AECOM Environment

Submitted to:

Orion Power Unit-2 Dhaka Limited

Orion House
153 – 154 Tejgaon Industrial Area
Dhaka - 1208
Bangladesh

Submitted by:

AECOM India Private Limited

5th Floor, Building 10-B
DLF Cybercity, DLF Phase II
Gurgaon - 122002
India

Volume IV- Environment and Social Management Plan and Categorization (Chapter 12-18)

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Environmental Impact Assessment Study

635 MW Coal based Thermal Power Plant, Munshiganj District, Bangladesh

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12.1 Introduction

OPDL-2 needs to incorporate an interactive process of management and monitoring environment, social, health and safety into all its activities during the construction and operation of the proposed Thermal Power Project. The Environment and Social Management and Monitoring Plan (ESMMP) intend to delineate management measures to minimize such impacts by allocating management responsibility for implementation of these measures during construction and operation phase.
The ESMMP is formulated to mitigate the adverse environmental and social impacts that have been delineated and quantified through the EIA process and presented in the previous sections. The ESMMP is aimed at managing and monitoring the environmental parameters in a sustainable manner. The ESMMP section is organized as follows:

- **Implementation Arrangements**- This subsection describes the process of implementation pertaining to activities both at construction and operation phase;
- **HSE organizational structure**– This subsection describes the role and responsibilities of personnel belonging to OPDL-2 and contractors who will be responsible for implementing this ESMMP.
- **Environmental Management Plan** – This Plan consists of a detailed description of the positive and negative environmental impacts anticipated from the proposed project, mitigation measures and the persons/ parties responsible for ensuring implementation of the mitigation measures. Additional plans such as Construction Labour Management Plan, Waste Management Plan, Pesticide Management Plan, Emergency Preparedness and Response Plan, Health and Safety Plan and Livelihood Restoration Plan have also been provided.
- **Environment and Social Monitoring Plan** – The Environment and Social Monitoring Plan details the locations, parameters and frequency of environmental monitoring, and the minimum requirements for testing and analysis of environmental parameters.
- **ESMMP implementation review process** – This subsection describes the requirements for periodic review and updation of the ESMMP to address any new impacts due to change or modification of the project.
- **Documentation and record-keeping** – Specifies the requirements for documents to be maintained for HSE aspects.
- **Budgetary allocation for ESMMP implementation** – Provides the details of budget allocation for the various mitigation measures proposed for the Project.

12.2 Implementation Arrangements

OPDL-2 proposes to enter into an EPC arrangement with the contractor responsible for providing Engineering, Procurement, and Construction & Commissioning of proposed 635 MW power project. The contractor will take responsibility for the construction site to confirm contractual aspects and applicable environmental standards. The entire workforce required during construction phase will be employed through EPC contractor. The facilities and other components of construction phase will

be directly implemented by the contractors while overall management and responsibility will lie with OPDL-2.

The civil work would involve the following activities:

- Site clearance and levelling works along with development of material storage yards;
- Land survey and geotechnical investigation;
- Component delivery- construction of access roads, foundations, erection of boiler units;
- Installation of plant structures such as boilers, generators, turbines, storage tanks, welding/cutting; and
- Installation of heavy machinery, pumps and mechanical and electrical installations

OPDL-2 will also enter into an Operations and Maintenance (O&M) Agreement with another contractor for operation and maintenance of the Project for 25 years. OPDL-2 will only have a supervisory /management role during the operation phase.

12.3 HSE Management Organization Structure

OPDL-2 has formulated a Health, Safety, Environment and Quality Policy (HSEQ) Statement and Safety Policy Statement. OPDL-2 strives to provide adequate mechanism to mitigate safety risks arising from the work activities. OPDL-2 aims at ensuring that all its operations comply with applicable health, safety and environmental laws, regulations and other requirements. OPDL-2 endeavours for continual improvement and the adoption of international codes and standards.

OPDL-2 has established the structure of Head Office Team and Coal Site Team for operations of Power Plant. The structure of Head Office Team comprises of Chairman, Managing Director and Director of Power & Energy at top level. Going down in hierarchy, all Vice Presidents of Departments pertaining to mechanical, electrical, civil planning and scheduling, supply chain management and Site -
In-Charge are headed by Director (Power & Energy). All VPs in each respective department are followed by Senior Engineer and Engineer. To provide support services, Manager of Admin and Human Resource department has also been appointed. Deputy Manager of Accounts, Finance, Logistics and Legal are also present in the structure being formulated.

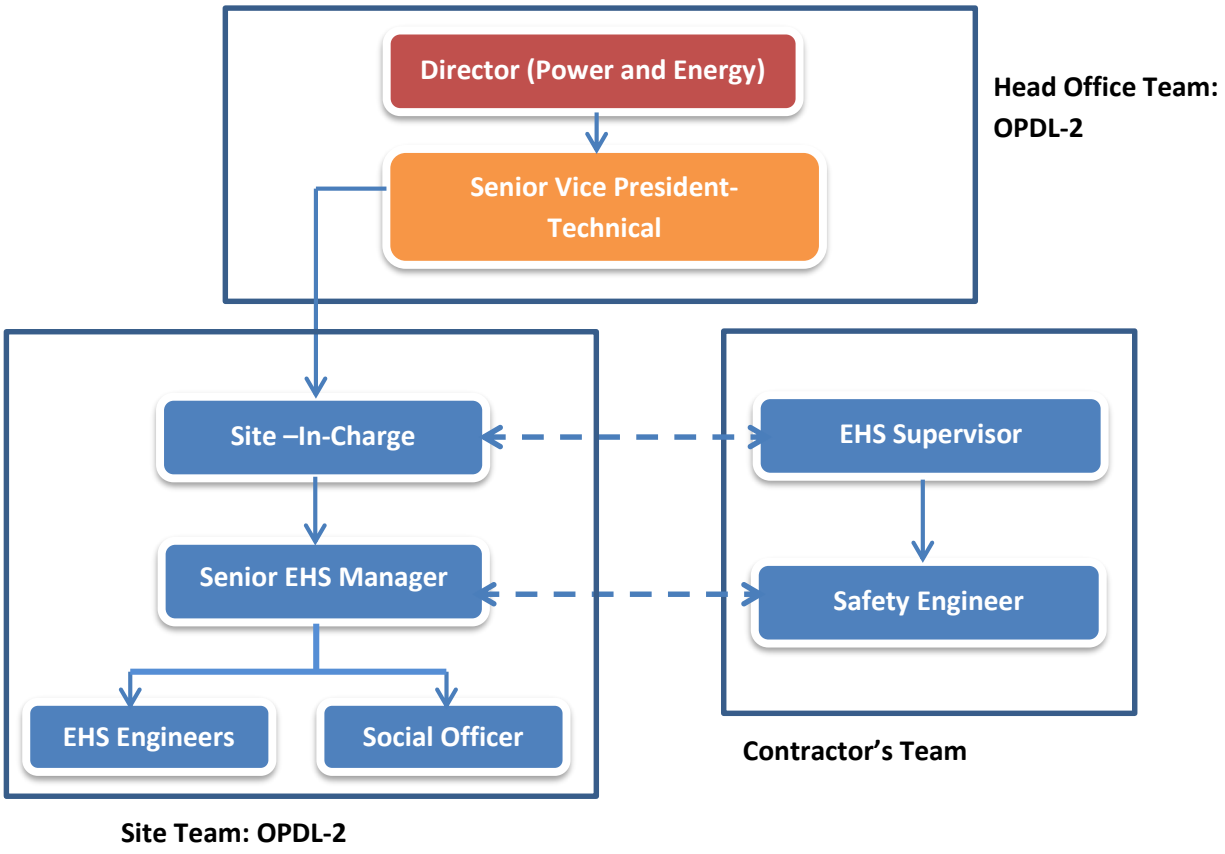
The structure for Coal site team comprises of a Site –In- Charge followed by Senior Managers of different departments like Civil, Commissioning etc. Deputy Managers are headed by Senior Managers of their respective departments. A Senior Engineer is present in each department who will be headed by respective Deputy Manager. A Senior EHS Manager and Senior Quality Manager also form the part of the structure of coal site team. Both the Senior Managers are followed by three Engineers (A, B and C) under them.

