance Standard 3: Pollution Prevention and Abatement
- Performance Standard 4: Community Health, Safety and Security
- Performance Standard 5: Land Acquisition and Involuntary Resettlement
- Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management
- Performance Standard 7: Indigenous Peoples
- Performance Standard 8: Cultural Heritage.

Of the above eight performance standards set by IFC, the Performance Standard 1 envisages establishing the importance of: (i) integrated assessment to identify the social and environmental impacts, risks and opportunities; (ii) effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and (iii) the client's management of social and environmental impacts throughout the life of the project. The rest seven of the performance standards, i.e., Performance Standards 2 through 8 seek to ascertain establishing requirements to avoid, reduce, mitigate or compensate the impacts on people and the environment, and to improve conditions where appropriate.

## **2.4.3 Environmental, Health, and Safety Guidelines for Thermal Power Plants**

The Environmental, Health, and Safety (EHS) Guidelines of the WB group are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). This document on thermal power plants (IFC 2008) includes information relevant to combustion processes fueled by gaseous, liquid and solid fossil 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 a separate Guideline for Waste Management Facilities), with a total rated heat input capacity above 50 Megawatt thermal input (MWth) on Higher Heating Value (HHV) basis. It applies to boilers, reciprocating engines, and combustion turbines in new and existing facilities. Annex A contains a detailed description of industry activities for this sector, and Annex B contains guidance for Environmental Assessment (EA) of thermal power projects.

## **2.5 ENVIRONMENTAL CLEARANCE**

Formal EIA guidelines in Bangladesh are set out in “Rules and Regulations under the 1995 Environmental Protection Acts” as published in the official Gazette on August 27, 1997. Any proponent planning an industrial project is currently required under Paragraph 12 of the Environmental Protection Acts, 1995 to obtain “environmental clearance letter:” from the Department of Environment.

The first to obtain environmental clearance is for the project proponent to complete & submit an application form which may be obtained from the appropriate DoE regional offices as per the category. The application is accompanied by other supporting documents (i.e. project profile, lay-out plan, NOC from local authority, Govt fees etc.) reviewed by the divisional and district offices of DOE who has the authority to request supporting documents as applicable. The divisional office has the power to take decision on Green and Amber-A & B category projects and the Red category projects are forwarded to head office for approval. The proposed projects receive an environmental site clearance at the beginning and the environmental clearance subject to the implementation of the project activities and all mitigation measures suggested in the IEE report or in the application. In case of Red category, the client needs to submit an IEE report for site clearance and EIA to obtain EIA approval and environmental clearance.

## **2.6 POWER SCENARIO AND MASTER PLAN IN BANGLADESH**

Power and energy are vital factors that determine the growth path of a developing country like Bangladesh whereas; electricity is the major source of power for country's most of the economic activities. Consistent supply of power and energy can ensure development of the economy. Nonetheless the huge demand supply gap prevailing in the power sector has turned out to be a hurdle for the economic expansion of the nation.

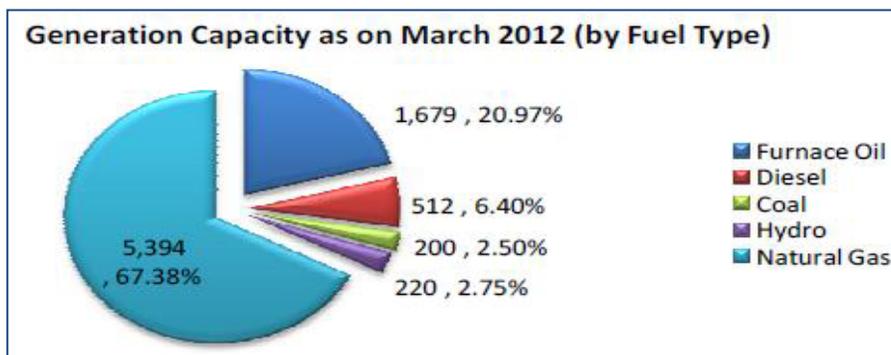
The per capital electricity consumption in Bangladesh remains one of the lowest in the Asian region, At present, only about 47% of the total population of Bangladesh has access to electricity. Even though power has reached many urban areas, approximately 53,000 of the 68,000 villages are connected to power. Further, one million retail electricity connections are pending. The contribution of power sector to GDP ratio has

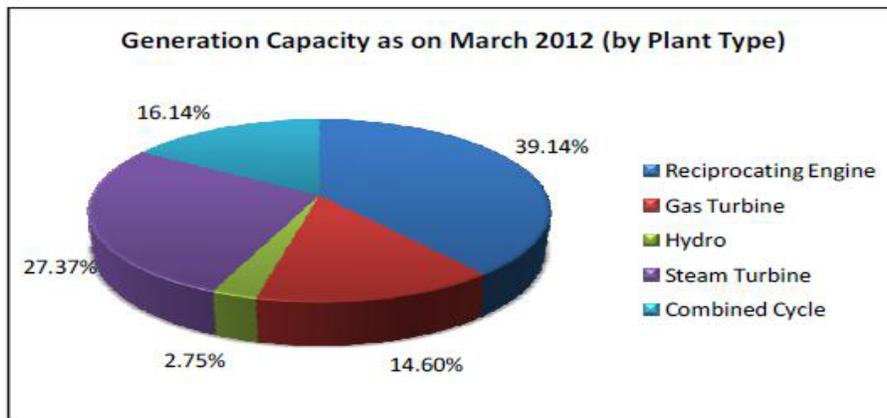
been stagnant around 1.3% for last 5 years with the power generation being increased annually by 2.8% during this period. The majority of power produced in the country is used for commercial purposes. Hence, the electricity supply to households remains delicate which is also a politically sensitive issue. The demand for electricity in the rural areas has experienced significant growth over the years mainly driven by agriculture and small & medium enterprises.

According to Bangladesh Power Development Board (BPDB) presently the installed capacity as on July 2012 in the power sector is 6,693.00 MW, whereas the derated generation capacity is 6,061.00 MW. According to a demand projection analysis, the peak electricity demand is more than 7000 MW in 2012 and 7400 MW in 2013. So, still there is a gap between supply and generation of electricity. The generation capacities on basis of fuel type and plant type as on March 2012 and installed capacities as on December 2011 are shown in the charts below.

Because of the critical nature, the Government of Bangladesh has given highest priority to the power sector to enhance the generation capacity. BPDB has come up with a comprehensive plan to meet the surging demand in power. Accordingly, the government plans to eliminate the demand supply gap by the end of 2012 and achieve the ultimate goal of providing "electricity to all" by 2021 by having generation capacity of 20,000 MW. To ensure overall and balanced development of the sector government has devised immediate, short term, medium term and long term generation plans. The plans have been developed based on a techno-economic analysis and least cost options. Accordingly, the generation capacity would triple to 13,554MW by 2016.

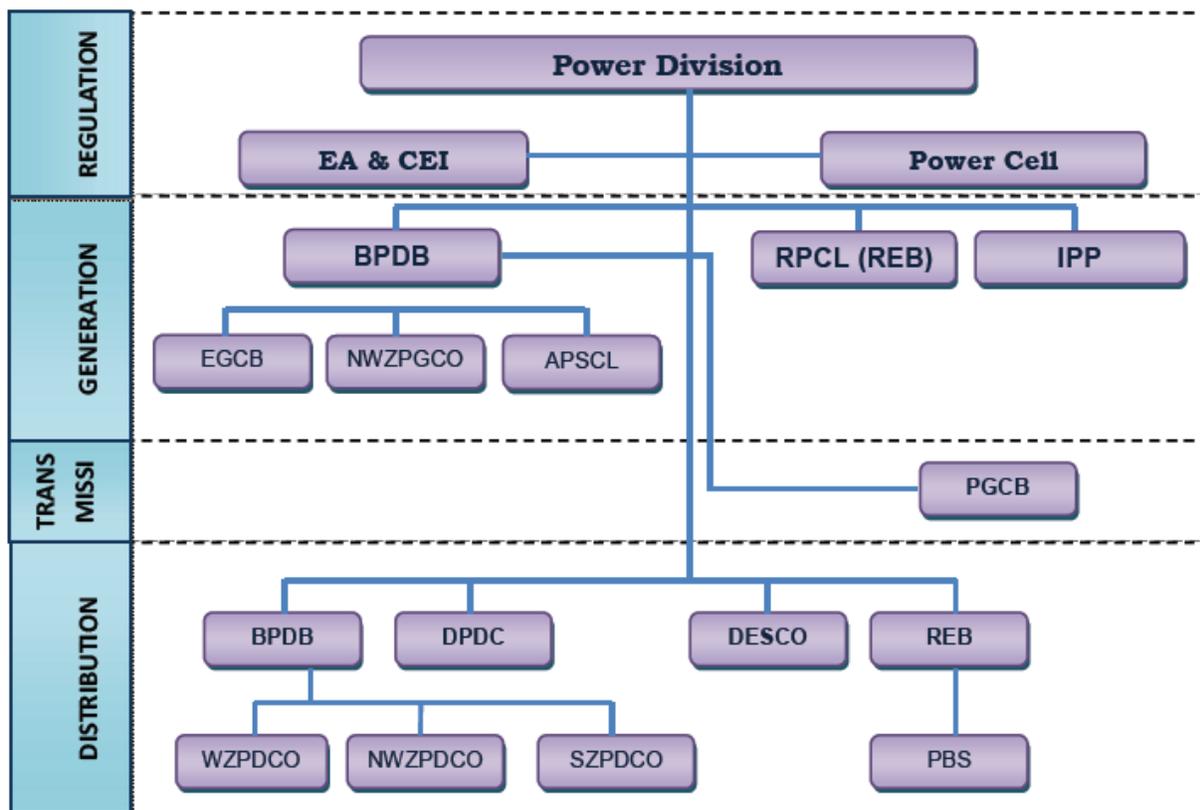
However, the timely implementation of above plans is a concern as there are issues with regards to availability of finance, competency of project sponsors and inherent bureaucracies and other bottlenecks in the system. Further, the demand estimates for power may also be understated to some extent. Strategies have been made to meet the investment requirement by involving private sector with Government through Public Private Partnership (PPP) initiatives. A successful IPP model has been designed with a lot of comforts and protection to investors.





## 2.7 INSTITUTIONAL STRUCTURE OF POWER SECTOR IN BANGLADESH

Power Division is responsible for formulating policy relating to power and supervise, control and monitor the developmental activities in the power sector of the country. To implement its mandate, the Power Division is supported by a number of organizations, related with generation, transmission and distribution. The overall organizational structure and linkage is shown below:



## *Chapter 3*

### *Description of the Proposed Project*

## Chapter-3

### 3.0: DESCRIPTION OF THE PROPOSED PROJECT

#### 3.1 PROJECT INFORMATION AND SPECIFICATIONS

The Baraka Patenga Power Plant is sponsored by Barkatullah Electro Dynamic Ltd (BEDL) and is being implemented by Baraka Patenga Power Limited (BPPL). BPPL has made a Power Purchase Agreement with its buyer, Bangladesh Power Development Board (BPDB) on 31 July, 2011 and Implementation Agreement with Government of Bangladesh on 31 July, 2011 and obtained Environmental Site Clearance Certificate from Department of Environment (DoE) vide letter No.PO/ChaBhi/Charpatra-17611/2011/147; Date: 13.10.2013. The plant will consist of 8 units of highly efficient Rolls-Royce HFO Generator sets and a steam co-generation system operated with waste heat from the HFO engines to supply to the national grid at South Patenga, Chittagong. The plant will be equipped with a FGD (Flue gas desulfurization) system to reduce SO<sub>x</sub> emission by about 90%. Baraka Patenga Power Plant is located in the heavy industrial and commercial setting of Patenga, Chittagong. There are no particularly sensitive ecological, cultural and archeological sites in the area. The plant will not involve any relocation of human settlement, as the project is situated on the purchased vacant land of private individuals based on willing sellers and buyer negotiations without any undue influence from the buyer. A declaration by the buyer (BPPL) on this is given in annex-14 The land ownership documents showing land records before (i.e., by the sellers) and after the transfer (i.e., to BPPL) are also given (referred to Khatians) in the annex-14. The area enjoys necessary infrastructure facilities, which include transport, electricity, telecommunication etc. For all construction activities for the plant, the provisions of Bangladesh National Building Code (BNBC) have been followed that include structural designs and seismicity tolerance.

The basic data of the Baraka Patenga Power Limited are furnished in Table-3.1

**Table-3.1: Basic data on Baraka Patenga Power Limited:**

|                        |   |
|------------------------|---|
| 1. Name of the Project | <b>Baraka Patenga Power Limited</b>   |
| 2. Project Proponent   | Gulam Rabbani Choudhury, Managing Director  |
| 3. Project Location    | Power Plant: South Patenga, Chittagong.<br>Dhaka Office: 6/A/1 (2 <sup>nd</sup> Floor), Segunbagicha, Dhaka-1000.<br>Phone: +88-02-9572305; 9560339 Fax: +88-02-9559015 |
| 4. Type of Business    | Power Generation  |
| 5. Final Product       | 55.87 MWh Electricity installed capacity<br>Additional 3.3MWh (Co-generation) installed capacity  |
| 6. By-product, if any  | None  |

|                          |  |
|--------------------------|--|
| 7. Net Plant Capacity    | 59 MWe (Nominal) output capacity<br>50 MWe contractual net output capacity |
| 8. Project Cost          | BDT. 335.00 Crore  |
| 9. Total Area of Land    | 3 Acres / 11,838 sqm (approximately)                                       |
| 10. Total Area Developed | 11,838 sqm (approximately)   |
| 11. Total Covered Land   | 1208 sqm   |
| 12. Employment           | 98 persons   |
| 13. Power Requirement    | No start up power is required  |
| 14. Fuel Requirement     | Heavy Fuel Oil: 6500 Tons/Month  |
| 15. Source of Water      | Deep Tube well   |
| 16. Water Requirement    | Household/Domestic: 1 cubic meter/hour<br>Industrial: 32 cubic meter/hour  |

## 3.2 SITE DESCRIPTION

### 3.2.1 Location of the Project

The proposed **Baraka Patenga Power** plant will be set up at South Patenga, Chittagong (22°14'17.25" N: 91°48'48.49"E). The location of the project is shown in different maps in Fig 3.1(a),3.1(b)&3.1(c).The site of the project falls under Patenga Heavy Industrial Zone where there are fuel deposit of Padma Oil Company Ltd., Jamuna Oil Company Ltd., Meghna Oil Company Ltd., International Oil Tankers Ltd., Food Silo, Heidelberg cement Bangladesh Ltd.,TSP Fertilizer Factory, LP Gas Ltd, Petro Bangla Chittagong Refinery, NGS Cement Ltd.,Eastern Refinery Ltd. (ERL), CEPZ Area and the Shah Amanat International Airport. On the immediate other side of the river there are Karnaphuli Fertilizer Company Limited (KAFCO), Anwara 1300 MW Power plant, Shikalbaha Power Station, National Cement Factory Ltd., Super Petro Chemicals, Star Cement, and Chittagong Urea Fertilizer Factory (CUFL) situated at Anwara. The project site is situated on the West Side of the river Karnaphuli and 1 km distance from the Shah Amanat International Airport Road. There is vacant low land lying on the West side; the Shah Amanat International Airport is on the North-West side of the project area. Some settlements with some tree covered areas are found in both the South side and the North side. The Patenga road is lying to the East side adjacent to the river Karnaphuli. The location is well communicated by both road and river ways. The site covers an area of 3 acres of land. The satellite map showing within 10 km of the plant site and the location of some of the major industries in the area is given in figure 3.1 (c). The Project layout plan is presented in Annexure – 1.

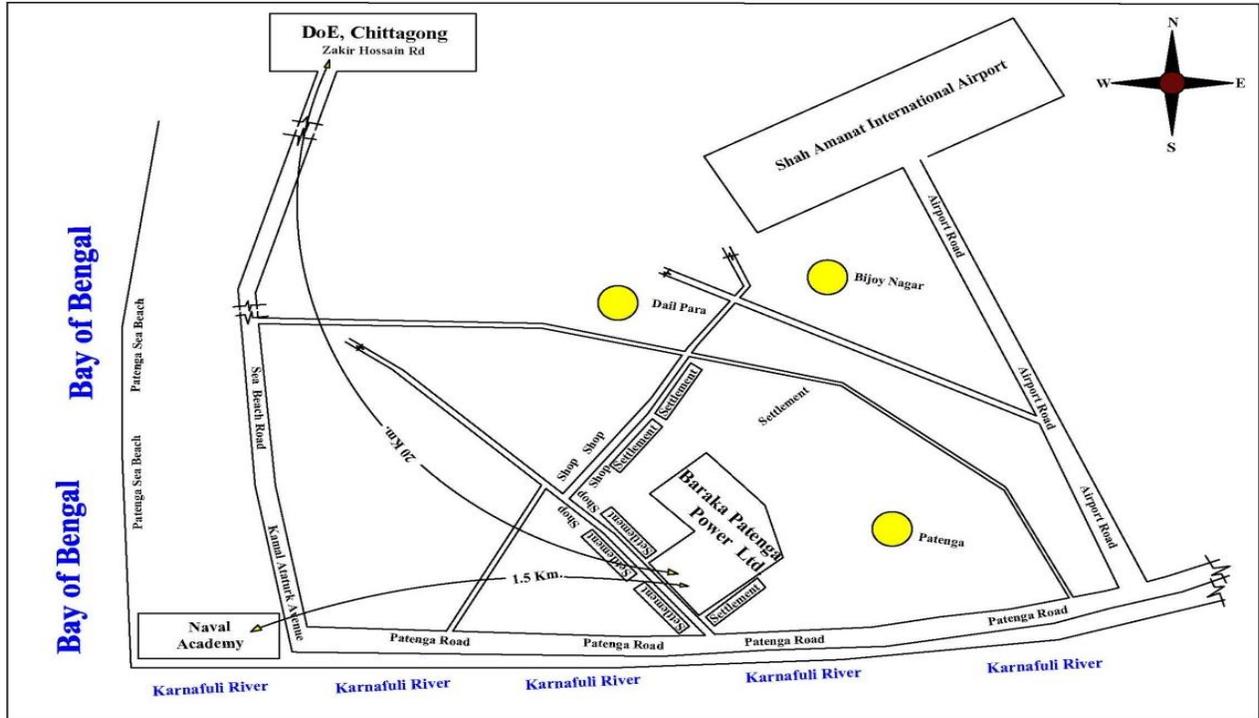


Fig: 3.1(a) Location of Baraka Patenga Power Plant

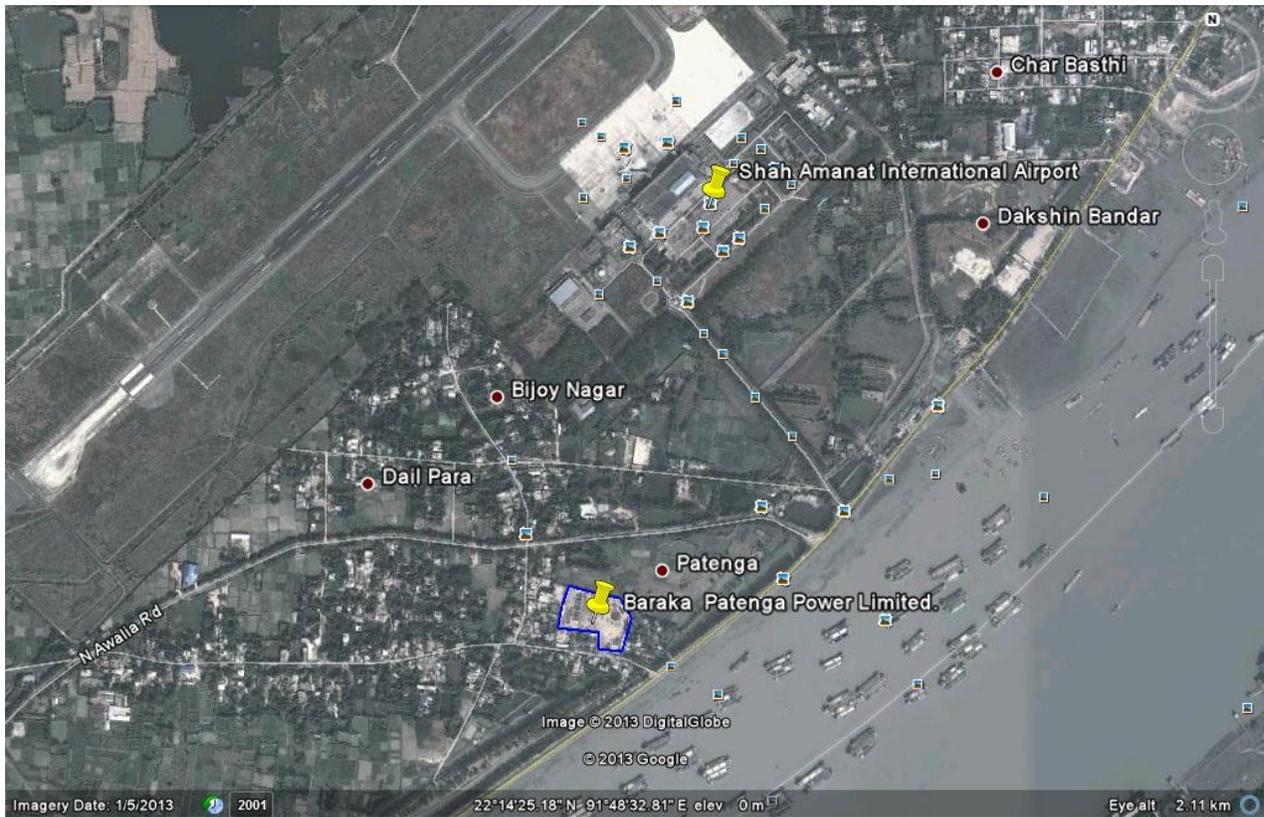


Fig: 3.1(b) Satellite image of Baraka Patenga Power Plant Site

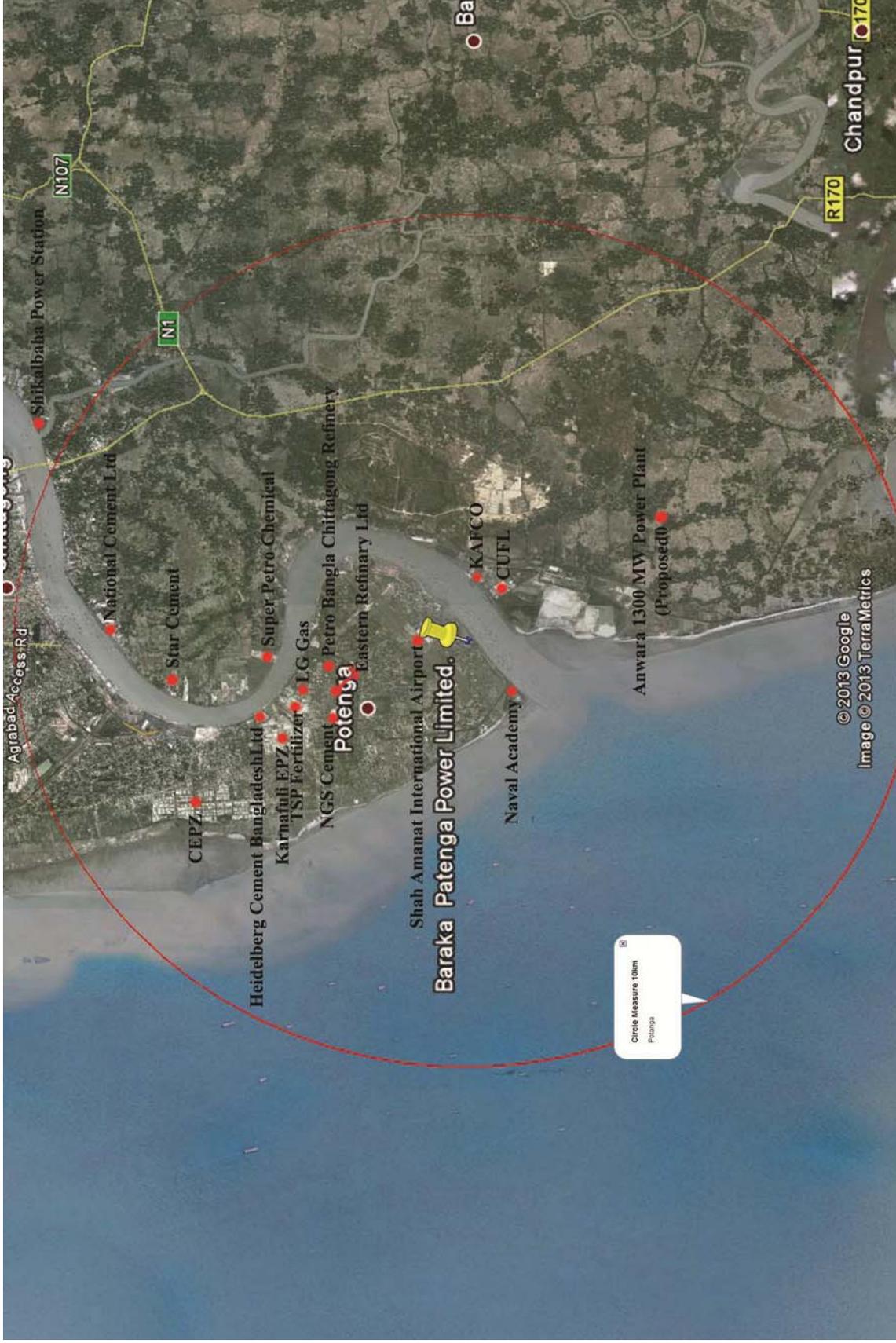


Fig: 3.1(c) 10 km Radius Satellite Map of area around Baraka Patenga Power Plant

**Table 3.2:** Industries in the 10km Air shed

| No   | Name of Industries   | Aerial Distance from BPPL (Approx.) | Power Generation |
|--|--|-------------------------------------|------------------|
| 01   | National Cement Factory Ltd.                                   | 7.6 Km                              | 5MW (Approx.)    |
| 02   | Star Cement  | 6.5 Km                              | 4 MW (Approx.)   |
| 03   | CEPZ (United Power Generations & Distributions Ltd., Malancha) | 7.8 Km                              | 44MW             |
| 04   | Super Petro Chemicals  | 4.6 Km                              | 5 MW (Approx.)   |
| 05   | Heidelberg Cement Bangladesh Ltd. (Captive Generation)         | 4.8 Km                              | 10 MW            |
| 06   | TSP Fertilizer Factory   | 4.1 Km                              | 5MW              |
| 07   | Karnafuli EPZ  | 4.4 Km                              | 44MW             |
| 08   | LP Gas Ltd   | 3.8 Km                              | 5 MW (Approx.)   |
| 09   | Petro Bangla Chittagong Refinery                               | 3.0 Km                              | 5 MW (Approx.)   |
| 10   | NGS Cement Ltd   | 3.4 Km                              | 5 MW (Approx.)   |
| 11   | Eastern Refinery Ltd (Captive Power Generation)                | 3.0 Km                              | 9 MW             |
| 12   | Shah Amanat International Airport                              | 0.8 Km                              | 3 MW (Approx.)   |
| 13   | Naval Academy  | 1.5 Km                              | 2 MW (Approx.)   |
| 14   | KAFCO (Captive Power Generation)                               | 1.5 Km                              | 21MW             |
| 15   | CUFL (Captive Power Generation)                                | 1.3 Km                              | 25MW             |
| 16   | Anwara 1300 MW Power plant (Proposed)                          | 5.3 Km                              | 1300MW           |
| 17   | Shikalbaha Gas Fired Steam Turbine Power Station               | 10.5Km                              | 88MW             |
| 18   | Shikalbaha Energis Power Plant                                 | 12 Km                               | 55MW             |
| 19   | Shikalbaha (Duel Fuel Combined Cycle) Power Plant              | 10.77 Km                            | 150MW            |
| 20   | EnergyPac Power Plant  | 12.34 Km                            | 108MW            |
| 21   | Aicom HFO Power Plant, Julda                                   | 9 Km                                | 100MW            |
| <b>Total Generation of Power (Approx.)</b> |  |                                     | <b>1993MW</b>    |

The Detailed Planning Zones within the Chittagong City Corporation (CCC) area are shown in table 3.3.

**Table 3.3:** The Detailed Planning Zones (DPZ) within the Chittagong City Corporation

| Chittagong City Corporation (CCC) Detailed Planning Zones (DPZ) |                          |             |
|---|--------------------------|-------------|
| Within CCC  | DPZs are:                | Area (acre) |
| DP Z 01   | Patenga-Halishahar       | 12,704      |
| DP Z 02   | Agrabad-Kattali          | 10,085      |
| DP Z 03   | Sadarghat - Chawk bazaar | 3,326       |
| DP Z 04   | Bakalia -Chandgaon       | 8,195       |
| DP Z 05   | Lalkhan bazaar-Pahartali | 5,914       |
| DP Z 06   | Panchlaish - Baizid      | 9,601       |

The table 3.1 above shows that the project is within the detailed planning zone 1 (DPZ-01). Bounded by the Karnaphuli River on the east and the Bay of Bengal on the west this area of 51.24 sq km / 12,662 acres (BBS); is on the southernmost tip of the City. Due its geographical location bordering the river and the sea, the port has been established here. The openness has made it convenient to establish the only airport, which has been upgraded to an international one in 1995. Large public sector manufacturing industries and two EPZ's have been established here. The riverside, coast and beach are tourist attractions. The Area consists of four wards which are; Ward 38, Ward 39, Ward 40 & 41. The project site is located at South Patenga which is Ward no. 41. The landuse map of DPZ-01 (Patenga-Halishahar) is shown below in figure 3.1 (d).

Significant uses are the port, airport, major industrial areas and defense establishments. Residential uses dominate around 24%, Water bodies consisting of khals; ponds and marshy areas, coastal chars and vacant land consist of 35.63% area.

Large public sector and heavy manufacturing industries such as the Karnaphuli EPZ (former Steel mill), the General Electric Manufacturing GEM Plant, oil installations, cement factory, grain silo are situated here. In the first phase the Karnaphuli EZP has leased 85 plots (@ 2000 sq m sized plots) to 7 overseas and 8 domestic companies. Two firms have started construction and it is estimated to be in operation within 2 years. In full capacity it is assumed to create a total of 40,000 jobs. The Chittagong EPZ (built in the 80's) has 295 industrial plots in some 560 ha of land in which 135 industries are in operation, currently employing some 130,000 persons.

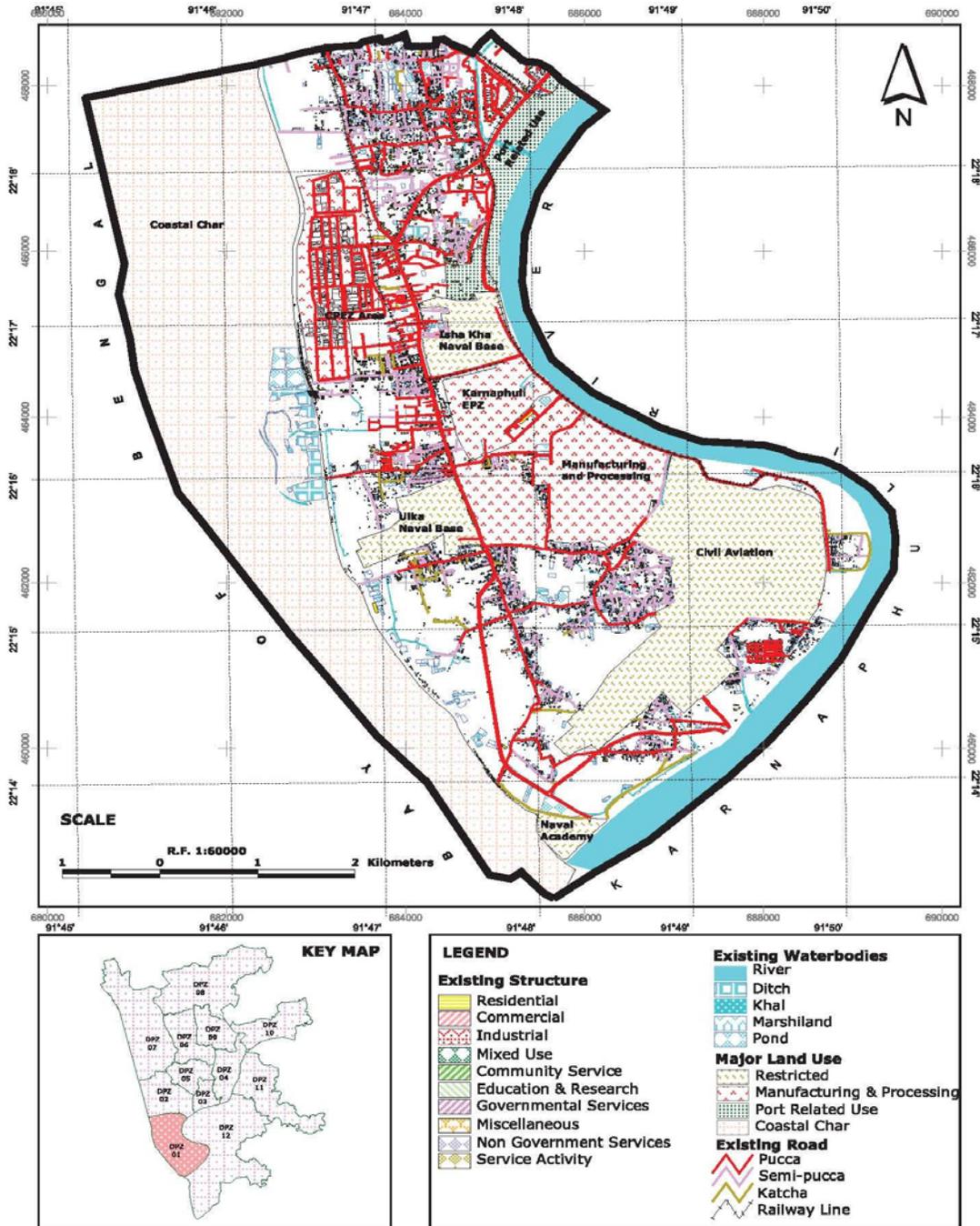
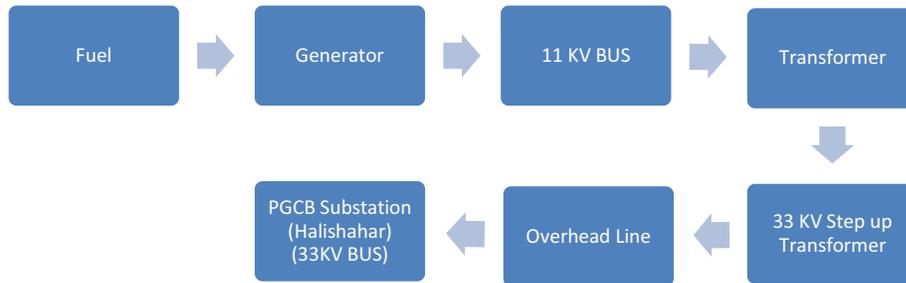


Figure 3.1 (d): Landuse Map of DPZ-01 (Patenga-Halishahar)

### 3.2.2 Electrical Interconnection

The BPPL plant output evacuating power will be of 33KV from the plant's 33KV Sub-station, which will be hooked to the 33/132KV Halishahar Sub-station of Bangladesh Power Development Board (BPDB) through a 6.5Km overhead transmission line. The electrical interconnection transmission line would be constructed by BPPL.

Electrical interconnection facility is shown in a flow diagram-



### 3.2.3 Fuel Transportation

Vessel carrying HFO will be offloaded at a rented HFO storage facility at Chittagong Port area at a distance of approximately 3-4 km from the power plant site. From there, the fuel will be transported by road to plant storage facility by 25MT capacity Tank Lorry.

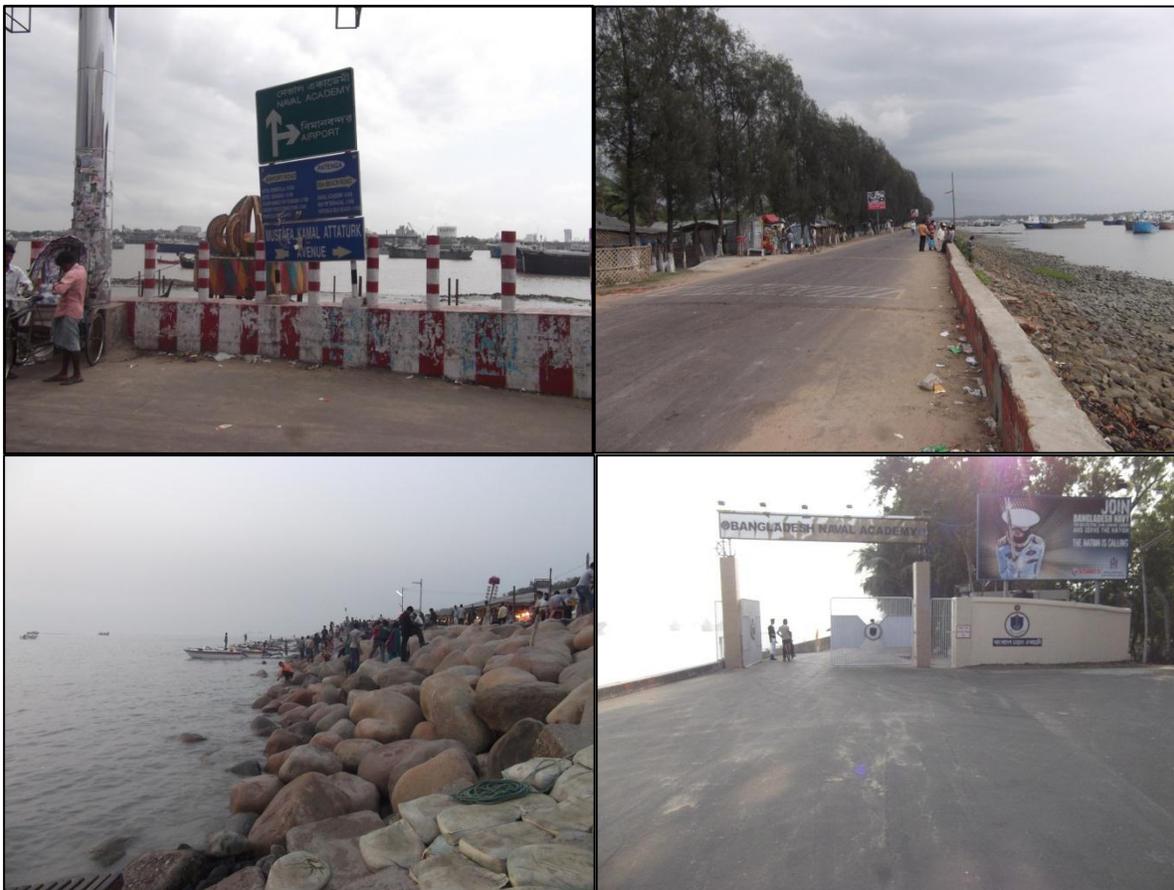


Fig 3.2: Surrounding features of South Patenga

### **3.2.4 Topography of the Site & Surrounding Land**

The site of the project falls under Patenga Heavy Industrial Zone on the West side of the river Karnaphuli. To the North lies the Shah Amanat International Airport within 1km from the proposed project site. The surrounding terrain is a low land seasonally flooded during rainy season.

## **3.3 PROJECT ACTIVITY**

### **3.3.1 Site Development & Construction**

#### **3.3.1.1 Site Preparation**

Site preparation would comprise the partial land filling and compaction in around 4 acres of land prior to construction a 300mm thick carpet of crushed stone should be spread in the lay-down areas and on the working surface. All known underground services should be flagged up and all redundant services coming onto the site should be blanked off and removed.

#### **3.3.1.2 Piling**

The proposed power plant is being founded on piles. The piles could be bored, augured or driven and the type will depend upon the geotechnical data available. However given the close location of existing generating plant it is anticipated that the piles will be of a type which could be installed with the minimum of disturbance to existing equipment. This would imply bored or augured piles rather than driven types.

Design load tests should be made on test piles for design purposes (design piles). Design piles are normally loaded until the failure of the bearing soil as an aid to the pile design in similar conditions.

#### **3.3.1.3 Foundations**

Foundations should be designed to British Standard Code of Practice BS 8004 or equivalent Bangladesh National Building Code. The design of foundations for all structures and equipment are to be such that differential and total settlements or other movements should not exceed acceptable limits and ensure safe and maintenance free operation of the plant.

Detail design parameters for the civil works would be provided by the relevant consultant. The nature of the fill material and the construction techniques used should be such that the less heavily loaded equipment and the buildings may be founded on rafts or spread footings.

### 3.3.1.4 Roads

The roads should be designed to be capable of carrying all the vehicles likely to be used during construction and throughout the life of the plant including articulated vehicles and transporters used for the removal and replacement of major items of the plant.

Car parking and hard standing areas should be of similar construction to the roads. The road pavements should be of reinforced concrete and in conformity with relevant British or equivalent Bangladesh National Code of Practice.



Fig 3.3: Present Status of the Project Site

### 3.3.1.5 Drainage

It is recommended that the surface water and foul drainage systems should be separate and should be designed in accordance with BS EN 752 Parts 1 to 4 "Drain and sewer systems outside buildings". Manhole and chamber covers should be heavy duty throughout.

## Surface Water Drainage

The capacity of the surface water drainage system should be sufficient to deal with a storm return period of 1 in 5 years. The surface water drainage should include all necessary gutters, down pipes, gullies, traps, catch pits, manholes etc. The quality of the discharge shall be acceptable in all respects to the local water and environmental authorities.

## Foul Water Drainage

All waste drainage should be taken to a septic tank. A septic tank is a long retention time tank where solids deposit out in an anaerobic bottom layer. A septic tank will be constructed for the original power station. The Contractor shall satisfy himself that the capacity of the septic tank is sufficient to cater for the additional load arising from the new power station. The septic tank should be connected to a soak way by means of an overflow pipe whereby the liquid effluent can be drained.

### 3.3.1.6 Power Station Buildings

The various buildings comprising the works should have a common architectural concept in order to unify the various elements and should be suitable for the operating and climatic conditions at site. The design should make selective use of materials to produce a pleasing concept throughout and a working environment, which is safe, durable and functional.

The dimension of all the buildings should be such as to provide generous space for the safe installation and proper operation and maintenance of the plant and its equipment. In particular generous space should be provided immediately in front of, behind and beside all items of the plant.

In all rooms or buildings housing switchgear, a clear working space should be provided around switchboards of at least 1.0 m behind and in front of the fully withdrawn trucks.

It is recommend that the floors should be constructed in reinforced concrete and designed to accommodate all foreseeable static and dynamic loads. They should be provided with surface finish appropriate for their intended usage and properly drained bounded areas should be provided wherever necessary to contain accidental spillage of oil or other harmful liquids. The design of all buildings must ensure that noise, vibration and temperature levels are within permissible limit.

### 3.3.1.7 Sub-station

Transformer compounds should be constructed with oil containment facilities. Compounds should each be provided with suitable fencing and a lockable access gate. Fences to transformer compounds and other electrical areas within the site boundary should be of 2.4 m minimum height.

The tank should be fitted with a suitable overflow system, air vents, access hatches, ladders, a sump and a means of emptying the tank.

### 3.3.1.8 Site Fencing

A security fence should be provided around the permanent boundary of the site that should be 3 m high above the site formation level.

Gates should be fabricated from galvanized steel and as a minimum provide the same level of security as the perimeter fence. All gates should be provided with suitable locking devices.

## 3.4 EQUIPMENT & PROCESS FLOW

### 3.4.1 Power Generation Method

The Baraka Patenga Power Plant is an HFO based IPP power plant of installed capacity 59MW. However, the declared capacity of the power plant is 50MW as per the PPA with the Bangladesh Power Development Board.

The plant is powered by 8 engines from the world renowned Rolls-Royce Company, each of capacity 6.985MW. Besides, the plant will have a Co-generation unit consists of Superheated Steam boiler and steam turbine to produce 3.3MW electricity. The 3.3MW Cogeneration Steam Turbine Plant will have a Cooling Tower to supply water to the steam condensation unit. The flue gas coming out from the waste heat boiler will be passed through the Flue Gas De-sulphurisation Plant (FGD) to reduce the sulphur di-oxide emission through the stack.

A small portion of the produced electricity will be consumed by all electrically operated machinery and for lighting of the plant. All the system of the plant is being installed as per the design, drawing and guide lines by the Original Equipment Manufacturer (OEM) and complying the Standards as set by the OEM. The engines are started by High Pressure Air. The process flow chart of the Baraka Patenga Power Limited is given in Fig 3.4

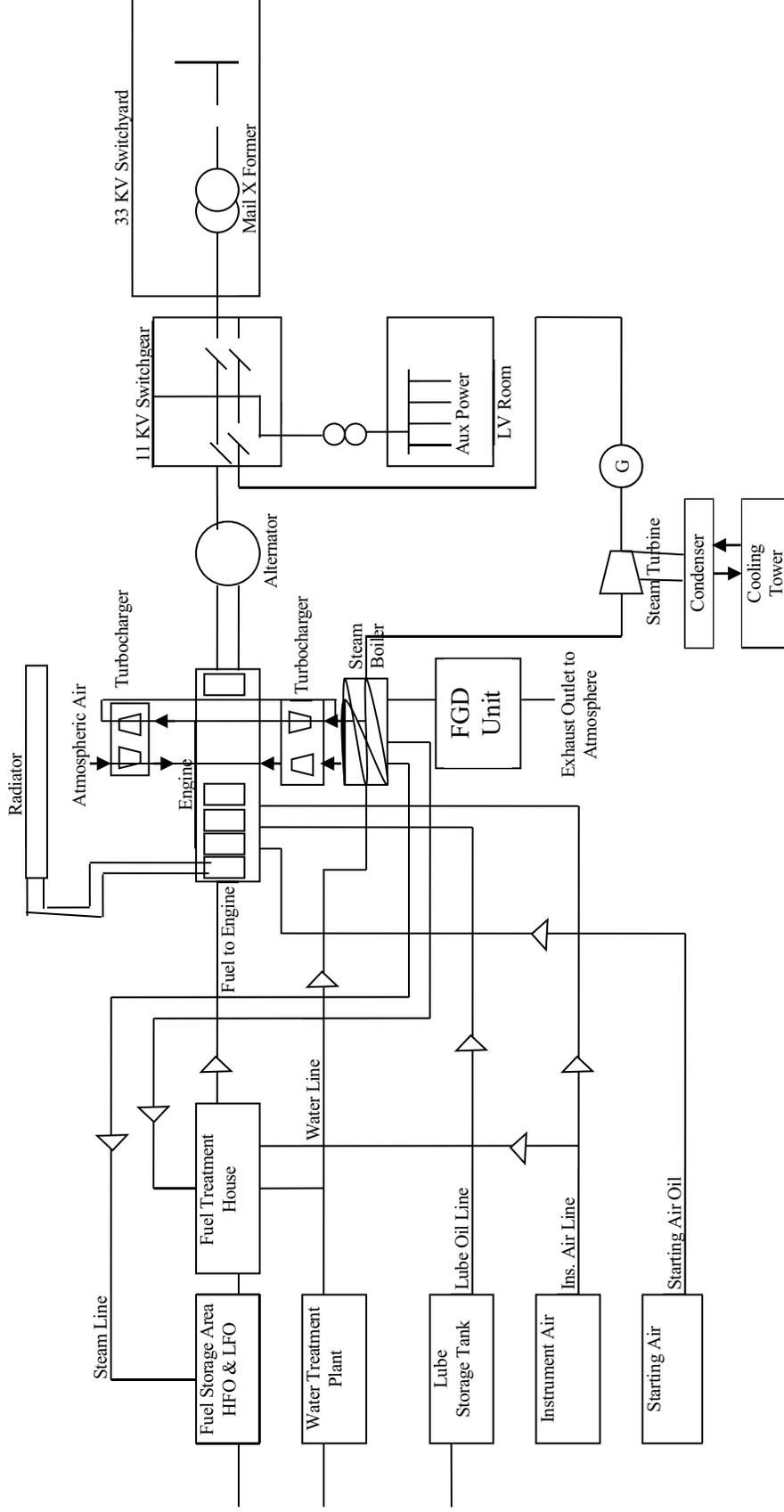


Fig 3.4: Process Flow Diagram of Baraka Patenga 50MW HFO Fired Power Plant

The carefully designed forced ventilated Power House will contain the generating units and other auxiliary machinery. All MV and LV electrical controls will be from the Plant's Control Room through the MV and LV Switch Room.

The other supporting machineries are HP Air Compressors, Charge Air Filters, Engine Hall Ventilation Air Filters, Fuel Treatment Plant, Water Treatment Plant, Oily Water Treatment Plant, Auxiliary Boiler, Auxiliary Diesel Generator etc.

### **3.5 POWER GENERATION DETAILS**

The proposed power plant will use imported Heavy Fuel Oil for the generation of electricity. This supplied fuel will be burnt in internal combustion engine for complete combustion; the generated pressure as a result of combustion will operate the generator sets by some rotating mechanism and will produce electricity.

#### **3.5.1 Technical Data of Engine**

The engine specifications of the HFO engine and 3.3 MW HFO engine exhaust gas secondary power plant engine are attached in the annexure-2 (a) & annexure-2 (b).

### **3.6 Fuel**

#### **3.6.1 Fuel Treatment**

Liquid fuels vary substantially in hydrocarbon composition, physical properties and level of contaminants. Hence, treatment of the heavy fuel oil is mandatory. The imported heavy fuel oil would undergo proper treatment before feeding to the engines.

The major functions of a heavy fuel forwarding system are: pumping, heating, fuel selection, filtration, and metering. Heating requirements will vary depending on the viscosity of the fuel. However, heavy fuel oils may require heating to 135-160°C to reduce viscosity to an acceptable level.

##### **3.6.1.1 HFO Purifier**

HFO Purifier will be used to separate sludge and water content from HFO. The separated water and sludge will be properly treated.

##### **3.6.1.2 Oily water Treatment**

There will be an oily water separator which will trap waste oil from the oily water. The treated water will be drained properly.

### 3.6.2 Fuel Specifications

The fuel specification is provided in the annexure – 3

### 3.7 Water Purification System

There would be efficient water purification system for the proper treatment of water to be used in the cooling towers and the boilers. The required water would be the extracted from the ground by deep tube well. The raw water would be filtered through Multimedia filter, Iron filter & Reverse Osmosis filter respectively. After filtration about 35 cubic m. per hour RO filtered water will be available which will be stored in the filtered water tank.

There will be closed loop cooling system in the power plant. The amount of make-up water for these cooling towers is about 21 cu. m. which will be supplied from the filtered tank. About 8 cu. m water will be pumped to the Reverse osmosis unit for second phase RO filtration for the boiler feed. The detail of water purification system is shown in flow diagram presented in the Annexure – 4.

### 3.8 Engine Emission Specifications

The engine emission specification is provided below in table 3.4:

**Table 3.4:** Flue Gas Data (Design Condition)@ESP inlet "40 mg/nm<sup>3</sup>" @ 02 Dry volume basis

| Items                     | Unit                    | "6.984"<br>MW/set |  | Remarks  |
|---------------------------|-------------------------|-------------------|--|--|
| Flue Gas Flow<br>(design) | Nm <sup>3</sup> /hr-wet | "86200"           |  | "315" deg. C at<br>100% load<br>"(m <sup>3</sup> /hr)"     |
|                           | kg/hr                   | "51100"           |  | At "315" deg. C<br>one standard<br>atmospheric<br>pressure |
| Flue Gas Density          | mg/m <sup>3</sup>       | 0.59280742<br>5   |  | "kg/m <sup>3</sup> " at 315<br>Deg C & 1.013 bar<br>(abs)  |
| Temperature               | C ( Normal)             | "315"             |  |  |
|                           | C (Maximum)             | "355"             |  | MAX  |
| Pressure                  | mmH <sub>2</sub> O      | "400"             |  | mmWC   |
| Flue Gas analysis         |                         |                   |  | Molecular Weight   |
| CO <sub>2</sub>           | % by vol                |                   |  |  |
| N <sub>2</sub>            | % by vol                |                   |  |  |
| O <sub>2</sub>            | % by vol                |                   |  |  |
| H <sub>2</sub> O          | % by vol                |                   |  |  |
| SO <sub>2</sub>           | % by vol                | "0.02"            |  | Depends on sulfur<br>content of HFO                        |
| SO <sub>3</sub>           | % by vol                | "0.02"            |  | „  |

|            |          |              |  |   |
|------------|----------|--------------|--|---|
| NOx        | % by vol | "1390"       |  | mg/nm3 at 15% O2                          |
| HF         | % by vol |              |  |   |
| HCl        | % by vol |              |  |   |
| TOTAL      | % by vol |              |  |   |
| Inlet Dust | mg/nm3   | " 40 mg/nm3" |  | A means the amount of dust in per nm3 air |

**Guarantee @ stack**

|                    |               |                         |  |     |
|--------------------|---------------|-------------------------|--|-----|
| <b>Outlet Dust</b> | <b>mg/nm3</b> | <b>"Not Applicable"</b> |  |     |
| Removal Efficiency | %             | "Not Applicable"        |  |     |
| Pressure Drop      | mmH2O         | "Not Applicable"        |  | Max |

*Chapter 4*  
*Baseline Environment*

## Chapter-4

### 4.0: BASELINE ENVIRONMENT

#### 4.1 General Consideration

Baseline condition of environment states the present status of different components of environment in absence of the project. The main objective of examining the present environment is to provide an environmental baseline against which potential impacts from construction and operational phases of any project can be compared. A second important function of establishing a baseline for parameters such as air and water quality is to ensure that any problems arising from existing sources are not erroneously attributed to the project under study. In the present study the different environmental components examined for setting baseline conditions of the project area, are physico-chemical, biological and socio-economical. The study area covered both the immediate site, and an extended area of about 5 km radius. In physico-chemical component, parameters included are land, water quality, air quality, climate, and noise.

#### 4.2 Physico-Chemical Environment

##### 4.2.1 Land

##### 4.2.1.1 Surrounding Land Uses

The **Baraka Patenga Power Limited**, a Bangladesh company, intends to build and operate a Power plant based on imported Heavy Fuel Oil (HFO) at **South Patenga, Chittagong**. The proposed power plant has a nominal capacity of 59 MWe. The site is connected by **Shah Amanath International Airport Road** to **Port Connecting Road** and **Dhaka-Chittagong Highway**. Heavy industries, such as dockyard, oil refinery, heavy metal industries are primarily located at South Patenga. The land use map of the area is given in fig. 3.4.

The site of the project falls under Patenga Heavy Industrial Zone where there are fuel deposit of Padma Oil Company Ltd., Jamuna Oil Company Ltd., Meghna Oil Company Ltd., International Oil Tankers Ltd., Food Silo, Heidelberg cement Bangladesh Ltd., TSP Fertilizer Factory, LP Gas Ltd, Petro Bangla Chittagong Refinery, NGS Cement Ltd., Eastern Refinery Ltd. (ERL), CEPZ Area and the Shah Amanat International Airport. On the other side of the river there are Karnaphuli Fertilizer Company Limited (KAFCO), Anwara 1300 MW Power plant (proposed), Shikalbaha Power Station, National cement Factory Ltd., Super Petro Chemicals, Star Cement, and Chittagong Urea Fertilizer Factory (CUFL) situated at Anwara. The project site is situated on the West Side of the river Karnaphuli and 1 km distance from the Shah Amanat International Airport Road. The Patenga road is lying to the East side adjacent to the river Karnaphuli. The location is well communicated by both road and river ways.

#### 4.2.2 Topography, Soil & Geology

Chittagong city has a unique topography and is well known for the panoramic view of its hilly landscape. This is the only mega city of the county having wide variety of morphological features, the spectacular undulating hill topography in one side and the low lying coastal mud flats on the other side. It is not the urban planners; rather it is the natural process that has given the city morphology in to its present shape. The Karnafuli River in the east, the Bay of Bengal in the West and the Tertiary hill landscape in the North are three major determinants for origin, development, and horizontal and vertical expansion of the city. A total of eight geomorphic units have been identified, which are Tertiary hills, piedmont and valleys, alluvial plain, ancient point bar, tidal mud plain, supra tidal plain, natural levee and sandy beach. The soil is made up of 93% loamy mainly with non-calcareous alluvium and non-calcareous flood plain soil. The remaining 7% has clayey texture.

The project area is near Shah Amanat International Airport which is ancient point bar in terms of land form. The land use pattern and landform in Chittagong City is given in the following **table 4.1**.

**Table 4.1:** Interrelation between Land use and Landform in Chittagong City

| Landforms            | Major Land uses  |
|----------------------|--|
| 1. Hill              | High Class Residential Area, Vegetation Coverage, Vacant Land, Government Buildings  |
| 2. Piedmont          | Middle Class Residential Area, Roads & High Ways, Commercial Area, Industrial Area, Administrative Uses, Slums and Squatters, Educational Institutes, Religious Places, Park and Playground etc. |
| 3. Alluvial Plain    | Agricultural Uses Middle Class Residential Area, Agrabad Commercial Area, Industrial Area, Administrative Uses   |
| 4. Ancient Point Bar | Agriculture, Mixed Residential Area, Industrial, EPZ Airport and Commercial Activities.  |
| 5. Supra Tidal Plain | Agriculture Area, Low Income Residential   |
| 6. Tidal Mud Plain   | Vacant, Mangrove forest, Shrimp farms,   |
| 7. Natural Levee     | Port Activities, Navy office and residents, Mixed Residential use  |
| 8. Sandy Beach       | Recreational (Tourism), Vacant Land  |

(Source: Department of Geography and Environment University of Dhaka)

The river Karnafully with its strong tidal behavior has been playing a major role to determine the land-sea interface in city morphology. Except the hilly, valley and

piedmont areas, remaining of the city is generally a plain land. The project area is located in the South Patenga plain which contains the inter-fingering of sand and silt-clay layers. The type of landform of South Patenga is recent alluvial, point bar and tidal deposits and abandoned channel and depression.

### 4.2.3 Hydrology

#### Surface Water of Project Area

Water supply of the Chittagong City is largely dependent on ground water abstraction from underlying aquifer system. As other parts of the country this area also receives sufficient amount of rainfall and there is a good availability of ground water, which is being, used by hand pumps for drinking and domestic purposes. Most of the water bodies in the area are ponds and some of these ponds are generated due to excavation of earth. There are some low lying flood plain areas, which remain under water during flood period (July-October).

### 4.2.4 Water Quality

#### 4.2.4.1 Surface Water

The Karnafuli River is the only surface water body adjacent to the project site. The river carries run-off water from adjoining areas and Chittagong city, which might contain some pollutants. Water was collected from the river and analyzed in AECL Laboratory. The water quality of limited parameters of the ditch near the project site as analyzed is given below in *Table 4.2*.