A significant portion of the project activities will be undertaken by contractors. It is to be ensured by OPDL-2 that the contractual documentation emphasizes the need to comply with all HSE legal requirements and the Environment and Social Management and Monitoring Plan (ESMMP). OPDL-2, either directly or through its contractors, will arrange for periodic training of the project crew on legal requirements and ESMMP. OPDL-2 will also undertake regular inspections of the installation

works and camp sites to ensure compliance to legal requirements and the provisions of ESMMP and document them.

The overall management of the project will be undertaken through coordination between Head Office Team and Coal Site Team of OPDL-2. The activities will be managed through Site –In- Charge who will be supported by the Senior EHS Manager and EHS Engineers. The Senior EHS Manager Will overview, monitor and control the activities of Site-In-Charge at the site. The Site-In-Charge will coordinate with Senior Vice President and Director (Power & Energy) of Head Office Team regarding the operations of the project. The site team is composed of Senior EHS Manager and EHS Engineers, who will regularly interact with the contractor's HSE team. The contractor will be required to have an EHS Supervisor followed by Safety Engineers in their team.

Figure 12-1: Proposed Organization Structure



The HSE team will have the following responsibilities:

- Ensure effective implementation of the Environmental and Social Management and Monitoring Plan (ESMMP) through review and periodic updation;
- Ensure compliance with legal requirements and strive to incorporate the best international industry practices;
- Ensure availability of resources and institutional arrangements for the above;
- Impart regular trainings and awareness program to the project crew in a planned manner; and
- Undertake periodic inspections of activities, with special focus on contractors.

Site –In-Charge

Site-In-Charge will look after day to day activities related to the construction at site. He will report to the Senior Vice President of Head Office Team. His primary duties will include:

- Act as the primary interface between the corporate staff and all the contractors working at site.
- Collect, review, and disseminate information regarding all activities at site.
- Process and prepare a summary on weekly basis from feedback, complaints and comments received from other team members.

Senior EHS Manager

- Dissemination of information about the aspects of environment, health and safety as per IFC guidelines applicable to the project to labour and contractors;
- Responsible for implementation of safety measures at labour camps and throughout construction site;
- Organise capacity building workshops and training programs for the construction labour such as mock drills, emergency evacuation procedures;
- Work in association with Safety Officer for addressing issues related to working environment and safety of the labours.
- Periodically review the EHS performance of the project during construction phase.

EHS Engineer

EHS Engineer will report to the Senior EHS Manager and will be responsible for handling the safety aspects of the site. He will work in close conjunction with the contractor. His key responsibilities will be;

- Carry out regular safety audits and inspections of the site and labour camps;
- Check implementation of security, fire, first aid and safety facilities and procedures at campsites and construction work areas;
- Check and ensure that all agreed safety standards and applicable safety regulations are observed and adhered to;
- Prepare periodic reports on the health and safety status;
- Report to the Senior EHS Manager on daily basis concerning the health and safety issues of the labours.

Social Officer

- He will be responsible for overhauling the implementation of CSR activities;
- Review the performance of contractors with respect to the adherence of contractual provisions pertaining to labour hiring and management;
- The person will be responsible for implementation of proposed CSR activities at the ground Level; and
- Liaison with local community for addressing their concerns pertaining to the project

12.4 Proposed Environment and Social Management Plan

The environment and social management plan (ESMP) covering various aspects during construction and operation phases, is provided in *Table 12-1* and *Table 12-2*.

Table 12-1: Environmental Management Plan during Pre-construction and construction Phase

S.No	Activity	Potential Impact	Management / Mitigation Measures	Responsibility
Pre-Construction and Construction Phase				
1.	Land Use	• Change of Land use • Loss of Income • Issues pertaining to compensation	• Maintain more than 30% of the area under green cover to offset some adverse impact of land use change and merge with the surrounding rural settings; • General facilities for staff, workers and construction labour shall be made available within the Project premises • Provision of spaces within the site for setting up of shops for daily requirements and engage local community for running the same.	• OPDL-2's Site Team
2.	Natural Resources	• Dredging of River • Change in Drainage Pattern • Impairing of localized landscape	• Restoration of land surface contours in relation to the surroundings followed by developing drains and providing adequate slopes across the project site prior to start of construction work thereby ensuring adequate cross drainage for quick evacuation of catchment water; • Utilization of all excavated soil and dredged material for filling up the low lying areas; • Testing of dredged material for its chemical characteristics to avoid contamination of land and surface water. • Construction of diversion dykes to channel runoff to avoid flowing of surface runoff into tidal channels and adjoining rivers. • Restoring the topography and drainage of all areas affected by the establishment of power plant or other areas under the direct control of construction contractor immediately after the construction activity culminates; • Ensure construction footprint is well defined and construction work is carried out within the Project footprints only; • Ensure adequate cross drainage is provided along the proposed access roads to prevent localized flooding.	• OPDL-2's Site Team in association with Contractor's HSE team
3.	Site Preparation	• Generation of loose soil; • Loss of significant amount of soil during monsoons	• Site backfilling, grading and excavation for foundation to be undertaken mainly during dry season; • Ensure stacking of excavated soil material in an area earmarked within the project site. Every care shall be taken to prevent soil erosion; • Ensure retention wall or bund is provided around the storage areas for excavated	• OPDL-2's Site Team • Civil Contractor

			soil and other construction material to prevent the flow of construction material along with storm water in case of rains; • Attempts shall be made to use the excavated soil for filling low lying areas at the site in order to raise the site level as planned; • Ensure proper fencing of Project site and restricting project activities including receipt and storage of construction material, within the Project footprint area; • No piling of construction material to be permitted outside project site boundary; • Ensure proper routing and adequate capacity of the storm water run-offs. The drains shall be provided with catch pits; • Completed earthworks to be sealed and/or re-vegetated as soon as reasonably practicable with the help of landscape expert; • Using impervious surfaces for vehicle and machinery refueling areas and other fluid transfer areas; • Training workers on the correct method of transfer and handling of fuels and chemicals and response to spills.	
4.	Soil contamination	• Land pollution; • Contamination of dredged material from heavy metals	• Ensure storage facilities are designed within paved surface, provided with covered shed and adequate secondary containment facility at the construction site to prevent contamination of soil or water bodies due to accidental spills of machine oil, lubricating oil, fuel oil, paints, thinner, varnishes, chemicals, used oil and grease; • Provide portable spill containment and clean-up equipment on site. Training shall be provided to workers deployed for handling the equipment; • Assess contents of hazardous materials and petroleum-based products in building systems (e.g. PCB containing electrical equipment, asbestos-containing building materials) and process equipment and ensure proper waste management. Decontamination and proper management of contaminated building materials shall also be ensured. • Dredged material used for filling low lying areas shall be tested for its chemical characteristic and pollution potential prior to use.	• OPDL-2's Site Team • Contractor's HSE Supervisor
5.	Handling, Storage and	• Contamination of River and soil;	• Workers to be strictly instructed about random disposal of any waste (hazardous or non-hazardous) generated from the construction activity;	• OPDL-2's Site Team

	Disposal of Wastes	• Prevalence of Unhygienic Conditions	• Ensure storage facilities at the construction site are designed with adequate secondary containment facility to prevent contamination of soil due to potential spills of lubricating oil, fuel oil, waste oil and chemicals; • Ensure suitable fire protection system is available onsite before start of construction activities. Fire protection system to be designed to suppress any fires that might occur from spillage or storage of flammable substances; • Establish waste management priorities based on an understanding of potential Environmental, Health, and Safety (EHS) risks. Establish a waste management hierarchy that considers prevention, reduction, reuse, recovery, recycling, removal and final disposal of wastes. Avoid or minimize generation of waste materials as far as practicable; • Solid wastes to be segregated into biodegradable and non-biodegradable contents in separate labelled containers provided at site. All biodegradable wastes from labour camp kitchen to be collected for secondary use such as animal feed or for vermi-composting. Other biodegradable wastes to be collected and disposed of in humus pits generated onsite for subsequent use as manure. OPDL-2 will ensure that no open burning of solid waste will be resorted to at site and surrounding areas; • Construction wastes from site, wharf, road corridors such as metal cuttings, debris, plastic packing material, wooden logs etc. to be segregated and kept in specially identified waste bins. All metal scrap shall be sold to recyclers while concrete waste/debris and other inert materials that cannot be recycled shall be crushed and reused for level raising onsite or for road/pavement development within the site; and • Ensure hazardous wastes including used oil, waste oil, oil soaked cotton and residues containing oil or other hazardous substances are stored at a designated paved area onsite for disposal through authorized vendors/ recyclers in Bangladesh. The hazardous storage area shall have restricted access and properly labelled.	• Contractor's HSE Supervisor
6.	Water Resources	• Usage of River Water	• Provide rainwater harvesting system prior to onset of monsoon for effective recharge of groundwater during rainy season.	• OPDL-2's Site Team

			• Proper storage and internal water supply facilities to be developed before undertaking construction activities; • Ensure optimal use of water by the Project construction labour through awareness training and frequent monitoring; and • Location for diversion of water from Meghna River for construction purposes shall be identified in order to avoid any conflict with existing users in the area.	• Contractor's HSE Supervisor
7.	Water Quality	• Contamination of surface and groundwater; • excavated soil along with surface drainage;	• To minimize adverse impacts due to escape/discharge of untreated sewage outside the project site, adequate number of toilets (at least 10 toilets per 100 labour) with septic tanks and soak pit arrangements to be provided onsite for disposal of sewage as per the design specified for area with high water level. • Random disposal of wastewater by workers in the labour colony to be strictly restricted. The Project is to ensure adequate drains and collection sumps for recharge of water from bathing system at the labour colony. • Provision of potable drinking water shall be ensured for the labour engaged for the Project. Use of disinfectants (chlorine tablets or sodium hypochlorite dozing) in drinking water bulk storage tanks onsite shall be ensured to render water fit for drinking. Installation of reverse osmosis cum ultraviolet water treatment system may be considered for rendering water fit for drinking purposes; • Provide bund around excavated soil or loose construction material to prevent runoff to nearby water bodies; • Keep storage area away from the storm water drain/water bodies to prevent any wash away into water bodies outside the facility; • All the debris resulting from construction activities to be removed from the site on regular basis to prevent their runoff. • Segregation and pre-treatment of oil and grease containing effluents from workshop (e.g. use of a grease trap) prior to discharge into water bodies; • Hazardous wastes and chemicals to be stored on paved surfaces with secondary containment to prevent potential contamination of groundwater; • Sludge from Septic tanks to be disposed in compliance with local regulatory requirements.	• OPDL-2's Site Team-Senior EHS Manager • Contractor's HSE Supervisor
8.	Ambient Air	• Fugitive dust	• Suppression of fugitive dust emissions through following measures:	• OPDL-2's Site