**Table-4.2:** Surface Water quality (limited parameters) of the Karnafuli River

| Parameter        | Value     |
|------------------|-----------|
| p <sup>H</sup>   | 7.5       |
| TDS              | 1010 mg/l |
| DO               | 6.8 mg/l  |
| BOD <sub>5</sub> | 0.5 mg/l  |
| COD              | 6.0 mg/l  |
| Chloride         | 252 mg/l  |
| Alkalinity       | 126 mg/l  |

Source: AECL Lab (sample collected on 05.12. 2011 and reporting on 10.12.2011)

#### 4.2.4.2 Ground Water

Ground water level exists at a moderate (Generally below 5.0 m) depth, which is being recharged mainly by infiltration of rainwater. Ground water is the source of water for domestic use in this area. Usage of ground water for irrigation is limited here. The recharge capacity of the ground water level seems to be adequate. To determine quality of ground water, water sample was collected from a nearby tube well of the existing plant of the BPPL and analyzed for different parameters. The results shows that all the parameters remain within the allowable limit of drinking water value as per

as Environmental Quality Standards for Bangladesh. The parameters which have been analyzed during this study are presented below in *Table 4.3* –

**Table-4.3:** Ground Water quality (limited parameters) of Project Site

| Parameter              | Value    |
|------------------------|----------|
| p <sup>H</sup>         | 7.1      |
| Total Dissolved Solids | 280 mg/l |
| Iron                   | 1.2 mg/l |
| Alkalinity             | 62 mg/l  |
| Hardness               | 74 mg/l  |
| Chloride               | 16 mg/l  |

Source: AECL Lab (water collected on 05.12. 2011 and reporting on 10.12.2011)

#### 4.2.5 Air Quality

National Ambient air quality standards (NNAQS) are defined in ECR'97. The ultimate aim of the NNAQS is the compliance in all areas in the country for the protection of health and wellbeing of the population. In six cities including Chittagong, ambient air quality parameters are monitored on a regular basis by the DOE using CAMS (Continuous Air Monitoring Stations). One of the CAMS is located at Agrabad area which is in the same air shed as the present power station located.

The data for six criteria pollutants (i.e., pollutants regulated by law) for the four months' period during December 2012 to March 2013 are shown in table 4.4. More detailed data from the Continuous Air Monitoring Station at Agrabad for the months of December-2012, January 2013, February 2013 and March 2013 are presented in Annexure - 5

**Table-4.4:** Air Quality Data (Agrabad CAMS, Chittagong)

| SI | Parameter | Unit  | NNAQS | Period | Monthly Average Data |          |          |          | 4 month's Average |
|----|-----------|-------|-------|--------|----------------------|----------|----------|----------|-------------------|
|    |           |       |       |        | Dec 2012             | Jan 2013 | Feb 2013 | Mar 2013 |                   |
| 1  | PM2.5     | µg/m3 | 65    | 24 hr  | 140.44               | 177.95   | 126.89   | 100.90   | 136.55            |
| 2  | PM10      | µg/m3 | 150   | 24 hr  | 195.42               | 277.62   | 231.20   | 193.83   | 224.52            |
| 3  | SO2       | ppb   | 140   | 24 hr  | 0.32                 | 6.00     | 10.54    | 8.09     | 6.24              |
| 4  | NO2       | ppb   | 53    | Annual | 7.68                 | 20.90    | 22.00    | 14.98    | 16.39             |
| 5  | CO        | ppm   | 9     | 8 hr   | 1.47                 | 2.17     | 1.14     | 1.25     | 1.51              |
| 6  | O3        | ppb   | 80    | 8 hr   | 4.36                 | 16.89    | 32.87    | 18.99    | 18.28             |

PM<sub>2.5</sub> - Fine Particulate Matter (EAD<2.5µm)

PM<sub>10</sub> - Particulate Matter (EAD<10µm)

SO<sub>2</sub> - Sulfur dioxide

NO<sub>x</sub> - Oxides of Nitrogen

CO- Carbone Mono-oxide

EAD- Effective Aerodynamic Diameter

The data show that the concentrations of PM<sub>2.5</sub> and PM<sub>10</sub> are much higher compared to the NAAQS. For the gaseous pollutants, the levels obtained are within NAAQS. An air shed where NAAQS are exceeded is referred to as a degraded air shed. So, as per the Environmental, Health & Safety guidelines (for Thermal power plant) of IFC/WB 2008, the fuel quality standard for degraded air shed would be applicable in the present case. This would mean that for the plant (i.e., with power level > 50 MWth), the sulfur level in HFO has to be lower than 0.5% or there should be some mechanism in the plant to reduce the emission to this equivalent concentration if fuel with higher level sulfur is to be used. The plant will use 2.8% Sulfur HFO and will be equipped with a wet FGD (Flue Gas Desulfurization) plant which can remove >90% of SO<sub>2</sub> (details in Annex 13b). The resultant SO<sub>2</sub> emission will thus be equivalent to about 0.3% sulfur HFO use. The FGD plant will also remove substantial fraction of PM and NO<sub>x</sub> as it uses a wet scrubbing process.

#### **4.2.6 Noise Level**

The most sophisticated machineries will be installed in **Baraka Patenga Power Limited**, which will produce little significant noise. It is suggested that the proponent should create a green belt around the project site, administrative building and other services buildings, which would reduce the noise level significantly. The ambient noise level data were collected from different sides of the project by noise level meter and they are given below in *Table 4.5*.

**Table 4.5: Ambient Noise Quality Analysis**

| Sample Location                                 | Project from West side (near boundary area)                                    |                               |                               |                               |                               |                               |                               |                               |
|---|--|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| Time of Experiments                             | Day Time   |                               |                               |                               |                               | Night Time                    |                               |                               |
|   | 06.00 To 09.00 am  | 09.00 am To 12.00 pm          | 12.00 To 03.00 pm             | 03.00 To 06.00 pm             | 06.00 To 09.00 pm             | 09.00 To 12.00 am             | 12.00 To 03.00 am             | 03.00 To 06.00 am             |
| Concentrations present (LA <sub>eq</sub> ) dBA. | Max: 66<br>Avg: 55<br>Min: 45  | Max: 68<br>Avg: 56<br>Min: 47 | Max: 70<br>Avg: 54<br>Min: 44 | Max: 66<br>Avg: 53<br>Min: 42 | Max: 65<br>Avg: 55<br>Min: 44 | Max: 62<br>Avg: 50<br>Min: 41 | Max: 59<br>Avg: 48<br>Min: 38 | Max: 58<br>Avg: 46<br>Min: 40 |
| Sample Location                                 | Project from East side (near boundary area)                                    |                               |                               |                               |                               |                               |                               |                               |
| Time of Experiments                             | Day Time   |                               |                               |                               |                               | Night Time                    |                               |                               |
|   | 06.00 To 09.00 am  | 09.00 am To 12.00 pm          | 12.00 To 03.00 pm             | 03.00 To 06.00 pm             | 06.00 To 09.00 pm             | 09.00 To 12.00 am             | 12.00 To 03.00 am             | 03.00 To 06.00 am             |
| Concentrations present (LA <sub>eq</sub> ) dBA. | Max: 68<br>Avg: 54<br>Min: 47  | Max: 72<br>Avg: 58<br>Min: 48 | Max: 71<br>Avg: 55<br>Min: 43 | Max: 69<br>Avg: 57<br>Min: 50 | Max: 68<br>Avg: 56<br>Min: 44 | Max: 66<br>Avg: 52<br>Min: 42 | Max: 64<br>Avg: 49<br>Min: 40 | Max: 63<br>Avg: 50<br>Min: 42 |
| Sample Location                                 | Project from North side (near boundary area)                                   |                               |                               |                               |                               |                               |                               |                               |
| Time of Experiments                             | Day Time   |                               |                               |                               |                               | Night Time                    |                               |                               |
|   | 06.00 To 09.00 am  | 09.00 am To 12.00 pm          | 12.00 To 03.00 pm             | 03.00 To 06.00 pm             | 06.00 To 09.00 pm             | 09.00 To 12.00 am             | 12.00 To 03.00 am             | 03.00 To 06.00 am             |
| Concentrations present (LA <sub>eq</sub> ) dBA. | Max: 69<br>Avg: 52<br>Min: 41  | Max: 71<br>Avg: 56<br>Min: 44 | Max: 72<br>Avg: 53<br>Min: 42 | Max: 70<br>Avg: 54<br>Min: 44 | Max: 69<br>Avg: 55<br>Min: 43 | Max: 68<br>Avg: 52<br>Min: 41 | Max: 67<br>Avg: 46<br>Min: 38 | Max: 66<br>Avg: 48<br>Min: 39 |
| Sample Location                                 | Project from South side (near boundary area)                                   |                               |                               |                               |                               |                               |                               |                               |
| Time of Experiments                             | Day Time   |                               |                               |                               |                               | Night Time                    |                               |                               |
|   | 06.00 To 09.00 am  | 09.00 am To 12 pm             | 12.00 To 03.00 pm             | 03.00 To 06.00 pm             | 06.00 To 09.00 pm             | 09.00 To 12.00 am             | 12.00 To 03.00 am             | 03.00 To 06.00 am             |
| Concentrations present (LA <sub>eq</sub> ) dBA. | Max: 68<br>Avg: 56<br>Min: 42  | Max: 71<br>Avg: 59<br>Min: 49 | Max: 70<br>Avg: 56<br>Min: 44 | Max: 68<br>Avg: 58<br>Min: 49 | Max: 69<br>Avg: 57<br>Min: 44 | Max: 68<br>Avg: 53<br>Min: 42 | Max: 69<br>Avg: 50<br>Min: 40 | Max: 75<br>Avg: 49<br>Min: 40 |
| <b>DoE (Bangladesh) Standard</b>                | <b>Day Time – 75 dBA &amp; Night Time – 70 dBA (For Industrial Zone)</b>       |                               |                               |                               |                               |                               |                               |                               |
| <b>IFC/Int'l Standard</b>                       | <b>70 dBA - Day &amp; Night time (For Industrial/commercial Zone)</b>          |                               |                               |                               |                               |                               |                               |                               |
| <b>Remark</b>                                   | <b>Maximum noise source from vehicular/ship movement and human activities.</b> |                               |                               |                               |                               |                               |                               |                               |

All units are in (LA<sub>eq</sub>) dBA

Source: AECL Lab (measured on 04.12. 2011 by Sound Level Meter of AECL)

#### 4.2.7 Climatic Condition

The climate of **Chittagong** of which the project is a part, is average tropical monsoon with alternating dry/wet seasons. The weather condition of the area is described in this report to have an idea of the project site in terms of climatic condition.

- November to February: The dry (winter) season is the coolest and driest period. Monthly average temperatures are below 28<sup>0</sup>C with a minimum at 15.7<sup>0</sup>C. Rainfall is very rare during this period. Winds are predominantly blowing from the Northwest but with a high frequency of calm wind situations.
- March and April: In the pre-rainy season (summer) and the early months of the wet seasons, the highest temperatures are reached. The monthly average temperature can rise up to 33<sup>0</sup>C. During this period, air becomes more humid, rainfall increases, and heavy rains with thunderstorm occur. This period is locally called as “Kalbaaishakhi”. Sometimes the rain falls with hail.
- May to October: In the wet season (“monsoon period”) more than 85% of the total annual rainfall occurs. Monthly average temperatures remain high with a maximum of 32.4<sup>0</sup>C. The period of periodic heavy thunderstorms lasts until June. June to mid-September to early November is the transitional period with decreasing rainfall, often thunder. During the wet season, the winds are predominantly blowing from the South.

During the pre-monsoon period, squally winds of up to 130 km/h or occasionally more, often accompanied by thunderstorms may damage assets and crops. Cyclonic storms occurring in the Bay of Bengal in April-May and October-November rarely penetrate as far as Comilla, but may cause serious damage to crops, livestock, assets, and people when they do so. Monsoon rains are generally not stormy, but downpours of 50-75 mm per day are not uncommon and rainfall with more than 250mm per day is occasionally experienced.

In the wet seasons, between June and September, the cloud cover reduces the hours of daily sunshine from about 8 to 5 hours. The cloud cover is thicker and appears more frequently than in other months. This is accompanied by a higher stability of the atmosphere, which reduces dispersion of emitted air pollutants and hence may cause higher concentration levels of pollutants in the vicinity of emission sources.

The relative humidity rises to above 90% during the wet season. The mean annual evaporation is high, with the highest daily figures occurring during March to May when the mean daily temperatures are at their highest. The mean monthly maximum temperature in Chittagong varies from 28.0<sup>0</sup>C in January, to 33.8<sup>0</sup>C in April. A maximum daily of 33.8<sup>0</sup>C and a minimum of 14.9<sup>0</sup>C have been recorded. The mean daily maximum temperatures rise during March (33.0<sup>0</sup>C) and April (33.8<sup>0</sup>C) as a prelude to the oncoming rains. As is to be expected, the mean daily maximum temperature drops when the rainy season starts.

The name of the weather station at Patenga is **419780 (VGEG)**. The monthly average climatic values of past few years are shown below in table 4.6.

**Table 4.6: Monthly average climatic values (2008-2011)**

**[Year: 2008]**

| Month | Mean temp<br>(°C) | Max temp<br>(°C) | Min temp<br>(°C) | Mean sea level pressure<br>(hPa) | Mean humidity<br>(%) | Precipitation amount<br>(mm) | Mean visibility<br>(Km) | Mean wind speed<br>(Km/h) | Maximum sustained wind speed<br>(Km/h) |
|-------|-------------------|------------------|------------------|----------------------------------|----------------------|------------------------------|-------------------------|---------------------------|--|
| Jan   | 20.8              | 25               | 15.8             | 1011.8                           | 70.7                 | 67.82                        | 3.5                     | 7.9                       | 16.7                                   |
| Feb   | 21.8              | 26.1             | 16.6             | -                                | 61.6                 | 8.13                         | 4.2                     | 8.7                       | 18                                     |
| March | 26.3              | 29.7             | 22.7             | 1011.8                           | 74.7                 | 6.35                         | 4.6                     | 7.1                       | 17.2                                   |
| April | 28.7              | 31.9             | 24.8             | -                                | 70                   | 0                            | 5.7                     | 10.4                      | 20                                     |
| May   | 29                | 31.9             | 25.8             | -                                | 74.8                 | 228.33                       | 6.7                     | 11.3                      | 22.8                                   |
| June  | 28.1              | 30.5             | 26.2             | -                                | 81.5                 | 612.89                       | 6.3                     | 15.8                      | 24.2                                   |
| July  | 27.3              | 29.4             | 25.7             | -                                | 85.6                 | 941.32                       | 6.4                     | 15.2                      | 23.1                                   |
| Aug   | 27.8              | 30.3             | 25.9             | -                                | 83.7                 | 528.58                       | 6.5                     | 14.5                      | 22.8                                   |
| Sep   | 28.2              | 30.9             | 25.9             | 1001.6                           | 81.2                 | 247.39                       | 6.7                     | 11.5                      | 20.2                                   |
| Oct   | 28                | 30.8             | 25               | 1009.7                           | 78.2                 | 176.28                       | 5.9                     | 8.9                       | 17                                     |
| Nov   | 25.7              | 29.6             | 20.9             | 1009.4                           | 68.8                 | 30.98                        | 5.6                     | 6                         | 14                                     |
| Dec   | 23.1              | 26.5             | 18.6             | -                                | 72.7                 | 0                            | 3.9                     | 8                         | 13.1                                   |

- The highest temperature recorded was **34.2°C** on June 15.
- The lowest temperature recorded was **12°C** on February 3.
- The maximum wind speed recorded was **74.1 km/h** on May 26.
- Annual total precipitation: **2848.07 mm**
- Annual average wind speed: **10.2 km/h**

**[Year: 2009]**

| Month | Mean temp<br>(°C) | Max temp<br>(°C) | Min temp<br>(°C) | Mean sea level pressure<br>(hPa) | Mean humidity<br>(%) | Precipitation amount<br>(mm) | Mean visibility<br>(Km) | Mean wind speed<br>(Km/h) | Maximum sustained wind speed<br>(Km/h) |
|-------|-------------------|------------------|------------------|----------------------------------|----------------------|------------------------------|-------------------------|---------------------------|--|
| Jan   | 22.4              | 26.5             | 16.1             | 1011.8                           | 63.1                 | 0                            | 4.1                     | 7.4                       | 17                                     |
| Feb   | 24.5              | 29               | 17.9             | 1013.9                           | 58                   | 1.78                         | 4.4                     | 9.9                       | 18.7                                   |
| March | 27.3              | 31.6             | 22.8             | 1011.3                           | 65.3                 | 42.93                        | 4.6                     | 8                         | 16.3                                   |
| April | 28.9              | 31.9             | 25.8             | 1007.6                           | 76.02                | 75.95                        | 6.1                     | 13.3                      | 21.4                                   |
| May   | 29.2              | 32.6             | 25.8             | -                                | 75.4                 | 374.39                       | 6.8                     | 11.4                      | 20.5                                   |
| June  | 29                | 31.7             | 26.5             | 1001.9                           | 79.9                 | 431.81                       | 6.8                     | 13                        | 19.9                                   |
| July  | 27.7              | 30.5             | 25.8             | -                                | 85.9                 | 1248.15                      | 5.9                     | 15.8                      | 24.8                                   |
| Aug   | 28                | 30.8             | 26.2             | -                                | 84.9                 | 580.64                       | 6                       | 11.6                      | 20.4                                   |
| Sep   | 28.3              | 31.3             | 25.8             | -                                | 82.1                 | 281.18                       | 6.1                     | 9.9                       | 20.6                                   |
| Oct   | 27.8              | 31.2             | 24.8             | 1007.7                           | 76.8                 | 299.72                       | 5.1                     | 7.3                       | 17.6                                   |
| Nov   | 25.6              | 29.9             | 21.5             | 1014.3                           | 70.7                 | 17.27                        | 4                       | 5.1                       | 14.7                                   |
| Dec   | 21.7              | 26.3             | 16.8             | 1014.3                           | 69.9                 | 0                            | 3.6                     | 5.9                       | 15.5                                   |

- The highest temperature recorded was **38.7°C** on July 28.
- The lowest temperature recorded was **10.8°C** on January 20.
- The maximum wind speed recorded was **79.5 km/h** on September 21.
- Annual total precipitation: **3353.82 mm**.
- Annual average wind speed: **9.9 km/h**.

**[Year: 2010]**

| Month | Mean temp<br>(°C) | Max temp<br>(°C) | Min temp<br>(°C) | Mean sea level pressure<br>(hPa) | Mean humidity<br>(%) | Precipitation amount<br>(mm) | Mean visibility<br>(Km) | Mean wind speed<br>(Km/h) | Maximum sustained wind speed<br>(Km/h) |
|-------|-------------------|------------------|------------------|----------------------------------|----------------------|------------------------------|-------------------------|---------------------------|--|
| Jan   | 20.6              | 25.2             | 15.1             | -                                | 67.9                 | 0                            | 3.2                     | 9.1                       | 16.4                                   |
| Feb   | 24                | 28.9             | 17.7             | -                                | 56.9                 | 7.87                         | 3.8                     | 6.5                       | 20.6                                   |
| March | 27.6              | 31.3             | 23.3             | -                                | 69.5                 | 154.18                       | 4.7                     | 11.5                      | 20.3                                   |
| April | 29.3              | 32               | 26.6             | 1011.8                           | 76.3                 | 31.49                        | 5.9                     | 14.2                      | 22.2                                   |
| May   | 29                | 31.9             | 26.1             | 1005.2                           | 78.8                 | 373.63                       | 5.8                     | 11.9                      | 23.5                                   |
| June  | 28.4              | 31.2             | 26.3             | 1004.7                           | 84.9                 | 648.46                       | 5.4                     | 13.2                      | 23                                     |
| July  | 28.6              | 31.6             | 26.4             | 1004.1                           | 82.6                 | 295.39                       | 6                       | 12.5                      | 20.4                                   |
| Aug   | 28.5              | 31.7             | 26.1             | 1006.1                           | 84                   | 460.01                       | 5.9                     | 9.3                       | 17.2                                   |
| Sep   | 28.6              | 31.8             | 26.2             | 1005.4                           | 82.7                 | 116.82                       | 5.9                     | 7.8                       | 14.5                                   |
| Oct   | 28.4              | 31.8             | 25.4             | 1005.5                           | 80.3                 | 320.81                       | 5                       | 5.4                       | 15.8                                   |
| Nov   | 26.1              | 29.8             | 22               | -                                | 73.3                 | 37.59                        | 4.4                     | 3.8                       | 13.9                                   |
| Dec   | 21.9              | 26.4             | 16.8             | -                                | 69.2                 | 19.05                        | 3.4                     | 4.5                       | 14.4                                   |

- The highest temperature recorded was **36.3°C** on March 18.
- The lowest temperature recorded was **12.6°C** on January 13.
- The maximum wind speed recorded was **55.4 km/h** on May 27.
- Annual total precipitation: **2465.30 mm**.
- Annual average wind speed: **9.2 km/h**.

**[Year: 2011]**

| Month | Mean temp<br>(°C) | Max temp<br>(°C) | Min temp<br>(°C) | Mean sea level pressure<br>(hPa) | Mean humidity<br>(%) | Precipitation amount<br>(mm) | Mean visibility<br>(Km) | Mean wind speed<br>(Km/h) | Maximum sustained wind speed<br>(Km/h) |
|-------|-------------------|------------------|------------------|----------------------------------|----------------------|------------------------------|-------------------------|---------------------------|--|
| Jan   | 19.9              | 24.8             | 13.9             | -                                | 62.4                 | 0                            | 3                       | 6.5                       | 16                                     |
| Feb   | 23.6              | 28.4             | 17.5             | -                                | 60.8                 | 0                            | 3.5                     | 6.9                       | 16.9                                   |
| March | 26.2              | 30.6             | 21               | -                                | 63.9                 | 109.72                       | 4.1                     | 9.2                       | 21.2                                   |
| April | 28                | 31.1             | 24.4             | -                                | 75                   | 49.28                        | 4.3                     | 6.5                       | 17.8                                   |
| May   | 28.7              | 31.5             | 25.5             | 1002.9                           | 79                   | 299.46                       | 5.3                     | 9.9                       | 22                                     |
| June  | 28.1              | 30.3             | 26.2             | -                                | 84.4                 | 456.43                       | 4.9                     | 10.6                      | 18.9                                   |
| July  | 28.3              | 30.9             | 26.1             | -                                | 83.4                 | 583.96                       | 5.3                     | 9.7                       | 18.5                                   |

|            |      |      |      |   |      |        |     |     |      |
|------------|------|------|------|---|------|--------|-----|-----|------|
| <b>Aug</b> | 27.8 | 30.3 | 25.7 | - | 85.3 | 807.47 | 5.1 | 8.7 | 17.1 |
| <b>Sep</b> | 27.9 | 30.5 | 25.6 | - | 84.3 | 764.79 | 5.2 | 9.3 | 20.6 |
| <b>Oct</b> | 28.2 | 31.1 | 25.1 | - | 77.7 | 23.87  | 4.8 | 4   | 13.2 |
| <b>Nov</b> | 24.7 | 28.9 | 20.2 | - | 70   | 0      | 4.1 | 3.6 | 15.4 |
| <b>Dec</b> | 21.3 | 25.3 | 17.2 | - | 73.1 | 0      | 3.2 | 4.6 | 15.1 |

- The highest temperature recorded was **34.4°C** on June 15.
- The lowest temperature recorded was **8°C** on January 8.
- The maximum wind speed recorded was **66.5 km/h** on September 23.
- Annual total precipitation: **3094.98 mm**
- Annual average wind speed: **7.5 km/h**

#### 4.2.8 Coastal Region

Bangladesh is one of the largest deltas in the world and it is formed mainly by the Ganges-Brahmaputra- Meghna river system, except for the hilly regions in the northeast and southeast and terrace land in northwest and central zones. It has about 710 km long coastline. About 28% of the populations live in coastal region.

The coastal region of Bangladesh is prone to multi hazard threats such as cyclones, storm surges and floods, as well as earthquakes and above all, climate change. It is frequently visited by the cyclone-induced storm surge. South Patenga where the project site is located falls in the exposed coastal zone.

#### 4.2.9 Cyclone and Tidal Surge

Bangladesh very often becomes the landing ground of cyclones formed in the Bay of Bengal. This is because of the funnel shaped coast of the Bay of Bengal, Most of the damage occurs in the coastal regions of Khulna, Patuakhali, Barisal, Noakhali and Chittagong and the offshore islands of Bhola, Hatiya, Sandwip, Manpura, Kutubdia, Maheshkhali, Nijhum Dwip, Urir Char and other newly formed islands. The coastal zone of Bangladesh is disaster prone. South Patenga is in the exposed coastal area which is frequently subjected to cyclone and storm surges.

#### 4.2.10 Seismicity

Bangladesh has been identified as one of the vulnerable areas to potential earthquake threat and damage. Earthquake vulnerability of any place largely depends on its geology and topography, population density, building density and quality, and finally the coping strategy of its people and it shows clear spatial variations. Most of the parts of Chittagong, the port city of Bangladesh consisting of fine sand and silt deposits are susceptible to liquefaction. Chittagong City is mostly a hilly region, but it also consists of alluvial flood plain and sandy sea-shore area. Although the hilly region is less susceptible to liquefaction, it is formed by sandy and clayey soil and the area bottom of the hill also liquefy if the intensity of shaking is high, which may cause landslide in the

highly region. On the other hand, flood plains and sea shore areas consisting of fine sand and silt deposit with shallow water table in most of the places, which may liquefy during a strong earthquake.

According to the Global Seismic Hazard Assessment Program (GSHAP), the most hazardous division in Bangladesh is the port city, Chittagong. Chittagong metropolis together with its surroundings is situated in the seismic zone 2, which has a basic seismic coefficient,  $Z=0.15$  (BNBC, 1993). The most hazardous division in Bangladesh is Chittagong division. Northern and southern sections could expect to have maximum peak ground acceleration (PGA) ranging between 0.24g to 0.40g. The Chittagong Hill Tracts region can expect the highest PGA of up to 0.4g to 0.48g. In the basic seismic zoning map of Bangladesh, Chittagong and its surrounding region has been shown under Zone II with basic seismic coefficient of 0.15 (BNBC-1993), but recent repeated shocking around this region indicating the possibilities of potential threat of even much higher intensity like 0.35g than projected. If the Indian seismic zones were extended across the border into Bangladesh, the country would lie in zones IV and V. Southern Chittagong division also would lay in zone IV with a PGA of 0.4g.

### **4.3 BIOLOGICAL ENVIRONMENT**

#### **4.3.1 Flora and Fauna**

##### **4.3.1.1 General Consideration**

Forests, pasture lands, rivers, surface water and other water bodies, etc. are the most important natural ecosystems. They are the foundation on which conservation of biological diversity depends. Biological diversity, which refers to genetic variation as well as to the diversity of human populations and ecosystems, is a resource that belongs not only to regions and to nations but also to all of humankind. Although it is a renewable resource, it can be irreversibly destroyed. Future uses of this resource (medicine, plant breeding. etc.) cannot be foreseen at present, although they will certainly be extensive in scope, and they even are crucial to the survival of humankind.

It is extremely rare to encounter completely natural areas nowadays. On the other hand, both extensive and local use of natural flora and fauna can be regarded as normal occurrences in natural ecosystems. Although the transition from hunting and gathering to settle agriculture in established agro-ecological zones is complete almost everywhere, traditional forms of resource use continue to play an important role in the lives of rural populations. Current pressure due to increase production and extend the area of land under cultivation is leading to more intensive use of remaining predominantly natural areas. This results in environmental stress and rapid loss of biological diversity, as well as permanent conversion of land to agricultural use.

Opening up natural areas in order to exploit their resources with modern technology frequently leads to additional forms of resource use. For example, forests opened up to commercial forestry are more exposed to uncontrolled over exploitation, as well as being subjected to ecological stress by migrants who practice agriculture.

Both extensive resource use over large areas and selective, intensive use of every favorable site can severely damage an ecosystem. Small-scale operations preservation of remaining natural areas and resource use in harmony with nature are important if the resources of a region are to be managed in an ecologically appropriate manner. Proper monitoring is needed in order to obtain reliable information about significant changes in an ecosystem.

Every region needs areas set aside to preserve ecological balance (nature reserves, of natural vegetation, fallow land) in order to conserve its biological diversity. The form, extent and location of these areas must be carefully evaluated in each individual case. Because many different products in predominantly natural areas are not traded in great volume and do not appear in statistics on trade, their immediate value to the local population is often underestimated. The use of such areas is often of great economic importance to the poorer segments of rural populations. Intense exploitation of such areas is therefore usually accompanied by corresponding social consequences and social costs, even when it appears reasonable on economic grounds.

Many predominantly natural areas are of environmental and economic value beyond their own borders. Forests, for instance, guarantee safe and regular supplies of water because they protect headwaters. The protective function of forests is often recognized only after its neglect has produced negative consequences (deforestation that leads to erosion, landslides, sedimentation in reservoirs, floods).

Intensification of resource use in harmony with nature should be based primarily on indigenous knowledge and modes of production established in the local culture. There is a need to undertake scientific studies in this area since information based on such studies is presently lacking. Locally established responsibility for conservation of natural resources requires appropriate local rights of use. These rights must be regulated by grass-roots organizations.

Regarding the ecological setting of the area has been already mentioned, the areas in mostly high and wet ecosystem with forest and other forms of greenery quite at abundance. There had been extensive field survey during the study to assess and also quantify to a certain extent the flora and fauna richness. These concentrated among others, on the wildlife (reptiles, amphibians, mammals and birds), separately on fishes and a floral species (Grass, shrubs, timber/fuel wood trees and fruit trees). Findings of the survey have been presented in *Table 4.10 to Table 4.12*, respectively in the following pages.

As this is obvious from the above-mentioned tables, the area is quite rich in flora and fauna. However, many of those are quite common for different other areas in Bangladesh. The already existing industries in the study area not just brought, some of the utility services, but have also provided with a different look of infrastructure setting in the area. This is still not something, which can be called aesthetically unacceptable or directly detrimental to the floral growth of the area. However, the industrial activities along with their discharges may prove quite detrimental to both flora and fauna in the area eventually, provided no appropriate corrective measures are taken.

#### 4.3.1.2 Flora

The proposed plant is completely in an industrial and commercial setting with limited greenery. But the other side of river (Anwara Upajilla) which cover the study area has floral abundance, these includes roadside plantation, natural vegetation, coastal greenery and agricultural crops. The project area has very few homesteads, mostly industrial in nature generally interconnected with certain manmade barriers and roads here and there.

Due to roadside plantations and certain homestead forests, the area is rich with floral diversities. Different fruit, fuel wood trees along with various shrubs are abundant. Among the trees, the most widely available ones are Shilkoroi, fulkoroi, Mehagani, Shimul, etc. Also there are some fruit trees such as Mango, Coconut, Jackfruit, Battle nut, guava etc.