	Quality	emissions; • Emissions from onsite operation of diesel generators	○ Spraying water in the construction area ○ Wetting of the stockpile at project site ○ Proper location of material stockpiles, especially sand and soil downwind from the habitations ○ Screening of or providing wind breaks for stockpiles • Covering soil and materials with tarpaulin sheets during transportation to the site; • Use of low-emission vehicles and wherever feasible, use of construction equipment that runs on electric power; • Power supply for construction will be sourced from the grid supply therefore use of diesel generators (DG) is expected to be limited; • Ensure that diesel generators meant for emergency power are optimally operated and regularly maintained so as to ensure that emissions from fuel combustion remain at design levels. Also ensure provision of appropriate stack height in the DG sets; Avoid dust generating activities in conditions of high wind (particularly during summer season) and tarpaulin covers will be provided for loose construction material at construction site; • Restrict vehicle movement within site to a speed less than 20 km/hour at site to minimize potential for dust generation in the surroundings; • Ensure that vessels are covered by tarpaulin sheets during off site transportation of friable construction materials and spoil; • Undertake periodic maintenance of construction equipment to minimize smoke in the exhaust emissions; • Ensure machinery is turned off when not in use; • Housekeeping of the area to be maintained by deputing sweepers to remove dirt/debris from the site on daily basis; • Paint, polishes, building fittings and flooring material etc. will be procured carefully to minimize emission of VOCs; and • Regardless of the size or type of vessel, fleet owners /operators to implement the manufacturer recommended engine maintenance programs.	Team-Senior EHS Manager • Contractor's HSE Supervisor
9.	Ambient Noise	• Generation of high	• Avoid loud and sudden noises, wherever possible. Fixed noise sources to be	• OPDL-2's Site

	Quality	noise levels	located away - more than 50 m away from site boundary wherever possible; • Provide acoustic enclosures and noise barriers in areas of high noise generating sources; • Provision of rubber paddings/noise isolators at equipment/machinery used for construction; • Integral noise shielding to be used where practicable and fixed noise sources to be acoustically treated with silencers, acoustic louvers or enclosures; • Mobile noise sources such as cranes, earth moving equipment and heavy goods vehicles (HGVs) to be routed in such a way that there is minimum disturbance to receptors; • Construction workers shall be mandated to use ear muffs in areas with potential for high noise generation; • Use of inherently quiet plant equipment as far as reasonably practicable and regular maintenance to ensure noise emissions are maintained at design levels; • All diesel generators to be installed in conformance with acoustic enclosure to achieve the 75 dB(A) level at 1 m from its enclosure; • Major construction works to be limited to daylight working hours to avoid noise exposure during night time; • Noise prone activities, including movement of vehicles, need to be restricted to the extent possible during night particularly during 2200 to 0600 hours to reduce the noise impact. There is also requirement of providing make shift noise barriers surrounding the high noise generating construction equipment; • Breaking of surfaces, if any, to be done using the lightest possible weight of breaker capable of doing the job without extending its duration; • Construction machinery and vehicles to be well maintained and idling of equipment or vehicles when not in use to be avoided; • Plan construction activities in consultation with local communities to minimize disturbance.	Team-Senior EHS Manager • Contractor's HSE Supervisor
10.	Traffic and Transport	• Increased road traffic; • Affect the	• Close consultation with community when unloading of construction machinery and material which is likely to obstruct ferry movement for requirement of local community;	• OPDL-2's Site Team-Senior EHS Manager, EHS

		movement of passenger ferries; • Possible accidents and capsizing of boats/vessels; and • Spill and leaks from poorly maintained boats /vessels	• Providing dedicated location along the site for exclusive loading and unloading of the construction vessels; • Necessary training to the ferry operators of construction vessels to ensure safe operations; • Developing Code of Practice for construction which will include management of traffic for construction phase; • All vessels engaged for transportation of construction materials shall be maintained at regular intervals to prevent leaks; • Explore the possibility of transporting construction machinery and material after daytime (or peak hours) to avoid discomfort to local community.	Engineers • Contractor's HSE Team
11.	Ecology	• Contamination to adjoining water bodies; • Increase in turbidity of water bodies Dredging of River will result to:	• Follow up of measures to control silt/sediments during construction phase and ensure that no contaminants or loose soil is disposed into nearby water bodies. • Minimum levels of noise during construction activities to be maintained to avoid discomfort to local avifauna; • Movement of labour to be restricted to the project footprint area only; • The construction contractors will ensure that fuel for resident workers are procured from legal sources and provided free of cost.	• OPDL-2's Site Team-Senior EHS Manager, EHS Engineers • Contractor's HSE Team
12.	Dredging of River	• Substrate removal; • Alteration of the bottom topography and hydrography; • Alteration of the sediment composition; • Re-suspension of sediments; • Increase of turbidity	• Dredging activities are undertaken frequently in the Meghna River; predominantly for filling of low lying land for setting up industries along the banks and for maintenance of navigation channel. • To minimize the localised turbidity (suspended sediment) generated by dredging activities, siltation control curtains will be used. Temporary silt curtains will also be deployed around work areas as required for additional protection. • Deployment of turbidity barriers around the dredging area where currents are less than 1.5 knots to prevent any movement of suspended sediments. • Dredging operations to be controlled and restricted to designated dredging sites to minimise sediment suspension.	• OPDL-2's Site Team-Senior EHS Manager, EHS Engineers • Contractor's HSE Team
13.	Occupational	• Potential electrical	• The construction staff and contractors involved in the construction activities to be	• OPDL-2's Site

	Health and Safety	hazards; • Safety hazards; • physical injury; • road accidents; • Other occupational hazards	trained about the mandatory precautions and safety practices prior to commencement of construction activity; • Construction contractors are required to ensure necessary safety measures to be taken up before and during the construction activities for all electrical driven machinery; • Usage of high speed diesel needs to be provided with proper storage in covered area, away from welding or other construction activities. Flameproof electrical connection to be provided in and near the HSD storage; • All required Personal Protection Equipment to be used by the workers at site and their use to be supervised; • Safety harness to be ensured for workers while working at heights; • Vehicle movements to follow the traffic norms and maintain a safe speed while moving through the hilly tracts; • All excavation activities to be conducted in supervision of the site contractor; • Proper signage to be provided in places of excavated areas; and • The design of the power plant to ensure sufficient safety margins to reduce the risk from wind and seismic activities.	Team-Senior EHS Manager, EHS Engineers • Contractor's HSE Team