**Table 4.7: Floral Species in the Study Area**

| English Name   | Scientific Name  | Local Name  | Main Name  |
|--|--|---|--|
| <b>Grass</b><br>Grass  | Spontaneum<br>Saccharum<br>Cynodon dactylon  | Khar<br>Gash (Kaichi<br>Kash, Dubla etc.)                                   | Fuel/Covering<br><br>Soil Binder   |
| <b>Trees</b><br>Lichi<br>Mango<br>Date Palm<br>Balck Berry<br>Jackfruit<br>Coconut<br>Papya<br>Gauva<br>Banana | Lichi chinensis<br>Mangifera indica<br>Phoenix sylvestris<br>Syzygium cumini<br>heterophyllus<br>Cocos nucifera<br>Carica Papaya<br>Psidium guajva<br>Musa Sepientum | Lichu<br>Aam<br>Khejur<br>Jam<br>Khatal<br>Narikel<br>Pape<br>Piara<br>Kala | Fruit<br>Fruit, Timber<br>Fruit, Timber<br>Brown sugar<br>Fruit, Timber<br>Fruit, Timber<br>Fruit, Fuel<br>Fruit<br>Fruit Fuel |
| Wood Tree<br>(Timber/Fuel<br>wood)<br><br>Mehagani,<br>Shal,<br>Shilkoroi,<br>Shimul<br>Eucalyptus             | <br><br>Shorea Robusta<br>Albizia procera<br>Salmalia<br>malabaricum<br><br>Eucalyptus cinerea   | <br><br>Shil koroï<br>Silk cotton<br><br><br>Eucalyptus                     | <br><br>Fuel, Timber<br>Fuel, Timber<br>Fuel, Pillow<br><br>Foliage  |

**Table - 4.8: Animal and Bird Species in the project area.**

| Scientific Name     | English Name           | Local Name           |
|---------------------|------------------------|----------------------|
| <b>Reptiles</b>     |                        |                      |
| Vulpes bengalensis  | Bengal fox             | Khek Shial           |
| Enhudris enhydris   | Smooth Water Snake     | Painnya Shap/ Huriya |
| Hemidactylus        | House Lizard           | Goda Tik Tiki        |
| Naja naja Kaouthia  | Narwo headed Softshell |                      |
| Chitra indicad      | Turtee                 | Chitra Katchap       |
| <b>Amphibians</b>   |                        |                      |
| Bafo melanostictus  | Common Toad            | Bang                 |
| Rana Cyanophyctis   | Skipper Frog           | Bang                 |
| <b>Mammals</b>      |                        |                      |
| Callosciurus sp.    | Squirrel               | Kat Biral            |
| Cynopterus spinex   | Short nosed fruit Bat  | Badur                |
| Funumbalus pennanti | Squirrel               | Kat Biral            |
| Herpestes           | Mongoose               | Bheji                |
| Auropuncatus        |                        |                      |
| Mus booduga         | Field Mouse            | Idur                 |
| Mus musculus        | House Mouse            | Nengti Idur          |
| Pteropus giganteus  | Gaint Flying Fox       | Boro Badur           |
| <b>Birds</b>        |                        |                      |
| Alcedo atthis       | Common Kingfisher      | Machranga            |
| Copsychus saularis  | Robin                  | Doel                 |
| Corvus splendens    | House Crow             | Kak                  |
| Egretta albe        | Great Egret            | Boro Bak             |
| Egretta gazetta     | Small Egret            | Chhoto Bak           |
| Durrurus adsimilies | Black Drongo           | Fingry               |
| Passer domesticus   | House Sparrow          | Choro                |

**Table 4.9: Fish Species in the Study Area**

| Family        | Species               | English Name         | Local Name        |
|---------------|-----------------------|----------------------|-------------------|
| Stromateidae  | Pampus Chinensis      | Chinese Pomfret      | Rup chanda        |
| Trichiuridae  | Lepturacanthus savala | Hairtail             | Chhuri mach       |
| Sparidae      | Argyrops spinifer     | Long spine sea Bream | Lal datina        |
| Harpadontidae | Harpadon nehereus     | Bambay duck          | Loitty mach       |
| Centropomidae | Lates calcarifer      | Gaint sea perch      | Bhetki/koral Mach |
| Ariidae       | Arius sp.             | Cat fish             | Kata mach         |
| Bagridae      | Mystus gulio          | Bagrid catfish       | Nuna tengra       |

|              |                              |                          |               |
|--------------|------------------------------|--------------------------|---------------|
| Sciaenidae   | Johnius argentatus           | Silver pennah<br>Croaker | Lalpoa        |
| Stromateidae | Pampus argenteus             | Silver pomfet            | Foli chanda   |
| Sciaenidae   | Protonibea<br>diacanthus     | Spotted croaker          | Kala poa      |
| Pangasidae   | Pangasius<br>pangasius       | Fatty catfish            | Pangas        |
| Palaemonidae | Macrobrachium<br>Rosenbergii | Gaint river prawn        | Golda chingri |
| Penaeidae    | Penaeus monodon              | Giant tiger<br>prawn     | Bagda chingri |
| Carangidae   | Parastromateus niger         | Black pomfret            | Hail chanda   |

#### 4.3.1.3 Fauna

##### Fishes

Fish is still reasonably available in the area as it is a part of coastal area in Bangladesh. Sea fish is available in this area. Among reptiles, narrow headed soft-shell turtle deserves special mention. Among birds, Bok, Salik, Finge, Machranga etc. deserve special mention.

The fishes include Pomfrets (Rup chanda, Foli chanda and Hail Chanda), prawns (Golda Chingri, Bangda Chingri), catfishes (Katamachh, Nuna Tengra), other (Churi Mach, Koral/Bhetki Mach, Loitya Macch).

##### Wildlife and Reptile

The common types of reptiles are found in the area, water snake, house lizard, soft-shell, turtle etc.

##### Amphibians

Mostly Toads and frogs- two species are prominent.

##### Mammals

These include fruit bat, Squirrel, field and house mouses, and flying fox. No major mammal species of national significance are present in this area.

##### Birds

A number of those are including common kingfishers, House crow, House sparrow, little fern etc.



**Figure 4.1** Water Hyacinth near the proposed project site



**Fig 4.2:** Terrestrial flora (tree) close to the project site



**Fig 4.3:** Terrestrial flora (herb) nearby the project site



**Fig 4.4:** Terrestrial fauna close to the project site



**Fig 4.5:** Aquatic fauna at South Patenga

#### **4.4 Socio-economic Condition**

##### **4.4.1 Population and Social Structure**

According to Statistical Pocket Book Bangladesh 2009 (Zilawise Household And Population of Bangladesh, 2009) , the total population of Chittagong was 6,611,000, where the total household is 1,241,000, total male 3,475,000 and total no of female 3,136,000 respectively. The population density was 1251 persons per sq.km. Being

rather lowest compared with 1584 of the country. However according to statistical year book 2009 Upazila wise population, census 2001, total population of Chittagong Port or Bandar thana was 213598, where the total household no. is 41,466, Total male 115,058 and female 98,513. The average literacy rate is 72.59%, with male 75.35% and female 69.32%.

#### **4.4.2 Living and Cultural Standard**

The study area of **Baraka Patenga Power Limited** is located at **South Patenga, Chittagong District** and connected by a branch road to the **Chittagong-Shah Amanat International Airport Road**. The heavy vehicles are running on the main road and lightweight vehicles like scooters, cars, rickshaws and rickshaw-vans are running on both the roadway and branch road.

According to Banglapedia Main occupations of this area: Agriculture 1.46%, fishery 1.29%, transport 6.3%, agricultural labourer 1.99%, wage labourer 3.02%, industry 2.04%, commerce 11.70%, construction 1.4%, services 53.20%, house rent 1.82%, others 15.78%

The average annual population growth rates were 6.3% according to City Mayors statistics. Such a rapid population increase must have been one of the most important factors, which restricted the alleviation of poverty, and satisfaction of basic human needs in the area.

#### **4.4.3 Agriculture**

##### **Crops and Cropping Pattern**

The major crops grown in the project study area (Patenga and part of Anwara) are varieties of rice. Major areas are put under Aus, Aman and Boro cultivation. Local Boro is grown in medium low land and low land areas. T. Aman (HYV) and T. Aman (L) are also grown, the former being preponderant. Other crops of importance are jute, oil seeds, potatoes, pulses and vegetables.

The three agro climatic cropping seasons prominent in the impact area are:

- Kharif 1 : March-May
- Kharif 2 : June-October
- Rabi : November to February

During Kharif 1 season HYV rice is the principal crop, during Kharif 2 medium Aman and Aus crops are grown or jute is cultivated in medium lowland. During the Rabi season, wherever the land dried up in early October to mid-October, farmers grow legumes, oil seed and vegetables. Vegetables are mostly confined to highland, oil seeds to medium land and pulses to medium lowland. Paddy is major cash crop of the

farmers in the study area and requires year-round production activity. Cropping patterns and crop diversity for kharif and Rabi seasons are scheduled according to land types, flooding frequency and duration of floods. The patterns in the study area are dictated by the local hydrologic regime and are essentially based on rice. Pre-monsoon and post-monsoon drainage congestion limits crop production. In monsoon season, the duration of water logging thus limiting the crop choice. Non-rice crops are grown mostly in the non-irrigated land in rotation with Rabi Aus and Aman, depending on the land type. Winter crops are inter-cropped with sugarcane. Irrigated HYV Boro is grown in winter in sequence with T. Aman on medium high land and T. Aman on medium lowland.

According to the 1996 agricultural census the study area has a relatively medium agricultural potentiality. Rice is still the dominant crop in this area and most of the lands are under paddy cultivation for at least a part of the year. Oilseeds, vegetables and other seasonal crops are the significant crops in this area.

Fertilizers and pesticides are increasingly used, particularly on rice, but in general, such use is at a fairly low level. Mechanization still plays small role in agriculture in this area, although many farmers spoken to during field visits said that they commonly used a combination of draught animals and hired-in mechanical cultivators for land preparation. Some of the villagers and semi-urbanites also practiced limited animal husbandry for the production of milk, eggs or meat. Animal kept includes cattle, goats, and poultry.

#### **4.4.4 Housing**

Majority of housing in this area is of pacca, semi-pacca, semi-permanent building i.e. walls made of 5 inch brick works and corrugated iron roof. The homestead areas are relatively medium.

#### **4.4.5 Public Health**

Health services are mainly provided by hospitals run by the Health Ministry. The City Corporation has its own Health Services and hospitals which supplement the services provided by the government and the NGOs. There are a number of NGO-run clinics in addition to mushrooming private clinics, which are run on a commercial basis. Chittagong Medical College Hospital is the largest government-run health service provider. This huge medical has so many wards, cabins and units. At present this facility also provides medical treatment of ICU and CCU for the serious patients. Other medical service institutes include General Hospital, TB Hospital, Infectious Disease Hospital, Diabetic Hospital, Mother and Children Hospital and Police Hospital. Notably, the total health service of Chittagong is intensifying day by day. At present, many non-government hospitals and clinics also belong to the city. Chittagong Metropolitan Hospital, Surgiscope Hospital, CSCR, Centre Point Hospital, National Hospital etc. are the noteworthy non-government hospitals and clinics Chittagong City. The nearest in the area is the CEPZ Hospital which within 1.25 km from plant location.

#### **4.4.6 Industries and Commerce**

The proposed Baraka Patenga Power Limited plant will be set up at South Patenga, Chittagong. The site of the project falls under Patenga Heavy Industrial Zone where there are fuel deposit of Padma Oil Company Ltd., Jamuna Oil Company Ltd., Meghna Oil Company Ltd., International Oil Tankers Ltd., Food Silo, Heidelberg cement Bangladesh Ltd., TSP Fertilizer Factory, LP Gas Ltd, Petro Bangla Chittagong Refinery, NGS Cement Ltd., Eastern Refinery Ltd. (ERL), CEPZ Area and the Shah Amanat International Airport. On the other side of the river there are Karnaphuli Fertilizer Company Limited (KAFCO), Anwara 1300 MW Power plant, Shikalbaha Power Station, National cement Factory Ltd., Super Petro Chemicals, Star Cement, and Chittagong Urea Fertilizer Factory (CUFL) situated at Anwara. The project is situated on the West Side of the river Karnaphuli and about 1km meter distance from the Shah Amanat International Airport Road. The location is well communicated by road and river ways.

## *Chapter 5*

### *Potential Impacts of the Proposed Project*

## Chapter-5

### 5.0: POTENTIAL IMPACTS OF THE PROPOSED PROJECT

#### 5.1 GENERAL CONSIDERATIONS

In case for most industrial projects, potential negative impacts sometime could be far more numerous than beneficial impacts. The regional and national economic benefits associated with the implementation of any development project are considered to fall outside the scope of an EIA, and therefore not considered here. However, it is generally expected that these long-term benefits will ultimately trickle down to the local population and will make a contribution to an improvement in the quality of life.

Likewise, the indirect benefits of strengthening of technical capabilities of local persons through association with foreign experts and other training elements that may form part of a project have been considered to fall outside the scope of EIA.

#### 5.2 SCOPING OF IMPACTS

The potential impacts due to implementation of **Project** are identified by using simple checklists. This method is described below:

##### 5.2.1 Checklist

**Checklist** is comprehensive lists of environmental effects and impacts indicator designed to stimulate the analysts to think broadly about possible consequences of contemplated actions (Munn, 1979). **Table 5.1** represents the checklists developed for the present plant. In this checklist, actions, which may affect at the various stages of the project activities, are listed and the degrees of Significant Environmental Impacts (SEIs) are shown. The terms none, minor, moderate and major are used in the checklists to evaluate the magnitude of SEIs. In the checklist, both the construction and operational phases of the proposed development are considered separately in order to distinguish the short term and long-term impacts. As can be observed from the checklists, major environmental components, which will be adversely affected by activities of the project, are air, noise & water quality and socio-economic environment. All these impacts will arise in operation phase of the project. It should be noted that identification indicated in the Checklist relates to the significant level of impact.

**Table 5.1: Checklists of Baraka Patenga Power Ltd.**

| Project Phase             | Action Affecting Environmental Resources & Values | SEIs without Mitigation Measures |       |        |       | Type    |            | Comments   |
|---------------------------|---|----------------------------------|-------|--------|-------|---------|------------|--|
|                           |   | None                             | Minor | Medium | Major | Adverse | Beneficial |  |
| <b>Plant Location</b>     | Land value depreciation                           | x                                |       |        |       |         |            | No land value changes anticipated  |
|                           | Loss of and displacement from homestead land      | x                                |       |        |       |         |            | No loss of and displacement from homesteads land; no impact                  |
|                           | Loss of and displacement from agricultural land   | x                                |       |        |       |         |            | Loss of and displacement from Agricultural land will not occur; no impact    |
|                           | Damage to nearby operation                        | x                                |       |        |       |         |            | No impact anticipated  |
|                           | Disruption to drainage pattern                    |                                  | x     |        |       | x       |            | Land development may create problems in local drainage pattern, minor impact |
|                           | Inadequacy of buffer zone                         |                                  | x     |        |       | x       |            | Buffer strip is absent   |
|                           | Encroachment into precious ecological             | x                                |       |        |       |         |            | No precious ecological issues; no impact                                     |
| <b>Construction Stage</b> | Run off erosion                                   |                                  | x     |        |       | x       |            | Filling would create runoff erosion during rainy season                      |
|                           | Worker accident                                   |                                  | x     |        |       | x       |            | Irregularly may occur in construction period                                 |
|                           | Sanitation diseases hazard                        |                                  |       | x      |       | x       |            | Concentration of labor force create un-hygienic condition                    |
|                           | Noise/vibration hazard                            |                                  | x     |        |       | x       |            | Piling/equipment installations create noise                                  |
|                           |   |                                  |       |        |       |         |            |  |

| Project Phase   | Action Affecting Environmental Resources & Values | SEIs without Mitigation Measures |       |        |       | Type    |            | Comments   |
|-----------------|---|----------------------------------|-------|--------|-------|---------|------------|--|
|                 |   | None                             | Minor | Medium | Major | Adverse | Beneficial |  |
| Operation Stage | Traffic congestion                                |                                  | x     |        |       | x       |            | Carrying of construction materials will create traffic congestion  |
|                 | Blockage of wildlife passage                      | x                                |       |        |       |         |            | No wildlife in the area; no impact   |
|                 | Employment  |                                  |       | x      |       |         | x          | Major employment opportunity during construction   |
|                 | Pollution from liquid discharge                   |                                  |       | x      |       |         |            | Oily liquid waste may generate due to handling of HFO and lubricants, medium impact                            |
|                 | Pollution from solid waste                        |                                  | x     |        |       | x       |            | No significant solid waste; minor impact   |
|                 | Air Pollution                                     |                                  |       |        | x     | x       |            | Air pollution from stack emission, major impact if FGD malfunction occurs                                      |
|                 | Occupational health and Safety                    |                                  |       |        | x     | x       |            | Inherently in all industrial plants but very important here due to storage of large amount of fuel at the site |
|                 | Odor hazard                                       | x                                |       |        |       |         |            | No obnoxious odor will be generated; no significant impact   |
|                 | Traffic congestion                                | x                                |       |        |       |         |            | No traffic congestion: no impact   |
|                 | Noise hazard                                      |                                  |       |        | x     | x       |            | Heavy noise generation is expected; major impact.  |
|                 | Employment  |                                  |       |        | x     |         | x          | Major Employment opportunity during operation  |

**Chapter 6**

***Prediction and Evaluation of Impacts***

## Chapter-6

# 6.0: PREDICTION AND EVALUATION OF IMPACTS

## 6.0 EVALUATION OF IMPACTS

### 6.1 GENERAL CONSIDERATIONS

The Impacts, which are likely to be occurred in the different phases of the project, are identified in section 5.0. In this section, evaluation of these impacts was done mentioning their origin and characteristics along with their possible mitigation/enhancing measures. At the end of each sub section, status of residual impact is also mentioned.

### 6.2. ADVERSE IMPACTS AND MITIGATION

#### 6.2.1 Impact due to Project Location/Pre-construction Phase

##### 6.2.1.1 Land Acquisition

##### Impact Origin

As discussed earlier the Proposed Project will require 3.00 acres of land. Land acquisition could affect the environment and peoples by the following ways

- i. Loss of Homestead land
- ii. Loss of Agricultural Land
- iii. Cultural, historical and Aesthetic Loss
- iv. Loss of sensible places
- v. Corruption and partiality during acquisition and Reacquisition process, etc.

##### Mitigation Measures

The proposed project didn't require any relocation of homestead and land acquisition has been done by paying proper compensation of land to the land owners. The entire land was fallow & vacant land in the project site. There is no homestead land falls inside the proposed project site. There was no cultural, historical and aesthetic interest in the project land and no loss of sensible place. So the above mentioned impacts are negligible.

#### 6.2.1.2 Loss and Displacement from Agricultural Land

##### Impact Origin

The land was flat, vacant land. So, there was no loss of agricultural land hence agricultural product in the country.

## Mitigation Measures

Since there is no loss of agricultural land, no mitigation measures needed in this regard. The land use map has been attached in annexure- 6.

### 6.2.1.3 Disruption of Earth Surface

#### Impact Origin

As mentioned earlier that a part of land filling would be required to develop the site to provide protection against flood. This land filling will be from its original level which will not disrupt the natural surface of earth and obstruct the natural drainage system of the area.

#### Mitigation Measure

According to the plan, **Baraka Patenga Power Limited** will not create any water logging and drainage problem as the BPPL authority collects the soil to develop the area by carried sand from different places. Cross drainage works should be constructed to bypass the surface water and other discharges. A land development map has been attached in the annexure-7.

#### Residual Impact

Provided that the mitigation measure indicated above is fully implemented, residual impact to be very insignificant.

### 6.2.1.4 Change in Landscape

#### Impact Origin

A landscape is a subjective concept that cannot be precisely quantified. However, in general, any project when not designed considering the local landscape, then it creates visual intrusion to the people. The proposed project may change the local landscape to some extent.

#### Mitigation Measure

Any built up part of the plant should be designed considering key criteria of landscape like coherence, readability, hierarchy and stability. It is understood that **Baraka Patenga Power Limited** will have a modern architectural view, which does not provide any significant visual intrusion. One simple way by which the altered green area can be turned into its original visual quality is the plantation of trees around the project area. The greenery layout plan shown in the annexure-8 indicates the tree plantation around the project site.

## **Residual Impact**

Provided that the mitigation measure indicated above is fully implemented, residual impact to be very insignificant.

### **6.2.2 Impacts during Construction**

#### **6.2.2.1 Disruption of Earth surface-Site preparation and Clearing and Earthworks**

##### **Impact Origin**

Each development project more or less requires site preparation. The preparation works generally done during construction stages includes

- Biomass Removal
- Biomass Disposal
- Property removal
- Construction of access road
- Cut and fill operation
- Soil Export and Import
- Drainage works etc.

The impacts generally arise from the above activities are as follows:

- Noise
- Fugitive dust
- Runoff and flooding
- Soil erosion: Land erosion along the uncovered space due to soil removal and excavation.
- Water Pollution through runoff and sedimentation
- Social concerns
- Infrastructure disruption
- Safety Concerns

However the proposed site is of the nature that it will cause negligible impacts in the pre-construction stages. The site will require some land filling. The proposed site has no homestead land so impact from property removal activities is negligible.

##### **Mitigation Measures**

Cutting and filling operation should be kept minimum. The proponent should ensure construction of proper drainage facility. Regular water sprinkle should be used to minimize fugitive dust emission. Safe working procedures should be ensured by the contractor. Undertaking construction work during dry seasons. The heavy equipment should be operated at day time.

### 6.2.2.2 Impacts on Air Environment

#### Impact Origin

The air quality in the project area may slightly deteriorate for the time being during construction. The major construction activities from which air emission mostly dust emission may occur are;

- Poorly paved service lane;
- Ground excavation;
- Delivery of building materials to site;
- Handling and mixing of cement

#### Poorly Paved Service

The access road to the proposed project should be perfectly paved. Dust nuisance from unpaved or partly paved road is of concern because:-

- There will be increased traffic driving in and out of the proposed site to deliver construction material;
- If soil moisture content becomes very low; it could create increasing quantity of loose particulate matter on road surface;
- There could be no or little vegetation cover to act as dust trap.

#### Ground Excavation

Site preparation in readiness for construction work may require vegetation clearance stripping off of overburden material, ground leveling and compaction. These activities will open-up the ground to wind action and thus potentially resulting in dust generation. This is because:-

- Vegetation clearance will directly expose the ground to agents of erosion;
- Stripping off of overburden material will loosen soil aggregates thus making them easily susceptible to wind action;
- Removal of tree stumps and roots will weaken soil bounding and thus can easily be blown by wind

#### Delivery of Building Materials to Site

Construction materials such as building blocks, cement, sand, steel bars, stone/brick chips will be bulky and thus will require to be delivered on site by a fleet of trucks driving in and out of the construction site. During this exercise dust is likely to be generated from the following:-

- Handling of cement which is dusty by nature of the way it is;
- Handling of sand, stone/brick chips may contain loose dust particles;

- Site clearing of area of holding ballast , building blocks and sand will expose the site to wind action;

### **Handling and Mixing of Cement**

The powdery nature of cement will be a potential source of dust especially during handling and mixing it with other materials such as sand and gravel. Cement dust will likely be of concern during:-

- Opening-up of cement bags and emptying the cement in order to mix with other construction material;
- During loading and offloading of cement.

#### **6.2.2.2.1 Potential Environmental Impacts of Dust**

Dust produced will potentially negatively affect the following:

- 1) Employees generally construction workers;
- 2) Immediate neighbors and general public; and
- 3) Vegetation.

#### **1. Effects of Dust to Employees**

Cement dust can affect plant employees in the following way

- ✓ Eye irritation;
- ✓ Skin irritation;
- ✓ Impairment of normal sweating of the skin as it blocks pores on the skin;
- ✓ chocking of the throat;
- ✓ Respiratory difficulties;
- ✓ Difficulty in breathing;
- ✓ Potential course of chest complication and ailment.

#### **2. Dust Impacts to Immediate Neighbors and General Public**

- ✓ Reduced visibility; emission of high particulate matter to the environment will reduce local visibility;
- ✓ Continuous exposure of people to dust will likely affect one's eye sight that can potentially result in an outbreak of eye infection;
- ✓ Chest related ailment; continuous exposure of people to dust will likely result in chest complications and respiratory disorders.

#### **3. Dust Impacts to Vegetation**

- ✓ Dust settling on plant leaf surface will block leaves stoma hence interfering with normal respiration of the plants;

- ✓ Dust settling on plants will reduce the evapo-transpiration of plants and animals such as butterflies, caterpillars, grasshoppers who feed of foliage will be affected as the dust settled on foliage will render the foliage unpalatable;
- ✓ Heavy dust settling on plant matter will impair on normal growth of the plant; and
- ✓ Heavy dust settled on plants will choke and kill plants.

#### **6.2.2.2.2 Proposed Mitigation Measures**

Following mitigation measures are proposed to minimize the air pollution during the construction stage:-

- ✓ The Project Proponent should ensure the complete paving of the service road
- ✓ Regular sprinkling of water to be done on open surface and dust grounds until paving is done;
- ✓ Transport of materials in tarpaulin- covered trucks
- ✓ The sand and other such dispersible material will be stored at site for minimum working period.
- ✓ Removal of soil/mud from trucks and other appliances prior to leaving the project area.
- ✓ Storage of top-soil in a safe space and creation of top-soil on filled land utilizing this preserved soil
- ✓ Selective cutting of trees in the site should be carried out. Only trees which on exact proposed position of the building should be cleared any other vegetation outside proposed building position should be maintained;
- ✓ Plantation of trees in the construction yard as quickly as possible. Any open area should be planted with appropriate vegetation (trees, flowers and grasses) ;
- ✓ Project management and contractor to enforce strict use of personal protective clothing;
- ✓ Complains of dust related ailments among employees and neighbours to be given access to medical attention.
- ✓ The equipment design will be chosen for least suspension of dust/sand into atmosphere.
- ✓ The construction activity will be carried out during day time only.

The emissions are temporary and not expected to contribute significantly to the ambient air quality and will be within prescribed limits for industrial regions by National Ambient Air Quality Standards.

#### **Residual Impact**

Provided that the mitigation measure indicated above is fully implemented, residual impact to be very insignificant.

#### **6.2.2.3 Impacts on Acoustic Environment**

Noise is likely to be generated from the following activities/areas:

- ❖ During ground preparation;
- ❖ During assembly of building materials on site;
- ❖ During construction of the various components of the proposed power plant.

A brief elaboration of each of the potential source/cause of noise is as follows:-

### **Ground Preparation**

Ground preparation is another activity that will potentially result in noise nuisance. Activities of ground preparation that are likely to result in noise nuisance include:-

- ✓ Use of heavy machinery such as excavators, caterpillars in ground excavation will be a source of noise nuisance; and
- ✓ Transportation of excavated earth material from site by use of dump trucks will result in noise nuisance. The noise will be mainly from the trucks.

### **Assembly of Building Materials**

Building materials to be used in construct site will first be gathered and assembled on site. These include building blocks, timber, steel bars, sand, gravel, cement. Possible courses of noise nuisance when assembling construction material on site include:-

- Offloading of building materials on site especially steel bars, gravel and building blocks can result in noise;
- Trucks ferrying in building materials can be a source of noise;
- Employees involved in offloading of building material can be a source of noise.

### **Construction of the Various Components of the Proposed Power Plant**

Construction of the civil work structures for the proposed power plant will be labour intensive. This will involve engaging a large workforce, also during construction some machines and equipment will be in use. Possible sources of noise during construction work may include the following:-

- Loud talking, shouting and conversation among employees;
- Noise from equipment such as cement mixers;
- Noise from machines such as welding machines and wood working machines;
- Increased machine and equipment activity on site.

#### **6.2.2.3.1 Potential Environmental Impacts of Noise**

Impacts of noise will potentially affect the following:-

- a. Immediate neighbors; and
- b. Employees.

#### **a. Impacts of Noise to Immediate Neighbors**

- ✓ Continuous exposure of neighbors to noise nuisance may result in noise induced hearing lose;
- ✓ Noise nuisance may reduce concentration of neighbors in their private matters.

#### **b. Noise Impacts to Employees**

- ✓ High noise level will force employees to shout loud when communicating to one another;
- ✓ Exposure of employees to high noise level (above 85dB ) continuous for 8hours per day may result in noise induced haring lose;
- ✓ Exposure of ear to peak sound level instantaneously may result to deafness.

#### **6.2.2.3.2 Proposed Mitigation Measures for Noise Nuisance Management**

- ✓ Noisy construction works to be limited to daytime hours
- ✓ Immediate neighbours to be notified in writing on the date of commencement of construction work at least one month in advance;
- ✓ All employees likely to be exposed to ear noise to be provide with ear protectors;
- ✓ The project Proponent and contractors to ensure strict enforcement on user of ear protectors;
- ✓ Where applicable and possible exceptionally noisy machines to be fitted with noise reduction devices;
- ✓ Any employee who may complain about ear related pain and or complication while at work to access medical attention at the expense of the contractor or project proponent;
- ✓ Fitting noise machines with noise reduction devices;
- ✓ Providing suitable hearing protection to all workers exposed to noise levels above 85dB(A);

The noise impacts will be local; limited to the premises and very short – term.

#### **6.2.2.4 Sanitation Hazard & Drinking water**

##### **Impact Origin**

The health of the project personnel, construction workers and laborers living at the base camp could be impacted if arrangement of sanitation and drinking water is not ensured adequately and properly. During construction stage, lot of local labors will work and hence they would generate considerable amount of human waste. These are the potential source for spread of diseases, as various insects will play dominating role in the spread of diseases. There are chances for the spread of water borne diseases also.

## Mitigation Measures

Proper sanitation system should be provided and at the same time, regular, proper and safe disposal of human waste should be ensured. Contractors and workers should obey appropriate means of waste removal and sanitation measures. Adequate number of toilets and bathrooms should be made for the workers, and proper disposal system of sewage waste should be implemented for sanitation purpose and the workers should be aware to practice those facilities.