Table 12-2: Environmental Management Plan during Operation Phase

S.No	Activity	Potential Impact	Management / Mitigation Measures	Responsibility
Operation Phase				
1.	Air Quality	• Discharge of Flue Gases – particulate, oxides of sculpture and nitrogen; • Discharge of Flue Gases – Green House Gas i.e. CO2 equivalent Emissions; • Fugitive Coal Dust Emissions	• OPDL-2 to ensure use of dry low NOx type coal burners of proven, advanced design to reduce NOx emissions; • Provision of space for Flue Gas Desulfurization system (FGD) shall be provided in the plant area. If coal having more than 0.6% sculpture is imported, FGD will be installed and operated to meet the ground level SO2 concentration requirements of IFC. • Ensure the proper functioning of electrostatic precipitators to achieve a minimum claimed efficiency of 99.67% to keep the particulate matter emission less than 50mg/Nm3. The flue gas to be exhausted at 275 m height; • An automatic emissions monitoring system to be installed on the stack to measure emissions of SO2, NOx, particulate matter and CO_2; • Ambient air quality monitoring stations to be installed within the project site to obtain such measurable parameters, while periodic air quality monitoring using high/low volume samplers to be conducted at other locations; • Install instruments to record meteorological data such as wind speed, direction, solar radiation, relative humidity and temperature shall be established so that operating power plant can record these parameters on regular interval. • The Project is to ensure periodical monitoring of ambient air quality and as well as of flue gas emission parameters and report these to the regulatory agencies to enable regulatory agencies to appropriately take any corrective action if required • The project shall install CO_2 monitor and analyses CO_2 equivalent emission from its power generating units once the Project achieves commercial operation date (COD). • Ensure coal dust suppression by water sprinkling at the coal transfer points, installing close conduit system (enclosed conveyors) or system under vacuum in areas prone to fugitive dust emissions.	• OPDL-2's Site Team-Senior EHS Manager • Contractor's HSE Supervisor

			• Different types of dust suppression systems are proposed for the plant: • During unloading and onward transfer to crusher, dust to be suppressed by spraying water to wet the dust particles, to enable dust particles to agglomerate and settle down due by gravity. The dust suppression system at crusher receipt and discharge area shall be based on dry fog type dust suppression • Use of loading and unloading equipment with minimized height of drop to the stockpile to reduce the generation of fugitive dust; • Dust extraction and dust handling systems to be installed at the coal handling plant, crusher house of CHP at feeder floors and ash handling units to reduce fugitive dust emissions. The coal dust extraction system to be designed to suck the dust laden air from the confined areas such as screening and belt feeders and at transfer points; • There shall be independent dust extraction system for each room. • Drainage from coal stockyards to be taken to a storage pond to remove coal particles; • Coal stockpiles to be mechanically compacted to minimize air ingress and the potential for auto-ignition and loss of volatiles; • Dust that may be emitted from the coal stockpiles and from the activity associated with the reclamation to coal bunkers to be controlled by the water spray. The dust suppression system for coal yard to be based on water type dust suppression system with swiveling nozzles. • Use of water suppression for control of loose materials on paved or unpaved road surfaces; • Wind fences may be provided in open areas of coal storage; the coal storage area may be fence with a 3-4m high wall • Fugitive dust will be further controlled by developing green belt along the periphery of the proposed power plant	
2.	Water Quality	• Increase in water demand • Generation of waste water	• Implementation of RO plant for potable water • OPDL-2 will also to ensure a rainwater harvesting system to harvest rainwater for use in recharging of groundwater as well as for collection in its water storage tank • The recovered water will be recycled and reused.	• OPDL-2's Site Team-Senior EHS Manager • Contractor's HSE

		• Hot water discharge	• OPDL-2 will undertake pre-treatment of cooling tower makeup water, along with installation of automated bleed/feed controllers, and use of inert construction materials to reduce chemical treatment requirements for cooling towers. • Storm water runoff drainage network will be developed to direct runoff from roof drains and other areas to the collection basins or to natural drainage, as appropriate. The collection basins will be designed to contain general site drainage, neutralization basin flows, oil/water separator flows, and service water system flows, septic tank. • Offsite runoff entering the site from surrounding areas will be routed around the site area through the use of overland flow, open channel flow, and underground piping or a garland drain around the site. • The elevated temperature areas because of thermal discharge from the project should not impair the integrity of the water body as a whole or endanger sensitive areas (such as recreational areas, breeding grounds, or areas with sensitive biota); • Adjustment of the discharge temperature, flow, outfall location, and outfall design to minimize impacts to acceptable level (i.e., extend length of discharge channel before reaching the surface water body for pre-cooling or change location of discharge point to minimize the elevated temperature areas); and • Use of multi-port diffusers;	Supervisor
3.	Noise Quality	• Increase in significant amount of noise levels due to operation of the turbines, exhaust gases, compressors, transformers, coal handling plant, coal conveyor movement, blow	• The steam turbine generators to be housed in closed buildings to reduce noise transmission; • Acoustic enclosures, hoods, laggings and screens to be provided at all high noise generating areas; • Provision of silencers at high noise generating utility equipment and erecting suitable enclosures to minimize the impact of high noise generating sources; • Ear plugs to be provided to the personnel working in high noise area; • Provision of green belt covering 30% of the project site including landscaping all along the periphery of the project site for further attenuation of noise levels; • Selecting equipment with lower sound power levels; • Installing suitable mufflers on engine exhausts and compressor components;	• OPDL-2's Site Team-Senior EHS Manager • Contractor's HSE Supervisor

		down of excess steam, steam venting from steam safety valves etc.	• Installing acoustic barriers without gaps in order to minimize the transmission of sound; • Limiting the hours of operation for specific pieces of equipment or operations, especially mobile sources operating through community areas; • Siting permanent facilities away from community areas if possible; and • Noise monitoring to be carried out for the purposes of establishing the existing ambient noise levels. Noise levels to meet the stipulated standards specified.	
4.	Traffic Movement	• Increase in traffic due to movement of man and material. • Movement of vessel through international waters can lead to Disposal of sewage, spillage leading to contamination of water • Increase in traffic will affect the traffic movement leading to congestion and increase in potential for accidents.	• All international vessels supplying coal to the plant shall follow the guidelines of Marplot for disposal of sewage and garbage. • The contract pertaining to supply of all type of fuels shall mention the responsibility of supplier for safe transportation and compliance to national and international requirements pertaining to environment. The Project will implement traffic and transport management plan with safe unloading facilities at the wharf. • The power plant complex will have well planned road network and walkways with proper signage e.g. speed limits, etc.	• OPDL-2's Site Team-Senior EHS Manager • Contractor's HSE Supervisor
5.	Ecology	• Disturbance to avifauna due to fugitive dust emission from coal	• Installation of ESP to minimize will substantially diminish the fly ash concentration from the stack • Installation of low NOx burners will help in limiting NOx emissions • The SO_2 emission will also be maintained as per the International limits (IFC	• OPDL-2's Site Team-Senior EHS Manager • Contractor's HSE