The project activities shall make higher demand on the local utilities and service facilities particularly potable water, health and sanitary facilities. There should be sufficient number of tube-wells for drinking purpose.

## Residual Impact

If, the mitigation measure indicated above is fully implemented, residual impact to be very insignificant.

### 6.2.2.5 Overland Drainage and Impact on Surface Water

The potential impacts on local hydrology are principally those of altered patterns as a result of onsite construction and earthwork activities. The proposed project will affect natural drainage, surface and ground water quality if not managed the construction works properly. There could be Siltation of water system or drainage from uncovered piles of soil

## Proposed Mitigation Measures

- Surface drainage shall be controlled to divert surface runoff away from the construction area;
- Laying barrier net;
- Undertaking construction work during dry seasons;
- Completed areas should be restored/re-vegetated as soon as practicable;
- Temporary silt-trap or digging of pond toward siltation prevention;
- Stockpiling of spoil soil at a safe distance from the drainage system;
- Utilizing spoil soil in land-fill;
- Strict supervision should be maintained to avoid blockage of natural creeks during the construction period, and;
- Containment of sanitary waste should be adequately disposed off to avoid surface and ground water contamination;
- Making provision for temporary disposal of wastes inside construction yard and disposal of solid wastes in an appropriate manner;
- Adequate provision has to be retained for the treatment and disposal of cuttings, drilling fluids and other chemicals and lube oil wastes generated during drilling, testing and commissioning stage;

### **6.2.2.6 Social acceptability of Construction workers to the host communities**

The differences in the cultures of workers (in case hiring is required) and local community may create some problems. In the rural area, the local people especially the religiously conservative section of the community will not accept the foreign workers in general. However the proposed site is in a rural industrial mixed area, where there are other industries for years and people living in the area are very much used to this kind of industrial activity.

#### **Mitigation measures**

The project proponent and his organization have practice of working with the workers of different cultures. It is recommended to aware the foreign workers (if any) about the social & religious actability in the area so that they could maintain those when they will have touch with local community.

### **6.2.2.7 Accidents or Occupational Health Hazard**

#### **Impact Origin**

Under controlled situation, accident is not expected. However, occasionally it occurs during construction works. Accident may occur during earth cutting, casting, construction works and installation of heavy machinery. The protection of head, eye, ear, and hand, foot of the workers, laborers and project personnel could be affected if proper and adequate arrangement is not ensured.

#### **Mitigation Measures**

The workers should wear PPE (Personal Protective Equipment), safety goggles, and other necessities.

### **6.2.2.8 Increase in Vehicular Traffic in the Area**

Increase in vehicular traffic in the area is likely to be experience during construction phase of the power plant. During the construction phase, increase in vehicular traffic in the area is likely to be because of-

- Trucks ferrying construction material to site;
- Trucks ferrying waste material from site; and
- Ferrying in of construction tools and equipment.

#### **6.2.2.8.1 Potential Negative Environmental Impacts Likely to Result From Increased Vehicular Traffic in the Area**

- ✓ Possible traffic congestion of local roads and lanes;
- ✓ Possible of occasional experience of delays on the said local roads;

- ✓ Increased number of vehicles on local roads will result in increased wear and tear of local roads thus reducing lifespan of affected roads;
- ✓ Cost of maintaining local roads will increase;
- ✓ Pedestrians and cyclists using local roads will have to exercise more care with increase of vehicular traffic on the said roads; and
- ✓ There will be an increase of exhaust emission from vehicles, which will pollute local atmospheric air.

#### **6.2.2.8.2 Proposed Mitigation Measures to Mitigate Increase in Vehicular Traffic in the Area**

The following measures can be put in place to mitigate possible negative impacts likely to result from increase in vehicular traffic in the area:

- ✓ Management to provide for adequate internal parking, for all vehicles coming to the plant premises;
- ✓ Management to pave the dilapidated service road with tarmac or more durable material;
- ✓ All users of said roads to always observe traffic rules this will give pedestrians and cyclist their space and safety while using the road; and
- ✓ Marking of the roads to be clearly done.

#### **6.2.2.9 Impact due to HFO Transportation**

##### **Impact Origin**

BPPL will use HFO would be imported by vessel from abroad through Chittagong port. Vessel carrying HFO will be offloaded at a rented HFO storage facility at Chittagong Port area at a distance of approximately 3-4 km from the power plant site. From there, the fuel will be transported by road to plant storage facility by 25MT capacity Tank Lorry.

##### **Mitigation measures**

The BPPL HFO storage facility will be designed so that there is no chance to spill HFO and mixing the HFO with surface water body. The unloaded area is designed to have hard standing floor with sealed drainage ended up to oil water separator. The HFO storage tanks are of double skinned design and have secondary containment 110% bigger than the storage capacity so that the HFO could be retained in the containment area in case of any emergency failure.

## 6.2.3 Impact during Operation Stage

### 6.2.3.1 Impact on Air quality

#### Impact Origin

Emission from the engine and generator stack may affect the ambient air quality. Unburned gases from the engine operation may affect the air quality. The situation aggravates when the fuel (here HFO) contains high percentage of impurities like sulfur, water, metals, MCR (micro carbon residue) etc. The high temperature of flue gases also impacts the air quality in terms of thermal pollution. The combustion of heavy fuels for power Generation inevitably results in emission of particulate and gaseous pollutants to the atmosphere. As the proposed power plants would be fired with Heavy fuel oil, the air pollutants emitted by the power plant will be Particulate matter, carbon monoxide, nitrogen oxides and sulfur dioxide.

#### Sulfur dioxide (SO<sub>2</sub>) Emissions from the power plant

SO<sub>2</sub> is a colorless gas. It smells like burnt matches. It can be oxidized to Sulfur trioxide, which in the presence of water vapor is readily transformed to Sulfuric acid mist. SO<sub>2</sub> can be oxidized to form acid aerosols. SO<sub>2</sub> is a precursor to Sulfates, which are one of the main components of respirable particles in the atmosphere.

#### Health Effects

Health effects caused by exposure to high levels of SO<sub>2</sub> include breathing problems, respiratory illness, changes in the lung's defenses, and worsening respiratory and cardiovascular disease. People with asthma or chronic lung or heart disease are the most sensitive to SO<sub>2</sub>. It also damages trees and crops. SO<sub>2</sub>, along with nitrogen oxides, are the main precursors of acid rain. This contributes to the acidification of lakes and streams, accelerated corrosion of buildings and reduced visibility. SO<sub>2</sub> also causes formation of microscopic acid aerosols, which have serious health implications as well as contributing to climate change.

#### Nitrogen Oxides (NO<sub>x</sub>) Emissions from the Proposed Plant

Nitrogen gas, normally relatively inert (nonreactive), comprises about 78% of the air. At high temperatures and under certain other conditions it can combine with oxygen in the air, forming several different gaseous compounds collectively called oxides of nitrogen (NO<sub>x</sub>). Nitric oxide (NO) and nitrogen dioxide (NO<sub>2</sub> - the criteria pollutant) are the two most important. Major source of nitrogen oxides in the proposed power plant include the fuel combustion in power plants.

The engine emission data from the HFO generator shows that NO<sub>x</sub> emission from each engine will be below 1390 mg/Nm<sup>3</sup> (15% O<sub>2</sub>), which is higher than the IFC/WB guideline. NO<sub>x</sub> emission guideline for liquid fuel-fired reciprocating engine power plants located in degraded air shed is 400 mg/Nm<sup>3</sup> (15%O<sub>2</sub>).

### Health Effects

Certain members of this group of pollutants, especially nitrogen dioxide (NO<sub>2</sub>), are known to be highly toxic to various animals as well as to humans. High levels may be fatal, while lower levels affect the delicate structure of lung tissue. In experimental animals this leads to a lung disease that resembles emphysema in humans. As with ozone, long-term exposure to nitrogen oxides makes animals more susceptible to respiratory infections. Nitrogen dioxide exposure lowers the resistance of animals to such diseases as pneumonia and influenza. Humans exposed to high concentrations suffer lung irritation and potentially lung damage. Increased respiratory disease has been associated with lower level exposures.

The human health effects of exposure to nitrogen oxides, such as nitrogen dioxide, are similar to those of ozone. These effects may include:

- Short-term exposure at concentrations greater than 3 parts per million (ppm) can measurably decrease lung function.
- Concentrations less than 3 ppm can irritate lungs.
- Concentrations as low as 0.1 ppm cause lung irritation and measurable decreases in lung function in asthmatics.
- Long-term lower level exposures can destroy lung tissue, leading to emphysema.

Children may also be especially sensitive to the effects of nitrogen oxides.

### Other Effects

Oxides of nitrogen also can:

- Seriously injure vegetation at certain concentrations. Effects include:
  - Bleaching or killing plant tissue.
  - Causing leaves to fall.
  - Reducing growth rate.
- Deteriorate fabrics and fade dyes.
- Corrode metals (due to nitrate salts formed from nitrogen oxides).
- Reduce visibility.

Oxides of nitrogen, in the presence of sunlight, can also react with hydrocarbons, forming photochemical oxidants. Also, NO<sub>x</sub> is a precursor to acidic precipitation, which may affect both terrestrial and aquatic ecosystems.

## Particulate Matter

Amount of PM emission can be substantial from HFO plants, which is generally estimated as 1.50 g/kWH<sup>1</sup>. With this level of emission, the emission from the plant will be 21.30 gm/sec. As a non-attainment area for PM (table 4.4), the addition of the present small capacity plant (i.e., 56 MWe which is about 2.5% of the total capacity in the airshed) would not make substantial difference to the PM levels as there are power plants with an aggregate capacity of 1993 MWe (details in table 3.2) in the airshed. In addition, there are two large urea fertilizer plants of 0.5 million ton capacity each and these are suspected to contribute ammonium aerosol which contribute substantially to the PM levels in the airshed. There is also a one million ton capacity petroleum refinery in the air shed, which flare escaping hydrocarbons contributing to the PM levels. The FGD in the plant will also substantially (>50%) reduce PM emission as it uses a wet scrubbing process. So, PM contribution of the plant in the airshed is estimated to be about 1% of the total and as such this issue has not been examined in further details as the plant's impact is expected to be marginal.

## Carbon monoxide and carbon dioxide Emissions from the Proposed Plant

Carbon monoxide is generated when incomplete combustion takes place. The emission of carbon dioxide depends on the fuel burn and the carbon content in the fuel. The proposed power station is a heavy fuel oil fired modern design with optimum designed cycle efficiency in order to maximize the MW output and less consumption of fuel and water, CO & CO<sub>2</sub> emission per unit of fuel burnt will be smaller amount compare to other power stations. The ambient CO level is low (table 4.4) and compression ignition engines use excess air for combustion. So, CO emission is low and it no mitigation is required.

## Mitigation Measures

### A. Engine Emission

#### SO<sub>2</sub> Emission

The emissions of SO<sub>2</sub> are dependent on the sulfur content of the fuel. The project authority will use HFO with approximated sulfur content of 2.80% which is above the allowable limit of IFC/WB Environmental Heal & Safety Guideline 2008, is 0.5% Sulfur content for the SO<sub>2</sub> emission of liquid fuel oil power plant in degraded air shed. There is no standard set in the Bangladesh ECR 1997 for the SO<sub>2</sub> emission for the liquid fuel fired power station. So we should consider the standard of IFC/WB guideline in this situation. The project will have a Flue Gas de-sulfurization plant (FGD) to reduce the sulfur emission (more than 90%). With this level of emission, the estimated SO<sub>2</sub> emission at the final exhaust will be equivalent to HFO with 0.3% Sulfur content. So,

<sup>1</sup> US EPA-420-R-09-007: Technical support document (2009)

the SO<sub>2</sub> emission level at the final exhaust would be lower than the requirement of IFC/WB standard.

The detail of the Flue Gas De-Sulfurization (FGD) plant has been discussed in the Chap-7.

### NOx Emission

The engine emission data from the HFO generator shows that NOx emission from each engine will be below 1390 mg/Nm<sup>3</sup> (15% O<sub>2</sub>), which is higher than the IFC/WB guideline. NOx emission guideline for liquid fuel-fired reciprocating engine power plants located in degraded air shed is 400 mg/Nm<sup>3</sup> (15%O<sub>2</sub>). There is no standard set in the Bangladesh ECR 1997 for the NOx emission for the liquid fuel fired power station. So we should consider the standard of IFC/WB in this situation. The Flue Gas de-sulfurization plant (FGD) will also reduce the NOx content of the exhaust as it uses a wet scrubbing process and NO<sub>2</sub> is very soluble in water. Considering the available information in literature, it is assumed that the wet alkali scrubber may remove 50-70% of NO<sub>2</sub>. The ambient NO<sub>2</sub> level is low (table 4.4) and considering small contribution to cumulative emission in the air shed, the NOx level is not expected to exceed the NAAQS.

### B. Ambient air quality

An effect on ambient air quality has been assessed based on air emission dispersion modeling. In this study, the SO<sub>2</sub> and NOx emissions for the reciprocating HFO engine system discharged through stack were modeled to obtain maximum possible downward ground concentration. USEPA AERMOD view version 8.0.5 model was used to estimate emission concentration from the plant. The exhaust specifications and stack parameters for the proposed reciprocating HFO engine are used as input to AERMOD model. The individual engine stack data was used as point source of SO<sub>2</sub> & NOx emissions and the results are the summation of 8 emission sources. The parameters and corresponding values are summarized in the table 6.1 below:

**Table 6.1: Summary of the exhaust specifications and model input data**

| Parameters                                    | values          |
|---|-----------------|
| Stack height (m)                              | 30              |
| Stack inside diameter (m)                     | 1.2             |
| Stack exit velocity (m/s)                     | 21.7            |
| Exhaust temperature (K)                       | (315+273) = 588 |
| Exhaust flow rate (Nm <sup>3</sup> /sec)      | 23.94           |
| NOx emission rate as NO <sub>2</sub> (gm/sec) | 15.456*         |
| SO <sub>2</sub> emission rate (gm/sec)        | 17.55*          |
| Ambient temperature (K)                       | 273             |

\*calculations have been attached in annexure -9

The model assumes the stack tip downwash with receptors on flat terrain and no flagpole receptor heights. The NO<sub>x</sub> and SO<sub>2</sub> concentration contour have been analyzed with 500 m interval with a radius of 5000m from the point source.

### NO<sub>2</sub> concentration:

The NO<sub>2</sub> concentration contour of 24 hour and annual average of have been analyzed. The maximum of 24 hour concentration of NO<sub>x</sub> has been predicted as 200 µg/m<sup>3</sup> at a radius of 100m of the project site (Fig-6.1) and average annual concentration as 30 µg/m<sup>3</sup> (Fig. 6.2). The NO<sub>2</sub> in the air shed of the plant ,has been found to be about 31 µg/m<sup>3</sup> (Table 6.2). The Bangladesh standard set for annual concentration for NO<sub>x</sub> is 100 µg/m<sup>3</sup>. The alkaline FGD is expected to remove a substantial fraction of NO<sub>2</sub> in addition to SO<sub>2</sub>. The annual concentration of NO<sub>2</sub> with the plant in operation even without FGD is estimated to be 61µg/m<sup>3</sup> (Table-6.2) which is within NAAQS.

### SO<sub>2</sub> concentration:

The SO<sub>2</sub> concentration contour of 24 hour and annual average of have been analyzed. The maximum of 24 hour concentration of SO<sub>2</sub> (200µg/m<sup>3</sup> ) has been predicted from modeling at 100m of the project site (Fig 6.3). The maximum annual concentration of SO<sub>2</sub> has been predicted as 40µg/m<sup>3</sup> at 100m from the plant site. With FGD, the emission levels for SO<sub>2</sub> from the plant will be reduced by 90% and thus the 24 hour and annual concentration with the plant will be 20 and 4 µg/m<sup>3</sup> respectively. The 24 hour average concentration of SO<sub>2</sub> in the airshed for plant has been found to be about 16 µg/m<sup>3</sup> (Table 6.2). The Bangladesh standards for annual and 24 hour concentrations for SO<sub>2</sub> are 80 and 365 µg/m<sup>3</sup> respectively. With FGD, the NAAQS will be met even with the emission from the plant. The impact of the plant on the concentration of AQ parameters are summarized in Table-6.2

**Table- 6. 2: Air Quality Impact of the Plant**

| SI | Parameter | Unit              | NNAQS | Period | Current Level* | Estimated Plant contribution with FDG at 100m | Level with the plant | Comments                      |
|----|-----------|-------------------|-------|--------|----------------|---|----------------------|-------------------------------|
| 1  | PM2.5     | µg/m <sup>3</sup> | 65    | 24 hr  | 136            | -   | 136                  | Non-attainment area for PM2.5 |
| 2  | PM10      | µg/m <sup>3</sup> | 150   | 24 hr  | 224            | -   | 224                  | Non-attainment area for PM10  |
| 3  | SO2       | µg/m <sup>3</sup> | 365   | 24 hr  | 16             | 20  | 36                   | Within Standard               |
| 4  | NO2       | µg/m <sup>3</sup> | 100   | Annual | 31             | 30  | 61                   | „                             |
| 5  | CO        | µg/m <sup>3</sup> | 10    | 8 hr   | 1.7            | -   | 1.7                  | „                             |
| 6  | O3        | µg/m <sup>3</sup> | 157   | 8 hr   | 36             | -   | 36                   | „                             |

\*Rounded values from Table-4.4 and converted to µg/m<sup>3</sup>.

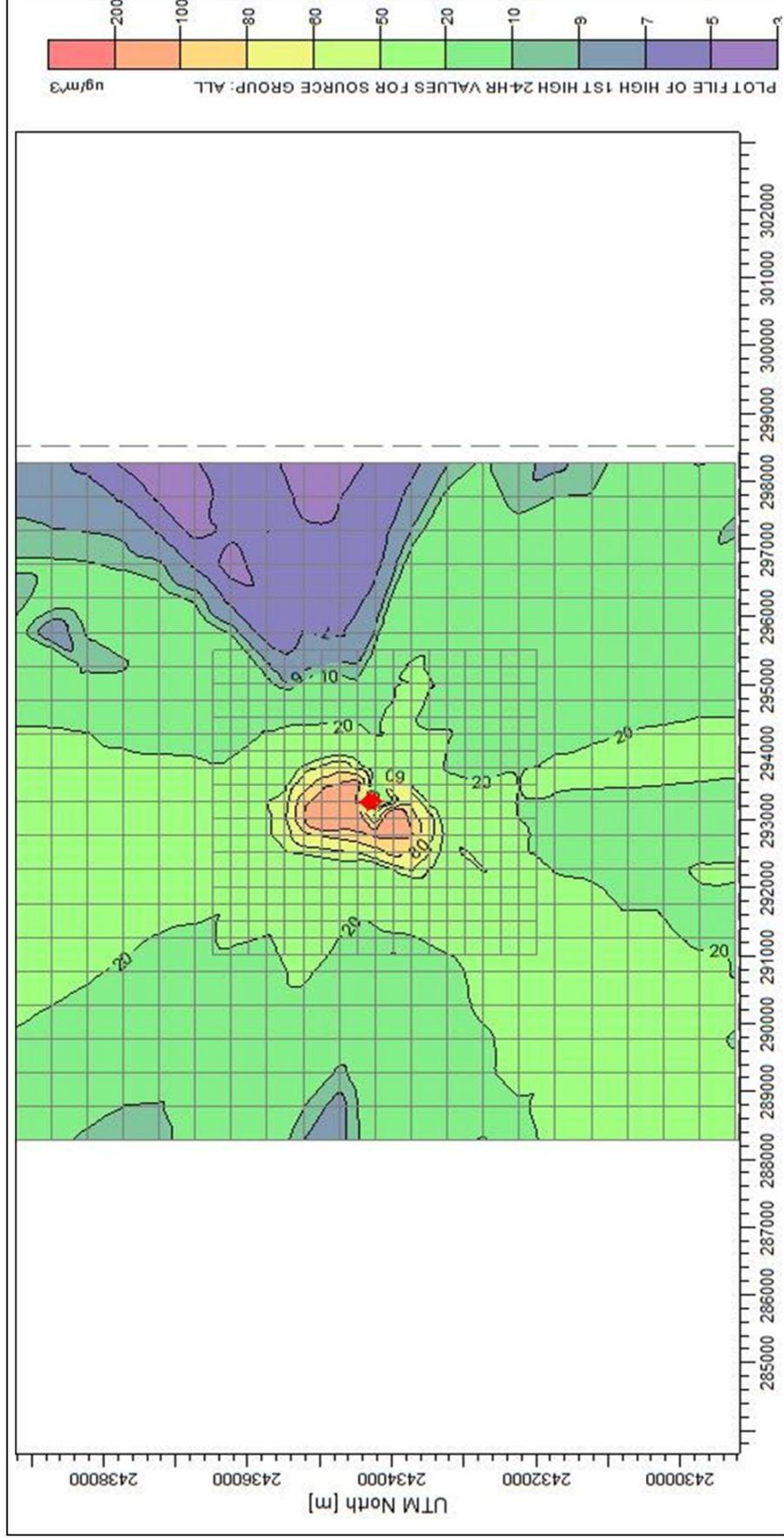
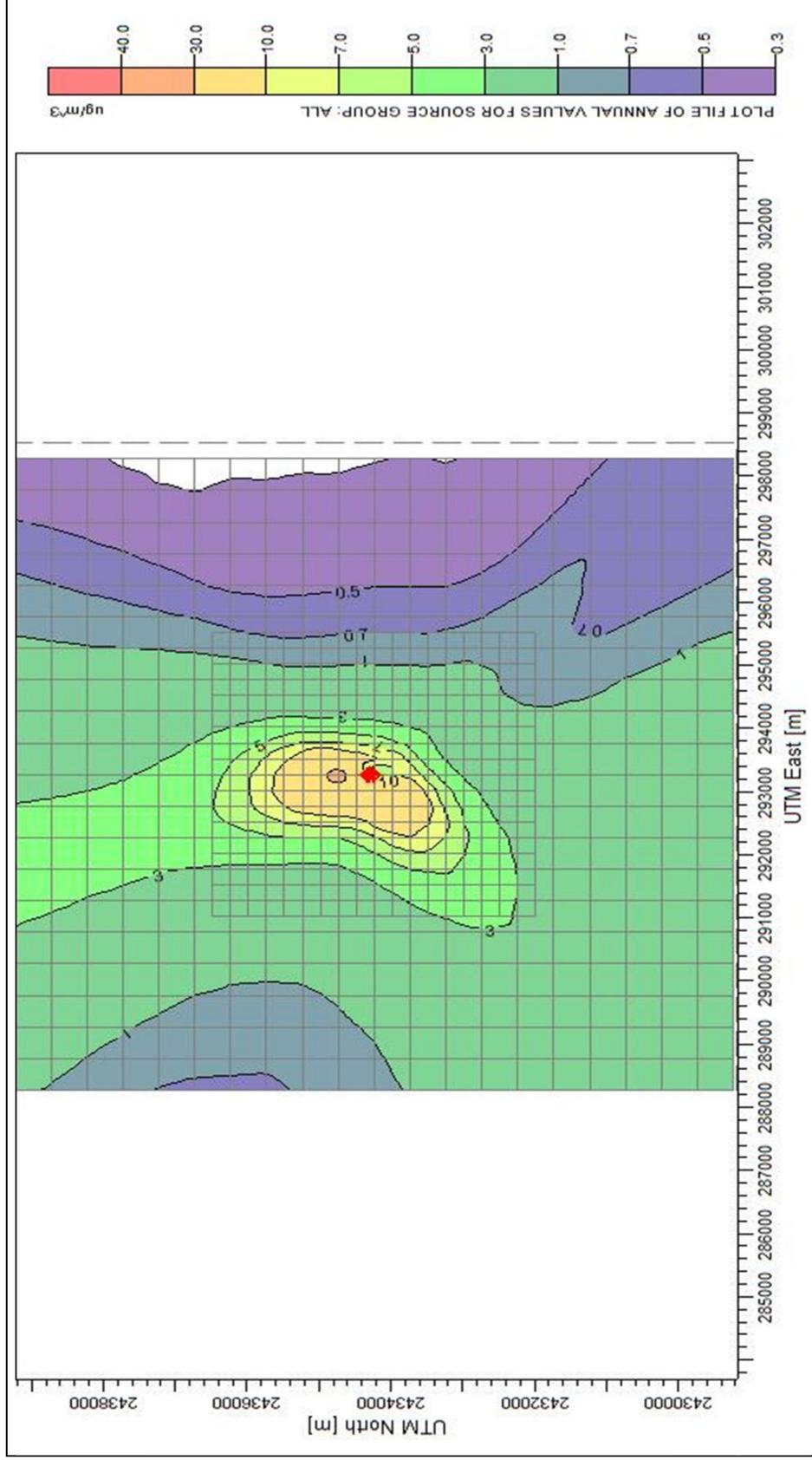


Figure 6.1: Emission contour map showing the NOx concentration (24 hour average) at 5000m surrounding the project location



6.2: Emission contour map showing the NO2 concentration (Annual average) at 5000m surrounding the project location

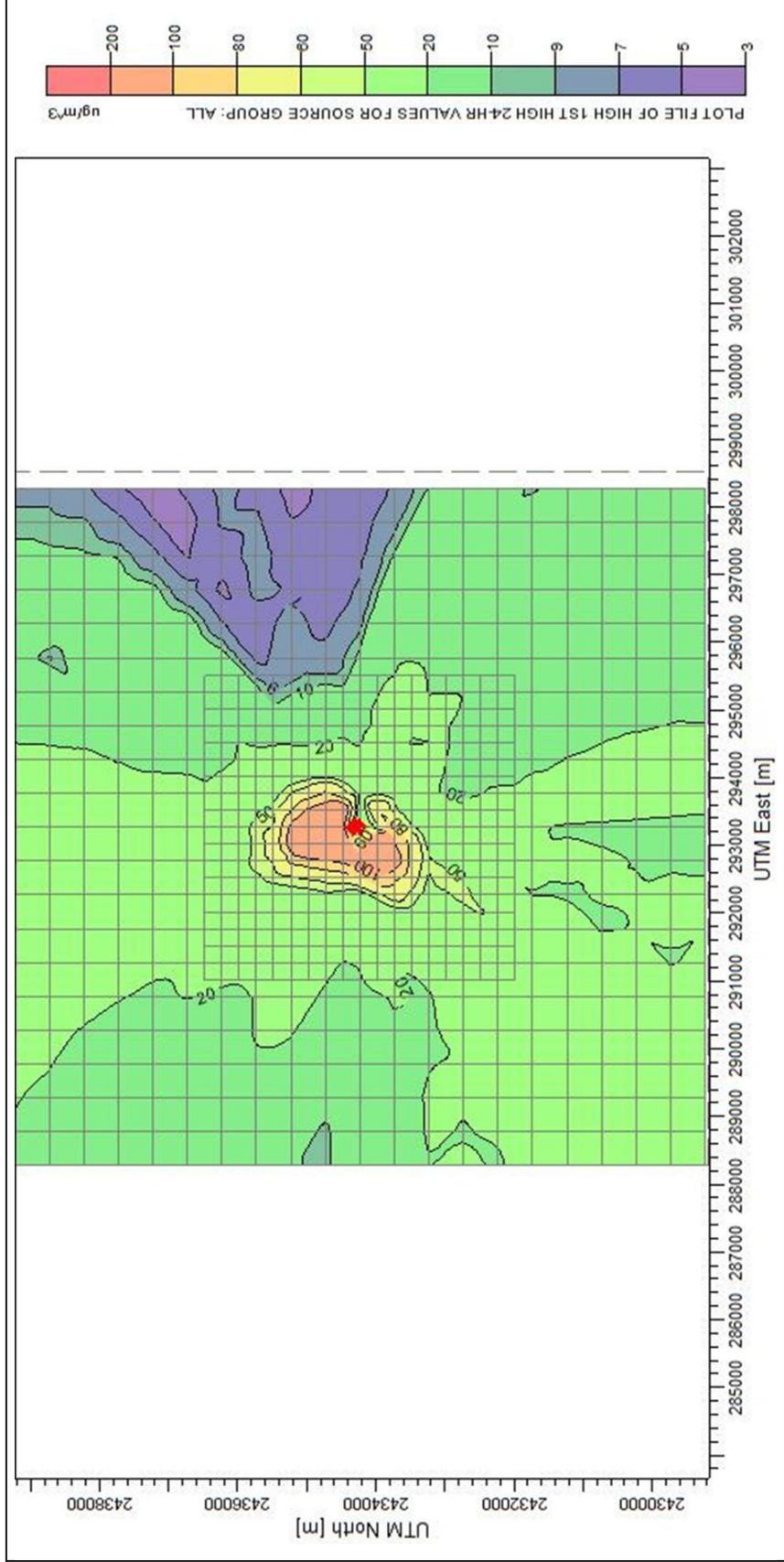


Figure 6.3: Emission contour map showing the SO2 concentration (24 hour average) at 5000m surrounding the project location

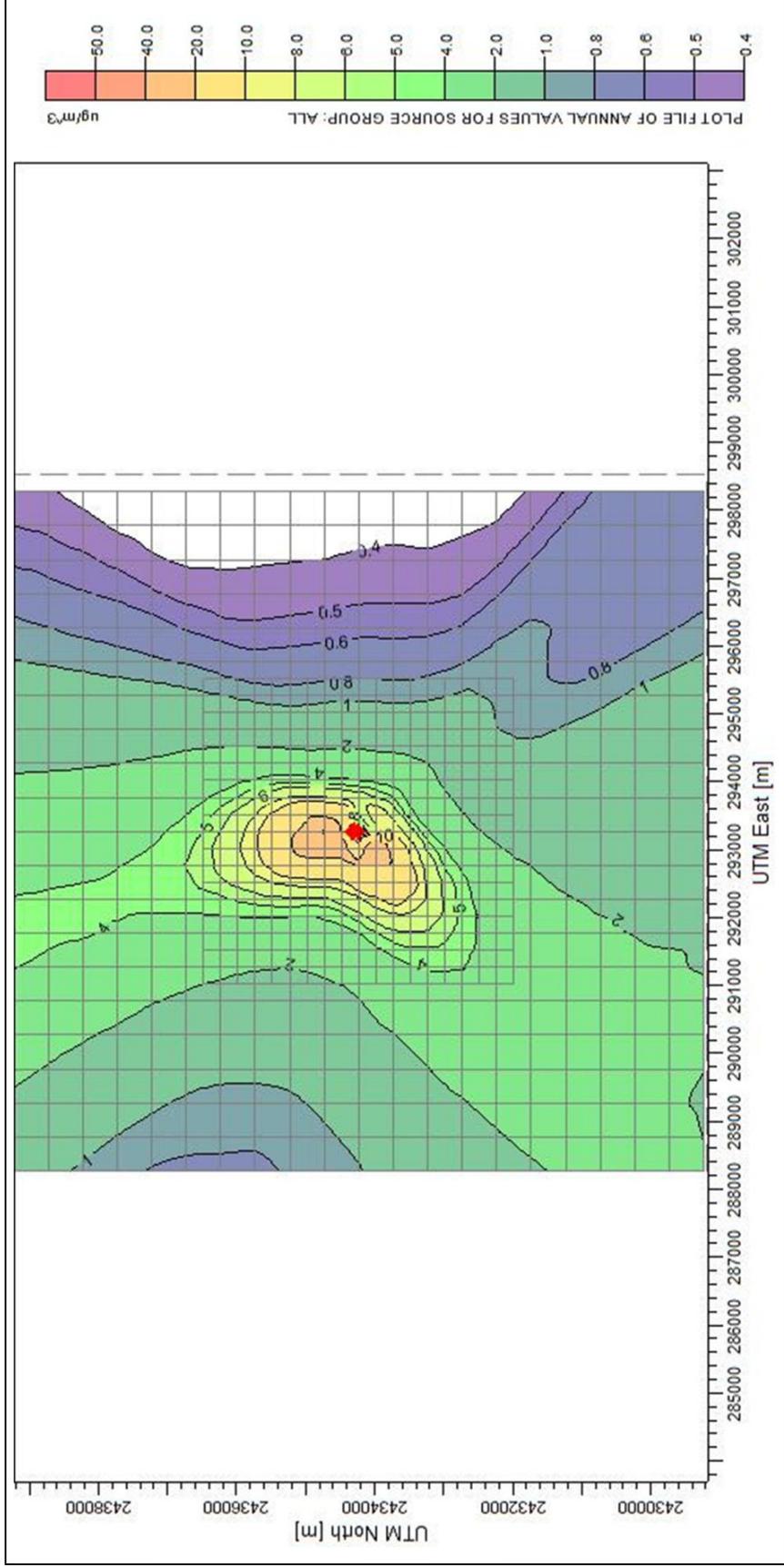


Figure 6.4: Emission contour map showing the SO2 concentration (Annual average) at 5000m surrounding the project location

From the Table 3.2 & Table 4.5, it is evident that the area fall under degraded air shed (IFC/WB definition) and after taking all above mitigation measures, the BPPL will contribute a small amount of air emission (NO<sub>x</sub>, SO<sub>2</sub> & PM) to the surrounding pollution comparing to the air existing emission source in the study area.

For the well dispersion of the hot air from the generator, the project authority will construct a 30 m high stack from the ground level. The stack would be connected with a silencer to prevent the noise from the engine. The stack heights have been designed to facilitate undisturbed and free dispersion of the emitted air pollutants. Exhaust gas sample extraction facilities shall be installed for emission monitoring on each stack.

The detail emission modeling report has been attached as annexure 10.

### **Residual Impact**

It is clear from above study that the project proponent has adopted necessary options suitable to their needs to meet the NAAQS. Adoption of measures set out above is not expected to provide total mitigation, because no machine works at 100% efficiency. After adopting proper mitigation measures to maintain national/international standards, **Baraka Patenga power Ltd.** will emit some residual pollutants, which can affect the environment in the long run. On the other hand, if other industries located in the area, emits air meeting the national requirement as **Baraka Patenga power Ltd.** the cumulative residual pollutants will create an adverse situation in the ambient air quality. So, this situation can be overcome by determining the exact level of treatment and maintaining it by following the management plan properly, which is required to maintain the normal ambient air quality of the area.

### **6.2.3.2 Impact due to Liquid Discharge**

#### **Impact Origin**

The Proposed power plant will not create any process liquid from the production process. The power plant will have close loop water cooling system for the main reciprocating engine system and in the waste heat steam turbine condensation unit (900 cu.m/hour). A small amount of water will be required as makeup water only which is approximately 21 cu.m/hour. In addition, small amount of water will also be used for occupational floor, equipment washing and for domestic purposes. This wash water will not contain significant amount of pollution, which may impact the surface water quality.

#### **Mitigation Measures**

The cooling water will be used in a close loop system having no discharge. Some make up water would be added (approximately 21 cu.m/hour) to the system. The domestic liquid waste will be disposed through a septic tank with a soak pit. The project will have planned drainage system to discharge the surface runoff. The surface drainage

network would be connected with an interceptor prior to discharge through natural water. The interceptor will trap all oily matter present in the water.

### **Residual Impact**

Provided that the mitigation measures indicated above are fully implemented; residual impacts are expected to be insignificant.

#### **6.2.3.3 Impact due to Solid Waste**

##### **Impact Origin**

The operation of the plant itself would not generate any solid waste. Solid waste generated by the people working at the proposed site is paper, cartoons, bags, boxes, office wastes, pallets, empty drums etc. along with negligible quantity of domestic waste. Some items such as spent spare parts, air filters and waste rugs etc. will be accumulated periodically which need to be properly disposed.

##### **Mitigation Measures**

All solid waste will be segregated properly. Some solid Waste may have secondary use and these will be sold to the secondary dealers. Other solid wastes will be disposed to the safe places carefully. The air filters and waste rugs should be collected in a safe place and would be disposed to landfills.

### **Residual Impact**

Provided that the mitigation measure indicated above is fully implemented, residual impacts are expected to be insignificant.

#### **6.2.3.4 Impact due to HFO and Lubricating Oil**

##### **Impact Origin**

The proposed project will be operated by HFO, so, there is HFO preheating and treatment system in the project before feeding the HFO to the engine. This will end up with some oily sludge & water. Moreover, the project will use lubricating oil in the engine cooling system from where insignificant amount of used lubricating oil would be generated from the plant. The generated waste oil will be stored in a sealed tank.

##### **Mitigation Measures**

The oil storage of the project (fresh and used) should be done on hard standing floor and roofing with a secondary containment facility of 110% bigger than the allowable maximum storage capacity. The project will produce 2000 liter per day of separated oil water sludge from the HFO preheater. This oily water sludge would be treated Pure

Bilge Oily water cleaning system, where clean water would be discharged with the oil content below Bangladesh national standard (below 10mg/l) and sludge thus collected and the waste lubricating oil will be supplied /sold to the vendors for recycling. These vendors or the Lube Oil Re-cycling facilities should be approved by DoE. As there is no chance of mixing and disposal of oil onto land or water, so there is no mitigating measure to be suggested.

Detail on oil water separation has been attached in Annexure-11

### **Residual Impact**

Provided that the mitigation measures indicated above is fully implemented, residual impact to be insignificant.

### **6.2.3.5 Noise and Vibration Impacts**

#### **Impact Origin**

##### **A. Engine room noise:**

The generator room will have internal noise level of around 108 dBA at 1m distance from the reciprocating engines and generators, 90 dBA at 1m distance from the steam turbine unit which will be minimized by sophisticated acoustic power house building design so as to minimize the noise emission up to standard.

##### **B. External noise emission:**

The individual reciprocating engine stack will emit a noise level of 73 dBA after providing the silencer (35 dBA abatement). The air intake opening will emit an approximated noise of 83 dBA after providing air intake silencer (25 dBA abatement) and the radiator cooling fan will generate around 70 dBA noise during operation period. These noises will be dispersed to the surrounding atmosphere to certain extent.

#### **Mitigation Measures**

##### **A. Engine room noise abatement:**

Necessary noise abatement measures will be taken as required avoiding adverse noise & vibration impact on the neighborhood. In particular, significant noisy components such as the generators and turbines are enclosed in buildings acoustically designed, providing **Styrofoam filler of 100 mm width in between 150 mm thick brick walls both side** (sandwich type) of the Styrofoam filter around the power house building. The following are the noise abatement capacity of the material which would be used for noise abatement for the engine room noise:

It is estimated that the Styrofoam filter and brick wall will absorb noise as following:

| Material   | Thickness, mm | Approximated noise absorption capacity, dBA |
|--|---------------|---|
| Styrofoam (Acrylic -Poly-Methyl-Meta-Acrylate (PMMA) | 100           | 90  |
| Brick with or without plaster                        | 150           | 40  |

It is estimated that the noise abatement measures of the power house building will be capable to absorb around 90 dBA noise from the engine room, but the maximum engine room noise is around 108 dBA near the generators, which is lower enough to minimize the engine room noise by the acoustic enclosure and it is expected that the noise emission from the engine room would be within the limit. Moreover, Vibration pad will also be used at the bed of all power generation units to prevent the vibration.

### B. External noise emission:

For the measurement of the noise dispersion to the surrounding area from the external noise emission sources, a noise modeling simulation has been done by using CUSTIC-3.2 noise modeling software. The model has calculated the aggregated noise from the 8 HFO engines stack, air intake filter and cooling tower radiators. The result of the modeling has been given below.

| Radius, m                       | 50    | 100   | 200   | 300   | 400   | 500  |
|---------------------------------|-------|-------|-------|-------|-------|------|
| Output Sound power level in dBA | 38.47 | 32.08 | 25.65 | 19.24 | 12.82 | 6.41 |

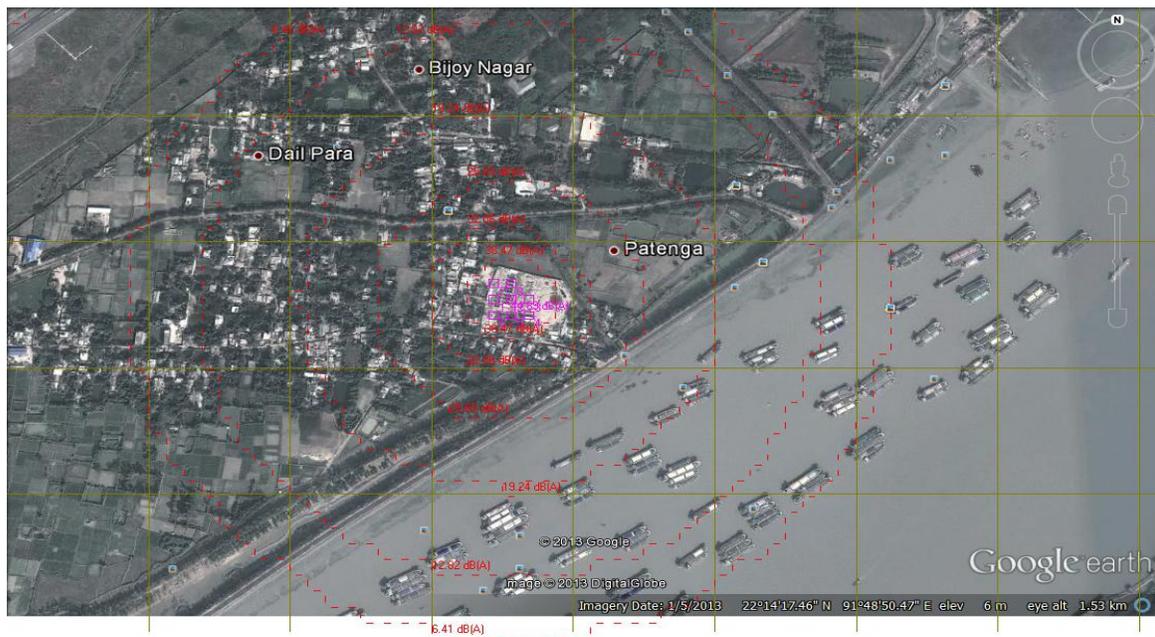


Fig 6.5: Plot of output noise power level in dBA vs Radius in meter

The modeling result shows that the power plant will produce max noise 38.47dBA within 50m radius and minimum 6.41dBA in 500m radius respectively during running condition of the project. There are few homesteads at the south west and North West side of the project within the 100m radius of the proposed project where the noise contribution from the project would be around 32.08 dBA.

The following are the World Bank and Bangladesh standard for the ambient noise:

| Standard           | Zone                                       | Day time<br>dBA | Night time,<br>dBA |
|--------------------|--|-----------------|--------------------|
| World Bank         | Residential, Institutional,<br>educational | 55              | 45                 |
| EHS Guideline 2007 | Industrial, commercial                     | 70              | 70                 |
| Bangladesh         | Mixed area                                 | 60              | 50                 |
|                    | Commercial                                 | 70              | 60                 |
| ECR, 1997          | Industrial                                 | 75              | 70                 |

The BPPL will be established in an area with heavy industrial set up within 5 km radius falls under the industrial zone category of Bangladesh standard. The day & night time average noise was found during the baseline study below the standard of industrial zone concentration. But noise generation from the power project was found below 70 dBA at a distance of 100m away from the project. Since the project itself will contribute little amount of noise to the surrounding atmosphere, it is expected that the cumulative noise would meet the standard of industrial area of Bangladesh standard. The noise modeling report has been attached in annexure-12.

### Residual Impact

Provided that the mitigation measure indicated above is fully implemented, residual impact to be very insignificant.

### 6.2.3.6 Occupational Health and Safety

#### Impact Origin for Occupational Health

The proposed project will employ around 98 people during its operational period. The workers who work inside the plant will face occupational health hazards due to different operational processes. Safe and good occupational health status of the employees and workers is important for only the persons working in the plant, but also for the better plant operation and maintenance.

#### Mitigation Measures

Protective clothing, earplug, helmets, shoes and accessories should be provided to the workers specially who will work in the power house building and engine room. Adverse impact on worker's safety would be minimized by implementing an occupational health

program. Regular medical checkup would be done to ensure the soundness of health of employees and workers. Pollution control measures would duly adopt if necessary, including noise and air pollution.

### **Residual Impact**

Provided that the mitigation measure indicated above is fully implemented, residual impact to be very insignificant.

### **Safety**

#### **Origin of Impacts**

Safety is an important issue in all industrial plants and it has many dimensions. As such it is discussed in several places in the document. Safety issues can arise in normal operations or in the case of accidents, faults and disasters. As the site is susceptible to earthquake and cyclones, the plant may be endangered due to structural failure. Fire is another major concern as a large amount of fuel is stored in the facility.

#### **Mitigation Measures**

Under the supervision of the 'Environment Management and Safety Committee', all plant personnel will have responsibilities assigned to them during emergency. The documented responsibility will be included in a program manual which can constitute a part of the plants operation manual. Compliance with the responsibilities should be monitored and if these are not carried out for any reason, corrective measures should be taken. The plant management will prepare an occupational health safety policy manual which should be updated from time to time. The policy should be signed and dated by the Chief Safety Officer who may be the Plant Manager. The policy should be discussed with all the plant personnel. The Chief Safety Officer should periodically review the policy and re-issue the policy.

Of course some of the issues have been addressed in the plant design. Structural design in compliance with BNBC is expected to protect the installation against cyclone and earthquake. Fire safety measures such as availability of firefighting equipment will provide some degree of safety.

#### **Residual Impacts**

There will always be some residual safety concern. Vigilance will always be needed to ensure that these concerns are minimized.

#### **6.2.4 Socio-economic Impacts**

The **Baraka Patenga Power Limited** will contribute to cover the increasing demand of electricity which is a beneficial operation factors, e.g. for producing industries. Site development will not lead to the loss of any jobs; instead will create around 98 new job

opportunities for the local workers. On the other hand, during the construction activities of the **Baraka Patenga Power Limited**, jobs and income opportunities will be created and as such per capita income will be enhanced in this area. For operation, a number of long-term skilled and unskilled personnel will be required which will create employment opportunities for the local inhabitants also.

Since there was no habitation located inside the proposed site, resettlement would not be necessary for the project. But migration will be increased due to creating new job opportunities in the plant area. People in the neighborhood are expected to get benefit from the employment that would be generated and from the increased business activities during construction period. There is no religious, cultural or historic place near the site, so the noise and air pollution during construction of the project would not create any potential impact. People of the surrounding area will be benefited by the development of local small businesses due to the increase of migration in the area.

### **6.3 Beneficial Impacts and Enhancement**

#### **6.3.1 During Construction**

##### **Impact Origin**

During construction period, the plant will create job opportunities for approximately 300 of skilled, semi-skilled and unskilled labors. However, the impact will be a relatively short duration, being restricted locally to the construction period. In addition to this, all construction sites attract small traders, who supply food and other consumable to the work force. Although the numbers of people who benefited in this way are relatively small, the impacts on individuals can be disproportionately high compare to the other local people.

##### **Benefit Enhancement Measure**

Although labor recruitment is a matter of construction contractor who has the right to determine whom he shall not employ, but still the project proponent shall encourage him to hire local people wherever possible and to give preference to employment of the land less people.

#### **6.3.2 During Operation Phase**

##### **Impact Origin**

The most significant positive impact of the plant would be the generation of electricity, which will reduce the gap between supply and demand of electricity. The other important positive impact of the plant would be the employment of personnel for the operation of the plant. The project envisages employing 98 skilled and unskilled personnel during its operational phase. Apart from the positive impacts other beneficial

impacts include benefit to local economy due to employment, community development, etc.

### **Benefit Enhancement Measure**

Although labor recruitment is a matter of company who has the right to determine whom he shall and shall not employ, but still the project proponent should take initiative to employ local people wherever possible and to give preference to employment of the jobless people.

## **6.4 Decommissioning**

### **6.4.1 General principles for Environmental Management During Decommissioning**

At this project of the project planning & implementation process, the necessity for and timing of the decommissioning of the **Baraka Patenga Power Limited** is not known. Therefore, only general principles of decommissioning are detailed below. These principles must be required to be revisited and supplemented in the event of decommissioning of the power plant.

On decommissioning of the power project, BPPL will:

- Ensure that all sites not only vegetated are vegetated as soon as possible after operation ceases with species appropriate to the area.
- All structures, foundations, concrete, and tarred areas are demolished, removed and waste material disposed of at an appropriately licensed waste disposal site.
- All access/service roads not required to be retained by landowners are closed and rehabilitated.
- All disturbed areas are compacted, sloped and contoured to ensure drainage and runoff and to minimize the risk of erosion.
- All hazardous materials should be kept separate, documented and disposed to the safe recycling or disposal site.

A detail decommissioning and restoration of site plan should have to be development prior to the decommissioning of the project.

## *Chapter 7*

# *Environmental Management Plan (EMP)*

## Chapter-7

### **7.0: ENVIRONMENTAL MANAGEMENT PLAN (EMP)**

#### **7.1 GENERAL CONSIDERATIONS**

In the context of a project, Environmental Management Plan (EMP) is concerned with the implementation of the measures necessary to minimize and offset the adverse impacts and to enhance beneficial impacts. Unless the mitigation and benefit enhancement measures are identified in EIA and fully implemented, the prime function of the EIA cannot be achieved. Thus, the objectives of EMP for the present project are: (i) Identification of Monitoring requirements and Monitoring indicators; (ii) Mitigation measures to reduce or eliminate negative impacts; and (iii) Enhancement measures to maximize positive impacts. Environmental management plan has to be considered as part of the plant's overall management and it would be part of the plant operational manual.

Monitoring of the performance of a plant is very important and sometimes vital. Industrial units in Bangladesh generally do not monitor the environmental parameters related to plant operation, thereby neglecting the environment. For surveillance of the environmental performance of an industry, and monitoring of the quality of the local environment, environment in the work-zone and the general impact zone have to be performed on a regular basis. A management set up has to be created for the environmental monitoring program which can ensure compliance with national environmental standards. To this end a committee (Environmental Management and Safety Committee) will be created with plant manager as head and with 2-4 other members. The committee must meet at least once in a quarter and take stock of the environmental status of the plant. The main waste products of the plants are sludge and the effluent discharged from the plant. These are to be analyzed as per SOP for the plant. Any additional monitoring required should be defined and resources allocated for the purpose. The proceeding of the committee should be recorded and used to produce quarterly and annual environmental reports indicating compliance or otherwise of the environmental regulations. These reports should be submitted to the DOE and shared with the World Bank. The quarterly and annual monitoring reports will also be placed on the company website for public scrutiny.

The cost of the Environmental Management Plan (EMP) has to be divided into several parts to reflect the different phases of the project and the requirements of each phase. The cost of EMP must include the costs of the capacity building, public consultation and the quality control requirements and the budget allocation should be made in the yearly operational budget of the plant.

#### **7.2 MITIGATION/BENEFIT ENHANCEMENT MEASURES**

For effective and environment friendly operation of an industry, a set for guiding tools and suggestions are necessary which need to be followed at various stages of plant

installation, operation and maintenance. This plan generally has various components of management depending on the type of industry or plant activity and types of discharge and their pollution potential. This Environmental Management Plan (EMP) once prepared forms the basis of environmental management actions from the part of the plant authority may need modification or up-gradation because of changes in the plant operation or accurate pollution load/environmental problems detected afterwards. The plant authority may also be needed to expand the suggested outline of the EMP proposed in this report.

All beneficial and adverse impacts which may likely to occur at different phases of the project are identified in section 5.0. In section 6.0 predictions, evaluation and aspect of mitigation and benefit enhancement measures have also been discussed concurrently with impacts prediction and evaluation. In view of the earlier discussion summary of recommended mitigation and benefit enhancement measures are presented in Table 7.1.

**Table 7.1: Recommended mitigation/enhancement measures**

| Potential Impacts                     | Mitigation/Benefit Enhancement Measures  |
|---------------------------------------|--|
| Impact on surface water quality       | <ul style="list-style-type: none"> <li>○ Dispose all domestic waste water through septic tank</li> <li>○ Surface drainage should be disposed through an interceptor.</li> <li>○ Collect the waste oil in a sealed tank, store in safe place and dispose through secondary trader for recycling.</li> </ul>   |
| Impact on solid waste                 | <ul style="list-style-type: none"> <li>○ Collect all solid wastes properly, recycle where possible and dispose in proper place.</li> <li>○ Waste rugs and waste air filters are collected properly and disposed to the landfill.</li> </ul>  |
| Impact on Air Quality                 | <ul style="list-style-type: none"> <li>○ Installation of FGD to reduce SO<sub>2</sub> emission by 90% which will also reduce PM and NO<sub>2</sub> substantially.</li> <li>○ Proper stack height (30m) has to be installed and maintained for each 8 stacks</li> </ul>   |
| Impact on health and safety           | <ul style="list-style-type: none"> <li>○ Set up warning signs, signals and provide helmets for workers in accordance with relevant accident prevention and work safety procedure</li> <li>○ Restrict access to plan site</li> <li>○ Supply good quality drinking water to the workers</li> <li>○ Provide well-planned sanitary facilities</li> <li>○ Provide regular health inspection among workers</li> <li>○ Promote health education campaign among workers</li> </ul> |
| Noise/vibration hazard                | <ul style="list-style-type: none"> <li>○ Proper acoustic design should be made for the power house building and silencer in the exhaust of each engine.</li> <li>○ Provide sufficient buffer strip around the project site and power house building</li> </ul>   |
| Traffic congestion                    | Avoid carrying of materials in peak hour of road traffic   |
| Impact on employment & family finance | Employ local people wherever possible  |

### 7.3 Environmental Management during Operation Phase

#### 7.3.1 Overview of Impacts and Mitigation Measures

Power plants invariably have potential for environmental impacts during the operational phase of the project. The following impacts are the most significant in the present case:

- Impacts on air quality;
- Acoustic and vibration impacts
- Wastewater discharge
- Occupational Health and Safety

Over viewing of mitigation measures due to impacts arises from the operation of power plant is atmospheric pollutant emissions, which are being controlled at source by the following mitigation measures:

- The plant would have a flue gas de-sulfurization (FGD) plant to reduce the sulfur level from the exhaust.
- A stack height of 30 m will ensure compliance with the National air quality limits.
- Using waste heat to steam turbine for extra power generation will reduce the pollutant level per unit of fuel used.
- Environmental noise from engine will be controlled through proper acoustic design within the plant.
- A septic tank will be provided to ensure that effluent discharge standards are met.
- Containment for HFO tank will reduce hazards from oil spillage

#### 7.3.2 Atmospheric Emission Management

The combustion of fossil fuels for power generation inevitably results in emission of gaseous pollutants to the atmosphere. As the proposed power plant is fired with HFO, the pollutants of potential concern are likely to be oxides of nitrogen (NO<sub>x</sub>), Sulfur Di-Oxide (SO<sub>2</sub>) and Particulate (PM). The project will install a waste heat recovery steam turbine unit to generate additional electricity by using the waste heat from the stack and the final temperature of the exhaust stack would be reduced from 315 °C to 174 °C, which will reduce CO<sub>2</sub> emission per unit of energy production. In addition, the project management will install a flue gas de-sulfurization (FGD) plant which will remove 90% sulfur from the exhaust.

The FGD plant will consists of main scrubber tower, limestone mixing and preparation, gypsum buffer solution collection tank, gypsum dehydrating system for gypsum recovery etc. This unit is the first of its kind in Bangladesh.

To comply with World Bank Group's "Environmental, Health and Safety Guidelines for Thermal Power Plants" requires 0,5% Sulfur in HFO for the plant of >50 MWth in a degraded airshed. The plant is planned to be fired with 2,8% sulfur HFO. This will

require SO<sub>2</sub> removal efficiency of 82% in the exhaust gas to match the equivalent emission. With 90% efficiency FGD HFO of even up to 3,5% Sulfur can be used in the plant. As the FGD uses a wet process, it will substantially reduce PM and NO<sub>x</sub> also.

In general limestone CaCO<sub>3</sub>, quick lime (CaO) or hydrated lime (Ca(OH)<sub>2</sub>) can be used for the wet FGD process. Limestone is planned to be used in the plant as it is easily available and cheapest.

The flue gas desulphurization process consists mainly:

- 1 free space nozzle scrubber plant with bypass-free liquid distribution system with integrated hot gas quencher and mist eliminator, capable for the flue gas of all 8 engines;
- Utility supplement equipment with reagent storage silo for limestone or lime powder and slurry preparation facility;
- Gypsum preparation plant by de-watering.

After implementing the above measures it is expected that the SO<sub>2</sub>, NO<sub>x</sub> and PM emission level will meet the GOB and IFC/WB Environment, Health & Safety guidelines. The lay-out plan and technical description of the FGD plant has been attached in annexure 13 (a) & 13 (b).

### **7.3.3 Management of Solid Wastes**

The area has no municipal solid waste collection system in the area. So, the BPPL authority will have its own solid waste collection and disposal system in place to abate the pollution from the solid waste. The solid waste which has secondary demand will be sold to the local traders after inspection and other waste will be properly managed and disposed of off-site. The air filter system shall be equipped with pressure measuring devices to indicate the operating conditions and the degree of filter contamination. Therefore, no significant ecological impacts arising from solid waste management are anticipated. Any excavated earth will be stored on-site and later used for landscaping activities.

### **7.3.4 Water & wastewater Management**

The proposed project would have water use for the domestic use, make up water from cooling tower and de-mineralized water treatment plant. There is no chance of polluting surface water from either sources since there will be no discharge from the project to the surrounding environment. The surface drainage network would be connected with an interceptor prior to discharge through natural water. The interceptor will trap all oily matter present in the water which will be disposed separately.

### 7.3.5 Domestic Sewage Management

All domestic sewage will be treated in a septic tank. The treated water will be discharged through soak pit.

### 7.3.6 Noise and Vibration Level Management

Adequate measures have been proposed for the control of noise and vibration from the equipment installed in the plant. Noise level monitoring would be performed periodically and the workers exposed to noise would have adequate protective device. Vibration protecting pad (shoe) would be provided under the generator during installation to protect the vibration during operation. An inlet silencer shall be incorporated to reduce the noise level to the specified level. The silencer shall consist of individual noise absorbing exchangeable elements filled with mineral wool.

### 7.3.7 Greening Program

A green belt development program with different kinds of trees would be undertaken. The vegetation would purify the air, reduce noise level, maintain ecological balance and generally contribute to the scenic beauty of the air. Soil in and around the plan site is fertile and plenty of water is available. Hence, the green belt as an environmentally sound and friendly project with a buffer zone surrounding the plant area may be created in a short time and therefore green area will be increased and reduce the environmental impacts.

## 7.4 MONITORING REQUIREMENT

Environmental monitoring is an essential tool in relation to environmental management as it provides the basic information for rational management decisions. The prime objectives of monitoring are-

- To check on whether mitigation and benefit enhancement measures are actually being adopted and are providing effective in practice
- To provide a means whereby impacts which were subject to uncertainty at the time of preparation of EIA, or which were unforeseen, can be identified, and steps to be taken to adopt appropriate control measures.
- To provide information on the actual nature and extent of key impacts and the effectiveness of the mitigation measures which, through a feedback mechanism, can be taken into account in the planning and execution of similar projects in future

There are two basic forms of monitoring:

- Visual observation or checking, coupled with inquiries
- Physical measurement of selected parameters

In the case of industrial projects in general, monitoring is done by physical measurement of some selected parameters like air, water, noise etc. It should be mentioned here that the monitoring program should be such so that it can ensure compliance with national environmental standards. The importance of this monitoring program is also for ensuring that the plant does not create adverse environmental changes in the area and providing a database of operations and maintenance, which can be utilized if unwarranted complaints are made.

## 7.5 MONITORING INDICATORS

Environmental monitoring requires a set of indicators that could be conveniently measured, assessed and evaluated periodically to establish trends of impacts. The indicators may be independent or may be functionally related. The physico-chemical, ecological and human interest including socio-economic indicators should be well understood. The monitoring program, in view of the possible impacts as assessed earlier, should consider the indicators for the impact assessment related to following issues is presented in Table 7.2 in the following page.