		handling plant, fly ash on vegetation, noise • Degradation of health of plantation within the airshed of flue gas emission • Disruption of benthic ecology during dredging activities for the navigation purpose.	guidelines) • Intake point from the Meghna River will be provided with sufficient screening to filter out any aquatic life (fish, toad, etc.), or any other foreign matter from being drawn into the pumps. Screens can be devices such as a perforated metal plate that physically prevents fish from passing. • Implementation of noise control measures will minimize disturbance to the fauna and avifauna of the area. Project will implement green belt development plan covering within the project premises. • Various tree species will be planted in the project area and around the power plant to create green belts. Plant species native to the area will be selected, avoiding monoculture and the introduction of alien plant species to the maximum possible extent. • A nursery will be established to support the afforestation program. Local forest nurseries will also be relied upon to supply saplings of some plant species. The green areas are planned to cover about one-third of the entire project area.	Supervisor
6.	Soil Quality	• Improper handling, management and disposal of ash generated can lead to unwanted spill over on to adjacent land leading to contamination of soil and vegetation from heavy metal constituents. • Spills and leakage from handling and storage of fuel Oil at site. • Inherent mercury in	• Dry handling of fly ash through pneumatic controls in a closed circuit system • Recycling of ash and its use in manufacturing of cement and other concrete products, use as construction fills • OPDL-2 shall enter into an agreement for procurement of fly ash prior to commissioning of the plant. • Removal of mercury can be achieved by installation of electrostatic precipitator (ESP) along with powdered activated carbon which will act as a sorbent in flue gas. • Fly ash to be efficiently managed to control the emission of heavy metals in the environment.	• OPDL-2's Site Team-Senior EHS Manager • Contractor's HSE Supervisor

		Coal		
7.	Coal transportation Storage and Handling	• Emission of fugitive dust • Generation of waste water • Dumping of waste	• All transfer points shall be provided with dry fog dust suppression system; • The loading and unloading equipment shall be used with a minimized height of drop to the stockpile to reduce the generation of fugitive dust; • Ensure no dumping of ballast water, no oil spillage, no discharge of waste water, no waste dumping in Meghna River or any other water body; • Limiting dropping of coal and escapee during unloading to feeder vessel/lighter vessel; • Monitoring activities of the Foreign ships during coal transportation; and • All vessels should comply with rules and regulation of IMO, Port authority, BIWTA and national laws of safety, and environmental conservations.	• OPDL-2's Site Team-Senior EHS Manager • Contractor's HSE Supervisor

12.5 EMP during Preparation Phase

12.5.1 Land development

The land for the project was being reclaimed by filling it with river sand. A total of 130 acre of private land has been procured for the proposed project. The existing low to medium high land within the project area will be changed to high land by filling it up by river sand. Backfilling has to be made layer by layer ensuring proper compaction and water spraying so that no dust can emit in air causing air pollution. Land surface contours will be restored and adequate drainage facilities will be developed prior to start of construction work.

12.5.2 Location of Sources of Soil and Other Material for Development

River sand is primarily being used for reclaiming the site which has been sourced from Meghna River and extracted soils from other places. Dredging is being carried out using a cutter suction dredger which has a suction outlet and utilize vacuum force to sucks up the loosened material. Dredging point is near to the site, thereby causing minimum disturbance in the River. However, following measures to be undertaken to ensure minimum impacts of dredging:

- It is preferred to locate the collection point of dredged material as near as possible to the area going to be dredged so as to maintain dredge efficiency and to keep the dredging cost low; and
- Dredging operations to be controlled and restricted to designated dredging sites to minimise sediment suspension.

12.5.3 Transport of Soil and Other Material

Dredged river sand is transported through pipe from the location of dredging to the point of re-filling inside of the site. The pipeline is elevated, which is reached to the site. Barges may be implemented with separation systems, increasing mobility and limiting transportation costs. Logistic considerations for transportation of dredged material includes: distance of the proposed site from the dredging project; site accessibility; required equipment to dredge the channel etc.

12.5.4 Method and Equipment for Collection of Soil and Other Material

The impacts of dredging activities are also influenced by dredging method. Dredging is being carried out using a cutter suction dredger which has a suction outlet and utilize vacuum force to sucks up the loosened material. Cutter heads are fitted with tough metal teeth, which rotate and bore into the seabed material, thereby enhancing the effectiveness of the suction force.

- The dredging method is to be selected which minimize suspension of sediments, minimize destruction of benthic habitat, increase the accuracy of the operation, and maintain the density of the dredge material;
- Equipments should be kept in good order with skilled operators. Disposal must be made in confined chamber;

- Cutter head speed will always be kept to the minimum level that yields an acceptable production rate; and
- Inspection and monitoring of dredging activities should be conducted to evaluate the effectiveness of impact prevention strategies, and re-adjusted where necessary.

12.5.5 Closing of Sites of Sources of Soil and Other Material

Mainly river sand is being utilized for reclamation of site through limited dredging activities Dredged material should be analyzed in order to select appropriate disposal options (e.g. land reclamation, open water discharge, or contained disposal). Beneficial reuse of uncontaminated, dredged material should be considered (e.g. for wetland creation or enhancements, habitat restoration, or creation of public access / recreational facilities). No closure is required for the dredged site, as it in at the bottom of the river.

12.6 EMP during Construction Phase

12.6.1 Site Preparation

The project site will be prepared before commencement of any construction works. This will comprise of site levelling, development of drainage channels, etc. the prior site development shall be well demarcated to cause minimum disturbance in the surroundings. The following activities should be performed:

- Site backfilling, grading and excavation for foundation shall be undertaken mainly during dry season;
- It shall be ensured stacking of excavated soil material is done in an earmarked area and care shall be taken to prevent soil erosion;
- It shall be ensured that retention wall or bund is provided around the storage areas for excavated soil and other construction material in order to arrest the flow of solid with storm water in case of rain;
- Attempts shall be made to use the excavated soil at the earliest for filling low lying areas at the site for raising the ground level as planned;
- It shall be ensured that Project site is properly fenced and project activities including receipt and storage of construction material are kept within the Project footprint;
- No piling of construction material shall be permitted outside project site;
- Proper routing and adequate capacity of the storm water run-offs drains with catch pits shall be ensured;
- Completed earthworks shall be sealed and/or re-vegetated as soon as reasonably practicable with the help of landscape expert;
- Impervious surfaces for refuelling areas and other fluid transfer areas shall be used in order to prevent percolation of oil in soil due to accidental spills;
- Training shall be provided to workers regarding correct transfer and handling of fuels and chemicals and the response to spills;
- Diversion dykes shall be constructed to channel surface runoff to the Meghna river;
- It shall be ensured that adequate cross drainage is provided along the proposed road to prevent localised flooding.