It is desirable that the mitigation measures for the negative impacts and environmental enhancement for positive impacts are implemented according to the suggestions presented in this report. There are two types of environmental monitoring activities associated with the project, during construction and during operation of the project. Each of the components is to be dealt with according to the requirement of suggested measures.

### Monitoring During Construction

The environmental monitoring 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

The environmental monitoring should also focus on enhancing the possible beneficial impacts arising from employment of local workforce for construction works. Table 7.2 summarizes the potentially significant environmental parameters needed to be monitored during the construction phase.

**Table 7.2** Monitoring plan during construction phase of the project

| Issue               | Parameters  | Location                | Monitoring Frequency                          |
|---------------------|---|-------------------------|---|
| Ambient air Quality | PM10, PM2.5, SO2, NO2, CO   | Around the project site | Data from DOE CAMS in the airshed can be used |
| Groundwater         | Groundwater level, pH, TDS, Ammonia, Nitrate, Phosphate, As, Fe, Mn and Coliforms | At the project site     | Once a Quarter                                |

|                    |  |  |   |
|--------------------|--|--|---|
| Soil quality       | Cr, Cd, Pb and Oil and Grease  | At the project site                          | Once during the construction phase                                    |
| Noise level        | Noise at different locations and to nearest receptor                 | Around the project site and nearest receptor | Once a month.   |
| Construction waste | Solid waste/construction debris, visual observation and record check | At site                                      | Once a month  |
| Health             | Health status of the workers, visual observation and record check    | At site                                      | Once every 2 months by the contractor's appointed health professional |

### Monitoring During Operation

Post construction monitoring is limited to a number of impact parameters to see the actual performance of the project. Some monitoring may be necessary during the operation period of the power plant. Environmental monitoring requires set of indicators that could be conveniently measured, assessed and evaluated periodically to observe the trends of change in base line environmental quality.

Most of the environmental parameters will experience beneficial effects during the operation phase of the power plant project. The plant management authority of BPPL should be responsible for overall environmental monitoring during the operation phase of the project. The environment monitoring 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

Table 7.3 summarizes the potentially significant environmental parameters needed to be monitored during the operational phase (IFC 2008).

**Table 7.3** Monitoring plan during operational phase of the project

| Issue                 | Parameters  | Location  | Monitoring Frequency                                  |
|-----------------------|---|---|---|
| Stack emissions       | NO <sub>x</sub> , SO <sub>2</sub> , PM  | Final exhaust (FGD)                             | Annual or Continuous if stack monitoring is available |
| Ambient air quality   | NO <sub>x</sub> , SO <sub>x</sub> , PM <sub>10</sub> , PM <sub>2.5</sub> ,                | Plant gate                                      | Continuous  |
| Noise level           | Noise at different locations at day & night   | Around the project site and nearest receptor    | Once in 3 months                                      |
| Surface water quality | TSS, TDS, COD, BOD, pH, Oil & grease, Total Nitrogen, Total Phosphorus and total coliform | At outlet point of drain after the interceptor. | Once in 6 months                                      |

## 7.6 Cost of Monitoring

The following are the cost of monitoring for the environmental parameters during construction and during operation period of the proposed power plant respectively:

**Table 7.4** Cost estimate for environmental monitoring other measures during construction

| Item                | Parameters  | unit cost (Taka) | Unit per year | Total cost per year (Taka) |
|---------------------|---|------------------|---------------|----------------------------|
| Ambient air Quality | SPM, PM10 and PM2.5   | 30000.00         | 12            | 360,000.00                 |
| Groundwater         | Groundwater level, pH, TDS, Ammonia, Nitrate, Phosphate, As, Fe, Mn and Coliforms | 30000.00         | 04            | 120,000.00                 |
| Soil quality        | Cr, Cd, Pb and Oil and Grease   | 30000.00         | 1             | 30,000.00                  |
| Noise level         | Noise at different locations  | 10000.00         | 12            | 120,000.00                 |
|                     | Total Cost  |                  |               | 6,30,000.00                |

**Table 7.5** Cost estimate for environmental monitoring during operational phase

| Item                | Parameter   | unit cost (Taka) | Unit per year | Total cost per year (Taka) |
|---------------------|---|------------------|---------------|----------------------------|
| Stack emissions     | NOx, SO2, PM  | 500000.00        | 01            | 500,000.00                 |
| Ambient air quality | NOx, SO2, PM10, PM2.5,                                | 30000.00         | 04            | 120,000.00                 |
| Effluent quality    | pH, DO, Sulfate, TSS, TDS, BOD, COD, Total N, Total P | 30000.00         | 04            | 120,000.00                 |
| Noise level         | Noise at different locations                          | 10000.00         | 12            | 120,000.00                 |
|                     | Total cost  |                  |               | 9,20,000.00                |

## 7.7 Management Capacity:

The environmental monitoring program should be carried out as an integral 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 Project Director (PD) for this specific project should take the overall responsibility of environmental management and monitoring during the construction period. The PD will form a team with required manpower and expertise to ensure proper environmental monitoring and to take appropriate measures to mitigate any adverse impact and to enhance beneficial impacts, resulting from the project activities. The PD through its team will make sure that the Contractor undertake and implement appropriate measures as stipulated in the contract document, or as directed by the PD 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.

To be an environmentally acceptable industrial unit, the proposed project should have its own environment monitoring unit/cell with trained manpower with necessary equipment and other logistics along with required budget. During the operation period, the project authority should establish their own monitoring team headed by the plant manager. Alternatively, BPPL may hire any local reputed monitoring company to undertake the environmental monitoring as suggested in the EMP of the ESIA report. In such case, the Plant manager will engage one of his Plant Engineer to look after the monitoring activities and keep the records available to view any concerned people or authority when necessary. In all occasions, BPPL authority should ensure that the equipment used for the monitoring services are properly calibrated and internationally accepted monitoring methods are followed to monitor the above parameters.

**Baraka Patenga Power Limited** should develop a working relationship with the Department of Environment (DoE) by undertaking a joint monitoring program per year or they may exchange data and information or submit periodic report of self-monitoring to the DoE or as the situation may require.

## 7.8 SAFETY MITIGATION PLAN

### Safety Management System

Safety is an integral part of the company's work. It is part of the company's operations and there to protect employees, clients, property, the environment and the public. There are many costs to accidents and unsafe work practices. The greatest costs are human cost. Protecting employees also protects their friends, families, fellow workers, management, the public and the environment from the far-reaching effects of serious accidents. In addition to protecting lives, a safety program contributes to employee morale and pride because employees participate in identifying safety needs and developing safe work procedures.

Visitors to the worksite may also face legal action if they knowingly disobey safety rules. In addition, the company may face legal action and fines for violations of regulatory requirements. Those individuals who do not fulfill their safety responsibilities will become accountable for any problems their negligence creates and may be liable under the law.

Everyone employed by a company is responsible for maintaining the safety program. Managers and supervisors are responsible for identifying safety needs, communicating safety hazards, investigating hazardous conditions and accidents, providing training, supply or wearing appropriate safety and personal protective equipment, and ensuring all equipment is properly maintained and meets legislated safety standards. Their role is supported by input from all employees.

All company employees are responsible for obeying all safety rules, following recommended safe work procedures, wearing and using personal protective equipment when required, participating in safety training programs and informing supervisors of any unsafe work conditions. Everyone has the right and responsibility to refuse to do work when unsafe conditions exist. By fulfilling safety responsibilities, workers will share the benefits of a safety place.

The company must have its own safety management and mitigation plan and policy. Listed below are the important features that need proper attention of company management.

### **Company Safety Policy**

The company must have its own safety policy. The safety policy should be updated from time to time. The policy should be signed and dated by the chief safety officer. The policy should be discussed with all personnel. The chief safety officer should periodically review the policy and re-issue the policy.

### **Safety Responsibilities**

All personnel should have safety responsibilities assigned to them. The documented responsibility should be included in the program manual. Compliance with the responsibilities should be monitored and if these are not carried out for some good reason, corrective measures should be taken.

### **Management Communication**

The management should decide how it communicates periodically with the personnel regarding safety. A site schedule for conducting site tasks should be developed; this should be included in the safety program manual. Documentation of site tours should be retained for verification.

### **Inspections**

A list of all work sheets, equipment, vehicles and work practices requiring inspection should be developed. Checklists and schedules should be developed as part of the inspection program. A system for correcting deficiencies noted during the inspection process must be developed. The system should prioritize deficiencies noted so that serious hazards are dealt with immediately.

### **Personnel Protective Equipment (PPE)**

The work site should be assessed to determine what personal protective and safety equipment is needed and the equipment must be available. A maintenance schedule must be developed for PPE and records for maintenance retained on file. Employees must be trained in fitting, care, maintenance and use of PPE.

Detailed rules and procedures identifying company and legislative requirements and expectations must be communicated to all employees and contractors. They serve as a reference and describe the minimum standard by which business is conducted. Most important rules and procedures ensure consistency in the performance of tasks by all employees. The current rules should be reviewed and assessed as to whether they are appropriate for the operation/facility/employees. The formulated rules must be communicated to the workers effectively, and workers must ensure that they understand the rules and have no difficulty to comply with the rules.

## Standard Operating Procedure

The intent of SOP is to ensure consistency in the performance of hazardous work and it must form the minimum standards by which specific tasks are performed. Workers must have clear understanding of the procedures they are required to follow. A system for periodic review of procedures must be developed. The employees involved in the work will be given an opportunity to suggest steps that would provide for continuous improvement to the procedures. The SOP shall also ensure that all hazardous tasks have been accounted for. Procedures and codes of practice have to be developed for hazardous work. To determine compliance with safety and hazard issues while performing a task by a worker, efforts should be made to ensure the following:

- Confirm that employees affected by these tasks participate in the development of safe work procedures,
- Confirm that the employees are involved in the maintenance of safe work procedures,
- Interview workers to determine if they know what tasks have work procedures, where these procedures are located and generally what makes up to content,
- Review records to ensure that employees receive training on hazardous work procedures and codes and practices,
- Where practical, observe employees performing critical tasks to confirm use of standard work procedures and codes of standards.

## Emergency Procedures

Emergency procedures will identify who does what and when in the event of an emergency. Responsibility for who is in charge of the co-ordination of emergency actions shall be identified. The procedures shall be easily referenced, concise and understandable. All employees shall be aware of the content and location of the procedures. The content lists associated with the procedures will be current. The procedures will be updated and tested on a regular basis. The training record and level of training gained by an employee shall be verified so as to ensure his first aid training. Subcontractor employees will also be trained in first aid. The following are the important events that need emergency procedures.

- Fire
- Injury/death
- Leakages and other releases of hazardous substances
- Natural disasters

## Safety Orientation and Training

Initial safety training is one of the most important aspects of any safety program. All employees and contractors must receive some level of basic training, specific to the facility and nature of the job. It must be ensured that appropriate orientation is given to:

- Employees
- Contractors
- Sub-contractors

- Visitors

The orientation shall also include a review of the following:

- Company safety policy and procedures
- Specific job hazards
- Safety precautions
- Job responsibilities
- Regulatory requirements
- Company enforcement policy, and
- Worker right-to-know and authority to refuse unsafe work.

### **Reporting Incidents and Accidents**

All accidents and near-miss incidents shall be investigated to determine what caused the problem and what action is required to prevent a recurrence. Employees required to perform investigations shall be trained in accident investigation techniques. The incident/accident investigation should be a fact-finding exercise rather than faultfinding. The investigations will focus on collection of evidence to find out the “root cause” of the incident. The recommendations of the investigation report are implemented in phases. Power plant construction and operation facilities have been and will continue to be designed to comply with the legal elements of both national and international standards, legislation, codes of practice and design specifications, and best practices. As a part of this process, measures to minimize the probability of releases and reduce potential impacts through selection of alternative processes to be considered as an integral part of the development.

Mitigation should reflect the intent and regulatory framework outlined in the GoB Environmental policy and in applicable World Bank Operational Directives. The purpose of impact mitigation and counter measures is to avoid creating negative impacts wherever possible, to minimize impacts where they may be unavoidable, and to generate opportunities for improvements or positive impacts where appropriate.

### **Protective Equipment**

The main reason for protecting workers is to eliminate or reduce the possibility of injury. The Occupational Health and Safety Act (USA) requires that every worker shall “wear or use such personal protective clothing, equipment or devices and is necessary for his or her protection from the particular hazards to which he or she is exposed”.

There are some people who resist wearing protective clothing or devices, and will only wear protective equipment when forced to do so. This is not the right attitude to take for the worker’s own safety. The consequences of an accident to his quality of life can be major. He can also lose his life. Personal protective equipment provides the worker with a measure of protection, but for it to be really effective; it must be accompanied by the right attitude towards during his job the right way. The wearing of personal protective equipment does not guarantee that he won’t get injured. However, when coupled with a good safety attitude it will reduce the likelihood and severity of accidents

## Body Parts That Require Protection

The body and its internal organs can be seriously injured, by any violent impact with an object. A direct blow to any part of a worker's body, even with protection, can easily result in some injury, either major or minor. The following eight areas or parts of the body require protection: (i) Head, (ii) Arms, (iii) Eyes, (iv) Chest, (v) Hearing, (vi) Legs (vii) Hands and (viii) Feet.

The worker's head houses his brain, which controls all the motor and sensory functions of his body. Any blow to his head, no matter how slight, can be very dangerous and result in injuries ranging from dizziness to total disability and even death. One of our most valuable senses is light. One must protect his eyes from the dangers of flying objects, bright light and chemicals. Without eyes one would live a life in total darkness. Hearing damage is not often a result of an accident, unless someone has had a head injury. A more common problem is hearing loss which can occur one exposed to noise levels above the exposure limits, as outlined in the Noise Regulation. In Table 7.6 Occupational Exposure Limits are described with a maximum permitted duration in the following page. Without hearing protection in a sound level of 100 dBA maximum permitted duration is 1 hour/day.

**Table 7.6: Occupational Exposure Limits (Without hearing protection)**

| Sound level (dBA) | Maximum Permitted Duration (hours per day) |
|-------------------|--|
| 85                | 8  |
| 90                | 4  |
| 95                | 2  |
| 100               | 1  |
| 105               | 2  |
| 110               | 1/4  |
| 115               | 1/8  |
| Greater Than 115  | 0  |

The longer one is expected to high noise levels, the greater the potential hearing loss. Hearing loss associated with exposure to noise tends to be gradual. It may take several years before one can realize that for some reason he has difficulty hearing normal conversation. Hearing is a valuable asset that should be preserved, so the worker can have a full and productive life. In Table 7.7, Safety hazard prevention, control and mitigation measures are described for particular event.

**Table 7.7: Safety Hazard Prevention, Control and Mitigation Measures**

| Event                          | Prevention, Control and Mitigation Measures   |
|--------------------------------|---|
| General Instruction of Workers | <ul style="list-style-type: none"> <li>○ Personal and continuous visual supervision of the worker who is not competent to perform the job.</li> <li>○ Workers to be conversant on the codes and standards of safety.</li> <li>○ Workers must be confident that they have adequate training on handling or unsafe hazards material.</li> </ul> |

| Event                                | Prevention, Control and Mitigation Measures  |
|--------------------------------------|--|
| Maintenance of Equipment             | <ul style="list-style-type: none"> <li>○ Employer shall ensure that all equipment used on a work site is maintained in a condition that will not compromise the health and safety of workers using or transporting the equipment.</li> <li>○ Will perform the function for which it is intended or was designed</li> <li>○ Is of adequate strength for that purpose</li> <li>○ Is free from potential defects.</li> </ul>  |
| Traffic Hazard                       | <ul style="list-style-type: none"> <li>○ Where there is a danger to workers from traffic, an employer shall take appropriate measures to ensure that the workers are protected from traffic hazards.</li> <li>○ Ensure that workers who are on foot and who are exposed to traffic hazards on traveled rural roads wear reflective vests or alternative clothing that is clearly distinguished.</li> <li>○ Where the operator of vehicle does not have a clear view of the path to be traveled on a work site, he shall not proceed until he receives a signal from a designated signaler who has a clear view of the path to be traveled.</li> <li>○</li> </ul> |
| Illumination                         | <ul style="list-style-type: none"> <li>○ Ensure that illumination at a work site is sufficient to enable work to be done safely.</li> <li>○ Where failure of the normal lighting system would endanger workers, the employer shall ensure that emergency lighting is available that will generate sufficient dependable illumination to enable the workers to               <ol style="list-style-type: none"> <li>a) Leave the work site in safety</li> <li>b) Initiate emergency shutdown procedures</li> <li>c) Restore normal lighting</li> </ol> </li> </ul>  |
| House keeping                        | <ul style="list-style-type: none"> <li>○ Ensure that each work site is clean and free from stepping and tripping hazards</li> <li>○ Waste and other debris or material do not accumulate around equipment, endangering workers</li> </ul>  |
| Falling Hazards                      | <ul style="list-style-type: none"> <li>○ Ensure that where it is possible for a worker to fall a vertical distance greater than 3.5 meters the worker is protected from the falling by guard rail around the work area a safety net fall arresting device</li> </ul>   |
| Overhead power Lines                 | <ul style="list-style-type: none"> <li>○ Ensure that no worker approaches and that no equipment is operated and no worker shall approach or operate equipment, within 7 meters of a overhead power line.</li> </ul>  |
| Sanitary facilities & drinking Water | <ul style="list-style-type: none"> <li>○ Ensure that an adequate supply of drinking fluids is available at the work site.</li> <li>○ Ensure that work site is provided with toilet facilities in accordance with the requirement of general health protection guidelines.</li> </ul>   |
| Working proper clothing              | <ul style="list-style-type: none"> <li>○ Ensure that where is a possibility that a worker or worker's clothing might come in to contact with moving parts of machinery, the worker:               <ol style="list-style-type: none"> <li>a. wears close-fitting clothing</li> <li>b. confines or cuts short his head and facial hair</li> <li>c. avoids wearing jewelry or other similar items</li> </ol> </li> </ul>  |
| Head protection                      | <ul style="list-style-type: none"> <li>○ Ensure that during the work process adequate alternative means of protecting the workers head is in place.</li> </ul>   |

| Event                            | Prevention, Control and Mitigation Measures  |
|----------------------------------|--|
| Eye protection                   | <ul style="list-style-type: none"> <li>○ Where there is a danger of injury to or irritation of a worker's eyes, his employer shall ensure that the worker wears property fitting eye protective equipment.</li> </ul>  |
| Foot protection                  | <ul style="list-style-type: none"> <li>○ Where there is a danger of injury to a worker's feet, ensure that the worker wears safety footwear that is appropriate to the nature of the hazard associated with particular activities and conditions.</li> </ul>   |
| Respiratory protective Equipment | <ul style="list-style-type: none"> <li>○ Where the worker is exposed to hazards gases, gums, vapors, or particulates appropriate respiratory protective equipment to be supplied.</li> </ul>   |
| Transportation of water          | <ul style="list-style-type: none"> <li>○ A worker in a vehicle shall not allow any part of his body to produce from the vehicle where this action creates or may create danger to the worker.</li> <li>○ A worker shall ensure that no equipment or materials for which he is responsible is carried in the compartment of a vehicle in which another worker is traveling unless it is so placed and secured as to prevent injury to himself and other workers.</li> </ul> |
| Testing & commissioning          | <ul style="list-style-type: none"> <li>○ Mobilize test rigs at site</li> <li>○ Ensure that the test equipment is in good condition</li> <li>○ Ensure other equipment and facility conforms to the approved specification of test.</li> <li>○ Public notice to be served before testing.</li> </ul>   |

## 7.9 Capacity Building and Training

For proper implementation the EMP, qualified manpower is absolutely essential. There should be a core group of people in the plant who should be well trained on environmental issues but all plant staff should be given basic training on environmental issues. The skills of staff should be upgraded periodically through need based training program.

*Chapter – 8*

*Emergency Response and Disaster  
Management Plan*

## EMERGENCY RESPONSE AND OCCUPATIONAL HEALTH & SAFETY

### 8.1 EMERGENCY RESPONSE

The initial response to an incident is a critical step in the overall emergency response. Like all other Industries and installations, Power generation facilities must have adequate measures against accidents or incidents to meet the emergency. The purpose of having an Emergency Response Plan (ERP) is to:

- Assist personnel in determining the appropriate response to emergencies.
- Provide personnel with established procedures and guidelines.
- Notify the appropriate Company Emergency Response Team personnel and regulatory/ Govt. agencies.
- Manage public and media relations.
- Notify the next-to-kin of accident victims.
- Promote inter-departmental Communications to ensure a “Companywide” Co-ordinated emergency response.
- Minimize the effects that disruptive events can have on company operations by reducing recovery times and costs.
- Respond to immediate requirements to safeguard the subtending environment and community.

Generally, the initial response is guided by three priorities Ranked in importance these priorities are:

1. People
2. Property
3. Environment

Emergency Response Procedures will identify who does what and when in the event of an emergency. Responsibility for who is in charge and their coordination of emergency actions shall be identified. Nature of Emergency & Hazardous Situations may be of any or all of the following categories:

#### I. Emergency

- ❖ Fire,

- ❖ Explosion,
- ❖ Electric shock
- ❖ Medical emergency,

## II. Natural Disasters

- ❖ Flood,
- ❖ Earthquake/ cyclone,
- ❖ Storm/ typhoon/ tornados, and
- ❖ Cloud burst lightning.

## III. External Factors

- ❖ Food poisoning/water poisoning,
- ❖ Sabotage, and
- ❖ War.

### 8.1.1 Six Steps in Emergency Response

#### Step-1)

- a) Determine the potential hazards associated with the incident, substance or circumstances and take appropriate action identify the type and qualities of dangerous goods involved and any known associated hazards.
- b) Determine potential hazards stemming from local conditions such as inclement weather water bodies etc. and ensure that the initial response team is aware of these conditions.

#### Step-2)

Determine the source/cause of the event resulting to the emergency and prevent further losses.

#### Step-3)

Conduct an assessment of the incident site for any further information on hazards or remedies.

**Step-4)**

Initiate redress procedures.

**Step-5)**

Report the incidence its nature cause impact applied redress procedures and any further assistance required etc. to the appropriate company, government and/or land owner.

**Step-6)**

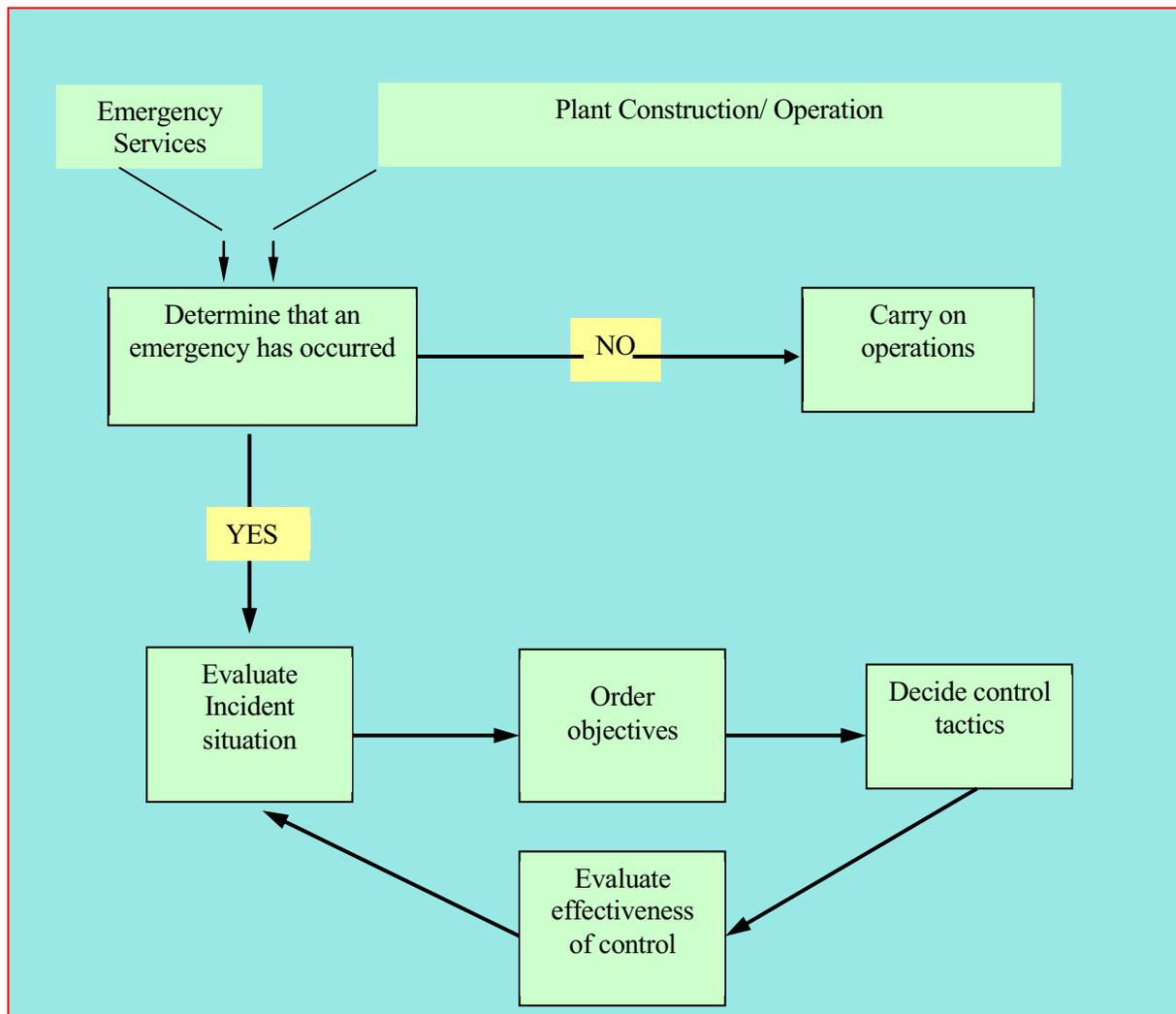
Take appropriate steps with respect to hazards to wildlife, other resources and addressing public and media concerns and issues, as applicable. Response priorities are to protect human lives, property and the environment.

**8.1.2 Reporting Incidents and Accidents**

All accidents and near-miss incidents shall be investigated to determine what caused the problem and what action is required to prevent a recurrence. Employees required to perform investigations shall be trained in accident investigation techniques. The incident/accident investigation should be a fact-finding exercise rather than faultfinding. The investigations will focus on collection of evidence to find out the “root cause” of the incident. The recommendations of the investigation report are implemented in phases.

**8.1.3 Approaches to Emergency Response**

For this project, emergency response systems should be in place to deal with dangerous goods uncontrolled releases of dust and gaseous emission, natural calamities fires burns and injuries. There are to be trained emergency response teams, specific contingency plans and incidence specific equipment packages in place to cope with these types of emergencies. In case of an emergency incident occur, immediate action must be taken to mitigate the impacts. In order to minimize the possibility of injury to the responders and others it is important that emergency responders follow a specific sequence of actions as stepped out in the preceding paragraphs. The overall emergency management will be implemented by the ‘Environment Management and Safety Committee’ under the leadership of Chief Safety Officer who may be the Plant Manager. All plant personnel should have safety responsibilities assigned to them. The documented responsibility should be included in a program manual which can constitute a part of the plants operation manual. Compliance with the responsibilities should be monitored and if these are not carried out for any reason, corrective measures should be taken. The management should decide how it communicates periodically with the plant personnel regarding safety. A site schedule for conducting site tasks should be developed; this should be included in the safety program manual. Documentation of site tours should be retained for verification.



**Figure-8.1:** Illustrates an Example System Approach to Plant Construction & Operations.

## 8.2 DISASTER MANAGEMENT PLAN

In normal operation of the plant, when all environmental protection equipment works according to design specification, then there would be no environmental problems for the present plant.

Disaster (to certain degree) may occur if the environmental protection equipment fails to work at normal condition. This situation may arise for any of the following causes-

- When plant runs at abnormal situation e.g. if emission level increases than its normal level or if the engines give unwanted noise than normal level
- If liquid waste over flows and pollutes the surroundings

Therefore, appropriate management plan should have to be taken by the project proponent to prevent any unwanted disaster in the plant. In this regard, there should be a provision to stop the production immediately during any process failure as discussed above.

The disaster management plan should consist of preventive measures including, among others, the following.

- Formulation and strict implementation of safety codes and measures;
- Periodic inspection of safety relief valves provided with pressure vessels and equipment;
- Preventive maintenance;
- Aware the workers about electric shock
- Declaring the factory a “no smoking zone”
- Mock drills by the fire fighting cells/ groups
- Provision and inspection of firefighting equipment and fire hydrant system in all the sections;
- Proper training of the employees about the importance of codes;
- Training the employees and the residents of the surrounding villages about the actions to be taken during an accident, disaster etc.

It is imperative to develop entire facility environment policy and display necessary documentation for ease in accessing information. Some of these documents include:

- ✓ Emergency contacts;
- ✓ Emergency response procedures for fires

The facilities operations and monitoring are carried out under the management and help from both the employees and relevant government lead agencies. In order to take care of any hazards the following control should be adopted:

- ✚ All safety precautions and provisions covering the general cleanliness of the entire facility down to, ventilation, lighting, sanitary, waste collection, smoke detector, heat detector, sand bucket, water bucket, fire blanket, first aid box provision, adequate fire extinguishers and site security by fencing.

### **8.3 OCCUPATIONAL HEALTH AND SAFETY**

There is always some probability of hazards to the workers in an industrial plant (WB 2011). Workers in a power plant can be exposed to a variety of hazards. Occupational Health and safety aspects of the entire facility should be given due attention. Protective devices as provided should continuously be used within the unit's operations to ensure the safety of the natural resources and boat owners is guaranteed.

The maintenance of Material Safety Data Sheets (MSDS) will be followed to ensure safety all section of the facility that chemicals are utilized.

An Environment, Health and Safety register is essential for monitoring of performance of the entire facility community in relation to the environment. The management will use this as a self-auditing tool. This register should include:

- Fire extinguisher servicing records
- EHS meeting schedules and training records
- Electrical installations
- Generator inspection and maintenance records
- Waste disposal records
- Inventory records (fuels, paints, cleaning agent
- Emergency response procedure.
- Record off all incidents, accidents, near miss etc.

### **8.4 FIRE HAZARD & FIRE EVACUATION PLAN**

Fire hazards such as large quantities of fuel, combustible/flammable liquids, electrical hazards, combustible dusts, and warehousing are common in electric power generating plants. Although fires are not a daily occurrence, they usually will cause severe property damage and business interruption. Sometimes the fire protection equipment systems have not received attention since they were installed. If these systems are needed, however, they are counted upon to perform reliably and protect vital plant equipment from fire. Fire protection systems are a combination of mechanical and electrical components and, like power generation equipment, need regular attention.

In addition, some people in charge of fire protection do not have an adequate knowledge of necessary inspection and testing frequencies, or they use the minimum frequencies prescribed by their authority having jurisdiction. For example, some jurisdictions only

require annual water flow alarm tests on sprinkler systems, a frequency which is considered inadequate by most fire protection professionals.

The information contained in this part is based on the current standards established by the National Fire Protection Association (NFPA); the most widely used in North America, and generally accepted guidelines. Most fire protection systems are designed and installed according to these standards. Unfortunately, information on inspection, testing and maintenance is not contained in a single standard but is contained within the various system-specific standards, making it cumbersome and difficult to obtain an overview of the tasks which need to be accomplished.

Other codes and standards such as UBC, UFC, BOCA, OSHA and MSHA also address fire protection, but their contents are usually based on NFPA documents and may not address testing/maintenance requirements. Members on the NFPA technical committees comprise a wide range of fire protection expertise and include representatives from manufacturers, testing laboratories, users, authorities having jurisdiction and insurance companies. Adherence to NFPA standards will satisfy most jurisdictions and insurance companies.

Suitable fire protection and detection systems shall be provided designed to the requirements of National Fire Protection Association (NFPA) standards. Gas detection systems and alarms shall also be included.

Fire protection shall consist of wet pipe, automatic deluge systems, hydrants, CO<sub>2</sub> gas flooding systems, and portable extinguishers of CO<sub>2</sub> and dry powder in sufficient quantities.

Areas to be covered by fixed protection installations shall be included but not be limited to:

- All oil filled transformers
- Gas engine
- Lub oil system
- Cable areas
- Storage areas.

The gas engines are to be protected against fire by a CO<sub>2</sub> total flood system within the enclosures. The only other significant fire risks are associated with the lube oil systems on the gas engines, cable areas, stores and with oil contained within transformers. Such systems will be protected from fires by water deluge sprays. All necessary systems are

required to be fire 'protected' with suitable extinguishing agents. Additional protections are to be provided by a ring main and hydrant system with hose/equipment cabinets located at strategic points. This ring main shall be provided with suitable section valves located in valve pits.

The firefighting water will be taken from the fire tank and will be pumped by a dedicated electric pump with a diesel powered back-up pump available in case of electrical failure. Pressure in the firefighting mains is maintained using an electric jockey pump.

A site wide fire and gas detection system will be provided to initiate the fire protection and alarms. Manual "break glass" fire alarms shall also be situated at strategic locations around the site and inside the buildings.

A modern electronic fully addressable master fire alarm panel shall be located in the Central Control Room. All local fire panels shall be linked into the master fire alarm panel. This master panel should have a separate section for the gas detection system. A repeater panel should be provided in the site gatehouse to allow swift identification of the affected fire zone to incoming local fire-fighting appliances. This master fire panel shall be provided with its own dedicated battery system.

*Chapter – 9*  
*Alternative Analysis*

## Chapter-9

### ALTERNATIVE ANALYSIS

#### 9.1 THE 'NO BUILD' SCENARIO

From a purely physical environmental point of view, the 'do-nothing' is preferable to any project implementation, since it would avoid creation of any of the adverse impacts associated with the project. However, the potential socio-economic benefits to the nation would be foregone and industrial growth would be hampered.

It is concluded that the 'No build' alternative is unacceptable, and the potential socio-economic benefits of implementation of such project far outweigh the adverse impacts, all of which can be controlled and minimized to an allowable level.

The project will be HFO fired. The power generation cost and environmental consequence of any HFO fired power project is minimum.

#### 9.2 CONSIDERATION OF ALTERNATIVES

##### i. Hydroelectricity:

The country is flat having relatively limited potential for hydroelectricity.

##### ii. Geothermal Plant:

No active geothermal site has been found.

##### iii. Renewable Energy Plant:

Solar and wind energy can be considered as renewable energy but per KWh cost of renewable energy is not cost effective for the end users especially in the country like Bangladesh.

##### iv. Coal-Fired Plant:

The country has about 1700 million tons of bituminous coal, most of which lie buried at depth of over 400-900 meters thus making extraction relatively expensive. However, coal from low-lying structure (Barapukuria) is being dug out for power generation. Coal is less environment friendly as it gives high emission of dust sulfur dioxide and carbon dioxide which lead to the acid rain.

**v. Resettlement :**

Site selection is ideal as it involves no resettlement issues.

**vi. Pollution Control:**

As shown in subsequent sections, environmental pollution during the period of construction and also during the period of operation will be mostly insignificant.

**vii. Connectivity with High transmission line:**

The proposed site is in a fairly close proximity to the 33/132KV Haliashahar Sub-station. So, the project is in a suitable location to get connected with the high tension grid line.

As per Power Purchase Agreement (PPA) signed with Bangladesh Power Development Board (BPDB) the Power Plant need to be connected and deliver its generated electricity through the existing Haliashahar 132/33 kV grid sub-station. So, as per BPDB requirement and contractual obligation the power plant need to be installed at a place from where the plant can be connected with Haliashahar 132/33 kV grid sub-station.

### **9.3 SITE ALTERNATIVES**

After signing the Power Purchase Agreement with BPDB and Implementation Agreement with Power Division, Ministry of Power, Energy and Mineral Resources BPPL conducted a detailed area survey for selecting a suitable site for the 50MW HFO Fired Power Plant from where the plant can be connected to the Haliashahar 132/33 kV grid sub-station. Initially the company looked in the possibility of selecting a site for the project very near to Haliashahar grid sub-station at the shore of Bay-of-Bengal inside the flood protection embankment. After thorough investigation it was found that any such construction is restricted by Bangladesh Navy.

As an alternative option BPPL also considered setting up the plant at West Patenga but this area found falls under the takeoff and landing funnel of the Shah Amanat International Airport.

Finally the selected site was found the most suitable place for installing the power plant. Prior to selecting the site BPPL representatives physically met the concern authority of relevant government entity like Bangladesh Navy, Airport Authority, Chittagong Development Authority (CDA), etc. and found they have no objection with location of the proposed project. Moreover the land was unutilized and very near to port storage area from where HFO can be very comfortably transported to plant. The site is well connected with the wide road which is also very suitable for transportation of project equipment and raw materials.

**Baraka Patenga Power Limited** is located in the Patenga Heavy Industrial Zone. The plant's visual looks are modern and environmentally compatible, the site is environmentally acceptable, the plant construction has started and the IEE checklist has been submitted to DOE earlier for obtaining the Environmental Site Clearance Certificate. So there is no logical need to look into alternative sites.

*Chapter – 10*

*Stakeholder*

*Consultation and*

*Disclosure*

## Chapter-10

### Stakeholder Consultation and Disclosure

Stakeholder consultation is a means of involving all primary and secondary stakeholders in the project's decision-making process in order to address their concerns, improve project design, and give the project legitimacy. Stakeholder consultation, if conducted in a participatory and objective manner, is a means of enhancing project sustainability.

Community input (both of knowledge and values) on socioeconomic and environmental issues can greatly enhance the quality of decision-making. Stakeholder consultation was therefore conducted in the project area not only to satisfy the legal requirements of the EIA process in Bangladesh but also to improve and enhance the social and environmental design of the project.

#### 10.1 Objectives of Stakeholders Consultation

The process of public participation and consultation was endorsed in the United Nations Conference on the Environment and Development (UNCED) in 1992 through one of the key documents of the conference— Agenda 21. Agenda 21 is a comprehensive strategy for global action on sustainable development and deals with issues regarding human interaction with the environment. It emphasizes the role of public participation in environmental decision-making for the achievement of sustainable development.

For projects that have environmental and social impacts, consultation is not a single conversation but a series of opportunities to create understanding about the project among those it will likely affect or interest, and to learn how these external parties view the project and its attendant risks, impacts, opportunities, and mitigation measures. Listening to stakeholder concerns and feedback can be a valuable source of information that can improve project design and outcomes and help a company to identify and control external risks. It can also form the basis for future collaboration and partnerships. For stakeholders, a company's consultation process is an opportunity to get information, as well as to educate company staff about the local context in which a project will take place, to raise issues and concerns, ask questions, and potentially help shape the project by making suggestions for the company to consider and respond to. Through the public consultation process, BPPL hopes to:

- Promote better understanding of the project, its objective, and its likely impact;
- Identify and address concerns of all interested and affected parties of project area;

- Provide a means to identify and resolve issues before plans are finalized and development commences, thus avoiding public anger and resentment and potentially costly delays;
- Encourage transparency and inculcate trust among various stakeholders to promote cooperation and partnership with the communities and local leadership;

## 10.2 Consultation Process

Primary stakeholders were consulted during informal and formal meetings held in the project area. The consultation process was carried out in the Bangla languages. During these meetings a simple, non-technical, description of the project was given, with an overview of the project's likely human and environmental impact. This was followed by an open discussion allowing participants to voice their concerns and opinions. In addition to providing communities with information on the proposed project, their feedback was documented during the primary stakeholder consultation. The issues and suggestions raised were recorded in field notes for analysis, and interpretation.

By reaching out to a wider segment of the population and using various communication tools—such as participatory needs assessment, community consultation meetings, focus group discussions, in-depth interviews, and participatory rural appraisal—EIA involved the community in active decision-making. This process will continue even after this EIA has been submitted, as well as during future EIAs in which similar tools will be used to create consensus among stakeholders on specific environmental and social issues in the context of a proposed project.

Secondary stakeholder consultations were more formal as they involved government representatives and local welfare organizations consulted during face-to-face meetings and through telephonic conversations. They were briefed on the EIA process, the project design, and the potential negative and positive impact of the project on the area's environment and communities.

It was important not to raise community expectations unnecessarily or unrealistically during the stakeholder consultation meetings in order to avoid undue conflict with local leaders or local administrators. The issues recorded in the consultation process were examined, validated, and addressed in the EIA report.

The stakeholders' consultation process will be continued in the operation phase of the plant. One consultation will be held when the plant will start operation and subsequent consultations will be held based on needs or on demand by the stakeholders.

### 10.3 Stakeholder Consultation Technique

In recognition of the diversity of views within any community, it is very important to obtain a clear understanding of the different stakeholders and to analyze their capacity and willingness to be involved in some or all of the project and its planning process. It is important to be aware of how different power relations can distort participation. It is also important to examine how community skills, resources, and 'local knowledge' can be applied to improve project design and implementation. All of this can be achieved by careful use of the various tools of Stakeholder Consultation. Therefore, the following participatory techniques were employed during stakeholder consultations:

- Informal meetings with communities in surrounding areas. Men and local elders attended these meeting.
- Focus Groups with women participants in South Patenga.

### 10.4 Stakeholders Consulted

In the consultation process for EIA, following key stakeholders were consulted:

- Local communities, Men, women and local elders attended meetings.
- Local Government representatives

Meetings with stakeholders consisted of community consultation meetings, focus group discussions, and in-depth interviews with men and limited focus-group discussions with women. The location of the meetings, the process followed, and the outcomes are discussed in this section. The list of the areas where public consultation was carried out is given in *Table 10.1* while the photographs of consultations are included as *Figure 10.1*.

### 10.5 Stakeholder Concerns and Recommendations

The findings of the Community consultations are given in *Table 10.2*. All these have been addressed in various sections of the EIA, and the mitigation plans have been incorporated into the EMP. The summary of the various stakeholder consultations is given below.

## 10.5.1 Community Concerns

### ***Project Approval***

The community consultations demonstrated that goodwill towards the project proponents indeed exists; approval for project activities by the communities was evident. The consultations were *considered* a good gesture and appreciated, especially by the men and women. The poverty level is such that communities are looking to any project proponent to improve their financial well-being to a great extent. BPPL recognizes that benefits from the project should be distributed judiciously and equitably especially among primary stakeholders in the project area, and will continue to ensure that this principle is followed in its projects and community development program.

### ***Resettlement/ Relocation***

The proposed site of 50 MW HFO Fired Power Plant is located at South Patenga, Chittagong near the Shah Amanat International Airport. BPPL purchased the land from the land owners compensating the current value for the lands. Most of the part of the land is vacant low land and the rest of the part is fallow and watery low land. There was no household inside the land. Therefore, resettlement issue is not applicable for the proposed project.

### ***Local Employment***

Communities in the project area emphasized that local people should be given priority when employing people for various project-related works and activities according to their skills.

### ***Compensation***

Compensation for the land has been paid to the landowners. Other compensations shall be paid e.g. trees and any damage to the crop. The compensation process shall be transparent.

### ***Interaction with Local Community***

Non-Local work force coming in the project area that will not be aware of the local customs and norms, may result in conflicts with the local community, keeping in mind the sensitive law and order situation and culture of the area.

### **Impact on Livelihood**

The communities also expressed some fear that construction process would disturb their cattle and that their livestock might get hurt or run away or die accidental death due to construction process.

### **Impact on Accessibility of the Surrounding Households**

The communities also expressed some concerns about the access routes to the main road. Especially the households nearby the access road emphasized about repairing the damaged road. The access road to the proposed project as well as the culvert adjoining should be repaired to avoid any difficulty of the surrounding local people.

### **10.5.2 Local Government Representatives**

The consultations were considered a good gesture and appreciated. They also expressed the jobs and business opportunities for the local community will be increased due to project activities. They also expressed the concern that most of the unskilled and skill jobs should be reserved for the local communities.

**Table 10.1: Stakeholder Consultations Conducted During EIA Study**

#### **a) Local Community:**

| <b>Date</b> | <b>Location</b>   | <b>Name</b>        | <b>Age</b> | <b>Occupation</b>     |
|-------------|-------------------|--------------------|------------|-----------------------|
| 02.02.2013  | Nearby BPPL Plant | Md. Delwar         | 38         | Service Holder        |
|             |                   | Md. Nurul Alam     | 40         | Service Holder        |
|             |                   | Monoara Begum      | 30         | Housewife             |
|             |                   | Md. Biplob         | 40         | Agricultural Labourer |
|             |                   | Sahida             | 20         | Housewife             |
|             |                   | Rumana             | 24         | Housewife             |
|             |                   | Md. Abdul Matin    | 44         | Service Holder        |
|             |                   | Josnara            | 26         | Housewife             |
|             |                   | Mr. Omor Faruk     | 17         | Service Holder        |
|             |                   | Md. Osman          | 22         | Agricultural Labourer |
|             |                   | Md. Minhaz         | 25         | Businessman           |
|             |                   | Md. Shahidul Islam | 30         | Agricultural Labourer |
|             |                   | Md. Atikur Rahman  | 41         | Agricultural Labourer |
|             |                   | Newton             | 28         | Agricultural Labourer |
|             |                   | Md. Josim          | 30         | Service Holder        |
| Ripon Borua | 22                | Businessman        |            |                       |

|             |                 |                 |            |                       |
|-------------|-----------------|-----------------|------------|-----------------------|
|             |                 | Sujon Borua     | 34         | Service Holder        |
|             |                 | Md. Abdullah    | 28         | Businessman           |
|             |                 | Md. Nasiruddin  | 23         | Businessman           |
|             |                 | Md. Abdul Latif | 44         | Service Holder        |
|             |                 | Md. Jasimuddin  | 27         | Service Holder        |
|             |                 | Md. Belal       | 28         | Service Holder        |
|             |                 | Md. Saber       | 29         | Service Holder        |
|             |                 | Kulchuma Khatun | 36         | Businessman           |
|             |                 | Md. Usuf        | 28         | Businessman           |
|             |                 | Md. Absar       | 22         | Service Holder        |
|             |                 | Ali Azam        | 30         | Businessman           |
|             |                 | Hasina          | 50         | Housewife             |
|             |                 | Nargis          | 23         | Housewife             |
|             |                 | Akter Hossain   | 18         | Service Holder        |
|             |                 | Ikram           | 25         | Student               |
|             |                 | Md. Alamgir     | 30         | Shopkeeper            |
| <b>Date</b> | <b>Location</b> | <b>Name</b>     | <b>Age</b> | <b>Occupation</b>     |
| 03.02.2013  | At Nearby Bazar | Shabuddin       | 48         | Agricultural Labourer |
|             |                 | Abdul Matin     | 55         | Businessman           |
|             |                 | Badal Mia       | 32         | Rickshaw Puller       |
|             |                 | Abul Kalam      | 43         | Shopkeeper            |
|             |                 | Sharif Alam     | 46         | Shopkeeper            |
|             |                 | Anwar Hossain   | 23         | Driver                |
|             |                 | Nurul Huda      | 28         | Shopkeeper            |
|             |                 | Md. Sagir       | 20         | Unemployed            |
|             |                 | Kulsum Ara      | 52         | Tea Stall Owner       |
|             |                 | Kamal Uddin     | 22         | Rickshaw Puller       |
|             |                 | Shajahan        | 27         | CNG Driver            |

**b) Local Government:**

| Date       | Location                               | Participants   |
|------------|--|--|
| 07.08.2012 | Civil Aviation Office at South Patenga | Md. Abdullah Al Faruk Station Air Traffic Officer  |
|            |  | Shah Amanat International Airport<br>Shaikh Shahjahan Alam Meteorologist<br>Bangladesh Meteorological Department,<br>Ministry of Defence |

**Table 10.2:** Concerns Raised by the Communities during Stakeholder Consultations

| <b>Issues</b>           | <b>Concern Raised by the Community</b>                                | <b>Communities' Remarks</b>  |
|-------------------------|---|--|
| Employment              | Provision of semi-skilled and unskilled jobs for the local labor      | Maximum unskilled jobs should be allocated to the locals.  |
| Livelihood              | Restriction of livestock grazing and accidental killings of livestock | Grazing and vegetation areas should be protected and speed of vehicles should be limited to avoid accidents                            |
| Access to the household | Difficulty to access to the households from the main road             | The access road should be repaired by BPPL or initiative need to be taken in repairing the access road after completion of the project |

Figure 10.1: Photographs of Public Consultations during Field Visit



Consultation nearby BPPL



Consultation nearby BPPL



Consultation nearby BPPL



Consultation nearby BPPL



Consultation at nearby Bazar



Consultation at nearby Bazar

**Figure 10.2:** Photographs of Consultations with Government Officers



Consultation at Civil Aviation with Md. Abdullah Al Faruk,  
Station Air Traffic Officer (SATO), Shah Amanat International Airport



Consultation at Civil Aviation with Shaikh Shahjahan Alam  
Meteorologist, Bangladesh Meteorological Department, Ministry of Defence

## **10.6 Disclosure**

The EIA report will be published in the Company's website and a copy will be kept at the plant for public review. The executive summary will be translated into Bangla and will be made available to the public. This action will meet the requirements WB's OP 4.01.

*Chapter – 11*

*Grievance Redress  
Mechanism and  
Disclosure*

## Chapter-11

### 11.0: Grievance Redress Mechanism and Disclosure

#### 11.1 Grievance Redress Mechanism

Public participation, consultation and information disclosure undertaken as part of the local EIA process have discussed and addressed major community environmental concerns. Continued public participation and consultation has been emphasized as a key component of successful project implementation. As a result of this public participation during the initial stages of the project, major issues of grievance are not expected. During the operational phase of the project, the complaints that may be anticipated are mostly related to noise & vibration of the engines. However, unforeseen issues may occur. To settle such issues effectively, an effective and transparent channel for lodging complaints and grievances will be established. The grievance redress mechanism should be scaled to the risks and adverse impacts of the project. It should address affected people's concerns and complaints promptly, using an understandable and transparent process. It should also be readily accessible to all sections of the community at no cost and without retribution.

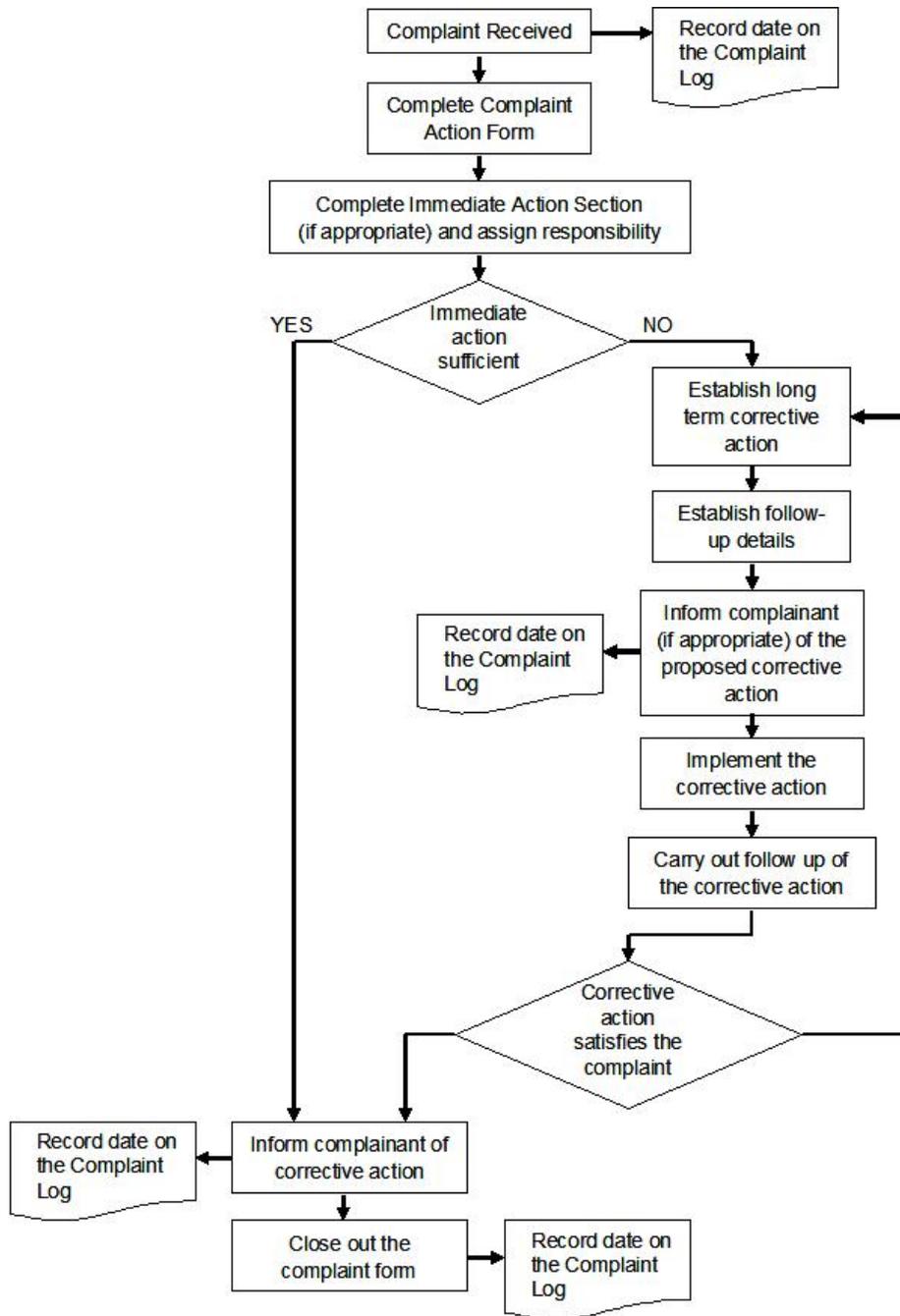
The Grievance Mechanism will be implemented during both the construction and operational period of the project to ensure that all complaints from local communities are dealt with appropriately, with corrective actions being implemented, and the complainant being informed of the outcome. It will be applied to all complaints from affected parties.

The mechanism will be accessible to diverse members of the community, including more vulnerable groups such as women and youth. Multiple means of using this mechanism, including face-to-face meetings, written complaints, telephone conversations should be available. Confidentiality and privacy for complainants should be honored where this is seen as necessary or important.

A grievance redress mechanism and procedures is setup to provide opportunity for project affected persons to settle their complaints and grievances amicably. The established grievances redress procedures and mechanism ensures that project affected persons are provided with the appropriate compensations and that all administrative measures are in line with the law. It also allows project affected persons not to lose time and resources from going through lengthy administrative and legal procedures. Grievances are first preferred to be settled amicably.

BPPL shall set-up a grievance redress committee that will address any complaints during both the construction and operational period of the project.

Figure 11.1 - Flowchart of Complaints/Grievance Procedure:



The representation in the committee makes project affected persons to have trust and build confidence in the system. The grievance redress committee reports its plan and activities to the Implementation committee. The following list presents members of the committee.

Table 11.1: Members of the Committee of Grievance Redress (GRC)

| <b>No.</b> | <b>List of Member Organizations</b>   | <b>Responsibility</b>              |
|------------|---|------------------------------------|
| 1          | Saleh Ahmed Chowdhury<br>Ex Commissioner<br>Ward# 31, Chittagong City Corporation | Chair Person                       |
| 2          | Nasirul Islam Chowdhury<br>Sr. Assistant Manager<br>BEDL                          | Executive Member                   |
| 3          | Kabir Hossain<br>Project Manager<br>BPPL  | Executive Member                   |
| 4          | Badal Debnath<br>Maintenance Engineer (Mech)<br>BPPL                              | Member                             |
| 5          | Shahabuddin Chowdhury<br>Local Businessman  | Member<br>(Representative of PAPs) |
| 6          | Ayub Rana<br>Local Businessman  | Member<br>(Representative of PAPs) |

GRC will maintain a Complaints Database, which will contain all the information on complaints or grievances received from the communities or other stakeholders. This would include: the type of complaint, location, time, actions to address these complaints, and final outcome.

The procedures to be followed and adopted by the grievance redress should be transparent and simple to understand or uniform process for registering complaints provide project affected persons with free access to the procedures. The response time between activating the procedure and reaching a resolution should be as short as possible. An effective monitoring system will inform project management about the frequency and nature of grievances. GRC will arrange half yearly meetings where the activities and the outcomes/measures taken according to the Complaints Database are to be monitored and reviewed by third party consultant to ensure the required transparency. In addition to the above, if there are any grievances related to environmental management issues in the project area, the GRC will record these grievances and suggestions and pass it on to the relevant consultant for necessary action and follow-up.

In case a dispute is not resolved by arbitrational tribunal, then if any of the Party disagrees, the aggrieved party has the right to appeal to the ordinary courts of law. However, the preferred option of dispute settlement ought to be the option of settling the dispute amicably because recourse to courts may take a very long time even years before a final decision is made and therefore, should not be the preferred option for both parties concerned.

A grievance form is presented below and hard copies of both English and Bangla will be made available at the BPPL project office.

| Table 11.2 : Sample Grievance Reporting Form  |  |       |  |
|---|--|-------|--|
| Contact Details   | Name:  |       |  |
|   | Address:   |       |  |
|   | Telephone Number/ Cell Phone Number:                                       |       |  |
|   | Email:   |       |  |
| How would you prefer to be contacted<br>(please tick box)   | <input type="checkbox"/> By Phone<br><br><input type="checkbox"/> By Email |       |  |
| Details of your Grievance<br><br>(Please describe the problems, how it happened, when , where, and how many times, as relevant) |  |       |  |
| What is your suggested resolution for the grievance?  |  |       |  |
| Signature:  |  | Date: |  |

## **11.2 Disclosure**

The draft EIA report has already been loaded on the Company website ([www.bedlbd.com/](http://www.bedlbd.com/)) and a copy is kept at the plant for public review. Once the final version is ready, it will replace the draft version on the website. The executive summary will be translated into Bangla and will be made available to the public.

*Chapter – 12*  
*Conclusions*  
*&*  
*Recommendations*

## CONCLUSION AND RECOMMENDATIONS

### 12.0 CONCLUSIONS AND RECOMMENDATIONS

#### 12.1 Conclusions

The present EIA report finds that though there are certain adverse environmental impacts associated with the industrial unit under consideration, these are manageable provided recommendations in the EMP are followed with due diligence.

The project is indispensable in view of the current energy shortage scenario in Bangladesh. The impact on the social environment is positive given the job and business opportunities created for local residents from the project. The project will help in the industrialization, accelerating socioeconomic growth, and improving quality of life. One of the most critical issues for the project is safety. This has been adequately addressed through compliance with national building code (BNBC) in the construction to ensure safety during natural disasters like earthquake and cyclone and a full-containment for the HFO storage tank.

The project has been designed to comply with the country's environmental laws and regulations, especially on air emissions, ambient air quality, wastewater effluent, and noise. The project management has taken steps to ensure that the plant meets the World Bank's environmental standards. To mitigate the impact of the use of high sulfur HFO in the plant, a FDG is being installed to reduce sulfur-di-oxide emission by 90%. Given the management measures and monitoring commitments by the BPPL for the project, environmental impact of the project will be manageable.

Given the proponent's commitments, actions undertaken for further measures to be adopted in due course of time as required, the Baraka Patenga Power Plant is going to be a nationally important and environmentally sustainable industrial venture.

#### 12.2 Recommendations

In order to manage the potential adverse environmental impacts, especially in the operational phase of the plant, the recommendations provided in the EMP should be followed with due diligence. Some of important actions required are:

1. Activation of Environmental Monitoring Committee, holding of its regular meeting and preparation of the monitoring report.

2. Activation of Emergency Management and Safety Committee and holding of its regular meeting.
3. Training of staff on EMP related issues.
4. Activation of the Grievance Redress Committee and prompt response to public complaints.
5. Development of an Environment Management System (EMS) for the plant and preparation of SOPs on specific issues.
6. Allocation of adequate resources in the yearly budget for implementation of EMP.
7. Conducting a post construction environmental study to evaluate the environmental impacts from the project and compare those with the EIA.

However, most important issue is the commitment for the implementation of the actions required under the EMP by the management.

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