12.6.2 Infrastructure Services

Infrastructure services required during construction phase mainly comprises of construction yard, labour camp etc. Adequate numbers of bins, sanitary toilet, water supply system, run-on and run-off drains, fire safety and fighting system, etc should be provided in the site by the respective contractor or OPDL-2. It shall be ensured that construction footprint is well defined and construction work is carried out within the Project footprints only. EHS Manager from OPDL-2 will have the responsibility of monitoring the activities which causes any environmental effects and ensuring enforcement of EMP during construction activities.

Sewerage Plan

The water demand for the construction works will be about 40 m^3/hour to 100 m^3/hour during normal and peak demand respectively and will be sourced from Meghna River after obtaining due approval from Bangladesh Inland Water Transport Authority. The wastewater generated will be treated in a temporary sewage treatment system of adequate capacity and discharged to Meghna River in compliance with the discharge norms (Schedule 9 of ECR, 1997). Sewage shall be chlorinated before final discharge.

12.6.3 Construction Equipments

A number of construction equipments will be required at the site for earthworks which involves hazards (falling, tripping etc.) with their movement. The following activities to be performed to minimize:

- Close consultation with community when unloading of construction machinery and material will obstruct ferry movement for requirement of local community ;
- Providing dedicated location along the site for exclusive loading and unloading of the construction vessels;
- Necessary training to the ferry operators of construction vessels to ensure safe operations;
- Developing Code of Practice for construction which will include management of traffic for construction phase;
- All vessels engaged for construction shall be maintained at regular intervals to prevent leaks of oil;
- Explore the possibility of safely transporting construction machinery and material after daytime.

12.6.4 Safety Measures

The construction activities will involve large scale of operations owing to the large number of labour. Safety talk, safety meeting, safety motto, safety billboard etc. are good techniques of raising awareness among the workers, visitors and locals. The other measures to be taken have been enumerated below:

- Personal Protective Equipments (PPEs) e.g., helmets, safety belts, welding masks, shock resistant rubber gloves, shoes, other necessary protective gear etc. should be provided to workers handling welding, electricity and related components.
- Safety harness and other fall protection measures shall be ensured for workers while working at height;
- Periodic inspection of PPE should be done to ensure that they are in proper condition. A register for keeping records of such inspection shall be maintained.
- Loading and unloading operation of equipment should be done under the supervision of a trained professional
- All excavation activities to be conducted in supervision of the site contractor;
- Proper signage to be provided in places of excavated areas;
- The design of the power plant to ensure sufficient safety margins to reduce the risk from wind and seismic activities;
- Fire extinguishing equipment should be provided in adequate number on site to handle any possible fire outbreaks;
- Effective work permit system for hot work, electrical work, working at height shall be ensured;
- An accident reporting and monitoring record should be maintained. The objective shall be to minimize such occurrences in the future and attain zero accidents.

12.7 EMP During Operation Phase

12.7.1 Air Pollution Management

12.7.1.1 Transportation and handling of raw materials

The vessels to be used for coal transportation shall have to satisfy all national laws and IMO conventions signed by Government of Bangladesh. The measures related with handling of coal have been detailed below:

- Wet control dust suppression will be provided for the coal unloading area to reduce the fugitive dust emissions;
- Automatic dust detectors will be provided in the coal yard and in case the dust level exceeds beyond a threshold value, water sprinkling will be carried out;
- All transfer points shall be provided with dry fog dust suppression system
- The loading and unloading equipment shall be used with a minimized height of drop to the stockpile to reduce the generation of fugitive dust;
- Dust extraction and dust handling systems shall be installed to reduce fugitive dust emissions. The coal dust extraction system shall be designed to suck the dust laden air from the confined areas such as screening and belt feeders and at transfer points;
- There shall be independent dust extraction system for each unit;
- Coal stockpiles shall be mechanically compacted to minimise air ingress and the potential for auto-ignition and loss of volatiles;
- Use of water suppression for control of loose materials on paved or unpaved road surfaces;
- Wind fences may be provided in open areas of coal storage; the coal storage area may be fenced with a 3-4m high wall;

- Fugitive dust will be further controlled by developing green belt along the periphery of the proposed power plant.

12.7.1.2 Operation Stage

The sulphur content in coal received at the site must be low. The efficiency of all pollution abatement equipments must be checked on regular basis. Regular inspection of boiler, FD and ID fans, separation and handling system and other ancillaries shall be undertaken. The other measures to be undertaken are:

- OPDL-2 to ensure use of dry low NOx type coal burners of proven, advanced design to reduce NOx emissions;
- OPDL-2 shall explore options to reduce SO2 emissions, through selection of coal with low sulphur content, better than the design coal of 0.6%.
- Provision of space for Flue Gas Desulfurization system (FGD) shall be provided in the plant area. If coal having more than 0.38% sulphur is imported, FGD will be installed and operated to meet the ground level SO_2 concentration requirements of IFC.
- Ensure the proper functioning of electrostatic precipitators to achieve a minimum claimed efficiency of 99.67% to keep the particulate matter emission less than 50mg/Nm3. The flue gas to be exhausted at 275 m height;
- Potential for flue gas conditioning through controlled injection of small quantities of sulphur trioxide into the flue gas stream for reducing the resistivity of the fly ash and permitting its collection in the existing precipitator shall be explored.
- An automatic emissions monitoring system to be installed on the stack to measure emissions of SO2, NOx, particulate matter and CO2;

12.7.2 Waste Water Management

Waste Water to be generated from different point sources like office, household, workshops etc shall be efficiently collected, disposed and managed.

- Appropriate treatment shall be provided to the process effluents and runoffs prior to discharge into the River;
- Treated water effluent (about 15 m3/hr) shall be mixed with the cooling to dilute the concentration of the treated effluents;
- The quality of treated effluent shall be monitored before discharge into Meghna River
- Records of water being discharged into the River shall be maintained.
- Wastewater having light density fine suspended particles from different areas as well as other effluents such as boiler blow down, DM plant regeneration effluent will be neutralized and collected in a collection basin. The basin will be sized to contain minimum 24 hours storm water runoff from two most recent consecutive rainfall events and will be designed not to have a normal discharge. Total effluent collected shall be treated in clarification plant.
- Before discharging the treated effluent from the central monitoring sump the effluent standard shall have to be complied with ECR, 1997 defined standard for effluent.
- OPDL-2 shall ensure that the metals such as chromium and zinc (if any) from chemical additives used to control scaling and corrosion in cooling towers are eliminated.

- Also the minimum required quantities of chlorinated biocides in place of brominated biocides will be used or intermittent shock dosing of chlorine to be alternatively applied as opposed to continuous low level feed.
- Storm water runoff drainage network will be developed to direct runoff from roof drains and other areas to the collection basins or to natural drainage, as appropriate. The collection basins will be designed to contain general site drainage, neutralization basin flows, oil/water separator flows, service water system flows and septic tank.
- Offsite runoff entering the site from surrounding areas will be routed around the site area through the use of overland flow, open channel flow, and underground piping or a garland drain around the site.

12.7.3 Noise Management

Principal sources of noise in thermal power plants include the turbine generators and auxiliaries; boilers and auxiliaries, such as coal pulverizers; reciprocating engines; fans and ductwork; pumps; compressors; condensers; precipitators, including rappers and plate vibrators; piping and valves; motors; transformers; circuit breakers; and cooling towers. The measures to prevent, minimize, and control noise from thermal power plants include

- Workplace noise sampling including personal noise monitoring which identifies which employees are at risk from hazardous levels of noise;
- Provision of sound-insulated control rooms with noise levels below 60 dBA ;
- Design of generators to meet applicable occupational noise levels;
- Identification and marking high noise areas and require that personal noise protecting gear is used all the time when working in such high noise areas (typically areas with noise levels >75 dBA);
- Compulsory use of personnel protective equipment (PPE) such as ear plugs for the workers;
- Provision of insulating caps and aids at the exit of noise source on the machinery;
- Use of physical barriers and green belt development around the plant to restrict the noise from going outside the proposed plant boundary during operation; and
- Provision of training and information that ensures the workers are aware of the hazard from excessive noise exposures and how to properly use the protective equipment that has been provided;

12.7.4 Solid Waste Management

The following mitigation measures will be adopted:

- Fly ash (dry form) generated from the plant should be separated after burning of coal through ESP and commercially utilized to maximum extent possible;
- Increase the facilities of ash marketing through infrastructure development, creating awareness and formulating policies;
- The hazardous waste such as spent oil as well as non-hazardous wastes shall be disposed off to DoE authorised vendors only.

A detailed waste management plan for the site has been formulated and has been presented in section 12.18 of the report.

12.7.4.1 Fly Ash Utilization

The fly ash will be collected in dry form from the ESP hopper and will be loaded to silos for storage using a pneumatic system. The fly ash will be then sold to cement plants and will be transported using trucks or barges. The bottom ash will be collected in molten state in the wet bottom slag boiler and will be taken to the ash pond. An ash disposal area shall be provided for the storage of humidified bottom and fly ash.

From the electrostatic precipitator hoppers, flyash will be conveyed pneumatically (either vacuum system or pressure system) in dry form to storage silos. All efforts will be made for 100% utilization of fly ash during construction of road or embankments. Also, the nearby cement plants in the area will be contacted for a tie-up for sale of ash for its utilization in their plants.

The ash stored in the silos will be loaded onto the specially-designed trucks, through gravity flow. Purging with hot air will be done for dry dust free environment. These trucks will transport the ash to the nearby cement plants for its utilization. In case the cement plant is located beyond 5-7 km of the plant boundary; the fly ash will be transported in covered barges. The ash will be loaded to the barge using an inclined chute with hot air. With their given production capacity, these cement plants can utilise approximately, 2825 MT/ day of ash (25% of their total capacity).

It has been estimated that approximately 457.5 MT/day of flyash will be produced by the proposed Power Plant which can be 100% consumed by these four power plant.

The options for utilisation of residue ash such as use in brick manufacturing, clinker industries, cement industries, compaction purposes are also being explored. At initial stage, the generated ash will be used in land development within the project area.

12.7.4.2 Ash Utilization

A slag type wet bottom boiler will be installed in the proposed plant. The bottom ash will be kept in a molten state in the boiler and will be collected in the ash hopper which contains quenching water. When the molten slag comes in contact with the quenching water, it fractures instantly, crystallizes, and forms pellets. The ash pellets will be then stored in an HDPE lined ash pond. The dry bottom ash silo or container system shall minimum have a net capacity of 72 hours production.

Ash may be utilized for the following purposes:

- Concrete production, as a substitute material for Portland cement and sand
- Embankments and other structural fills (usually for road construction)
- Grout and Flowable fill production
- Waste stabilization and solidification
- Cement clinkers production - (as a substitute material for clay)
- Mine reclamation
- Stabilization of soft soils

- Road sub-base construction
- As aggregate substitute material (e.g. for brick production)
- Mineral filler in asphaltic concrete
- Agricultural uses: soil amendment, fertilizer, cattle feeders, soil stabilization in stock feed yards, and agricultural stakes

12.7.5 House Keeping

Good housekeeping is one of the prime steps of safety. Good housekeeping of mechanical parts, rotator parts, electrical equipments, plant site, green belt, ESP, stack, etc will ensure workplace safety and efficient functioning of the system. OPDL-2 needs to assess the scope for making improvements in maintenance and housekeeping inside and around the plant (e.g., check for excess oxygen levels, actual emissions levels, fuel spills, coal pile runoff, fugitive dust from coal piles, recordkeeping, monitoring etc. Good housekeeping practices will include keeping all walkways clear of debris, cleaning up oil spots and excess water as soon as they are noticed, and regular inspecting and maintaining of all machinery.

12.7.6 Safety and Occupational Health

Following mitigation measures have been suggested for minimizing work related health and safety impacts on workers.

- Identification of potential exposure levels in the workplace during working activities;
- Regular inspection and maintenance of pressure vessels and piping shall be carried out
- Adequate ventilation shall be provided in work areas to reduce heat and humidity;
- Time required for work in elevated temperature environments will be reduced and access to drinking water will be ensured;
- Shielding surfaces where workers come in close contact with hot equipment, including generating equipment, pipes etc. shall be done;
- Warning signs near high temperature surfaces and personal protective equipment (PPE) as appropriate, including insulated gloves and shoes shall be provided;
- Provision of sound-insulated control rooms with noise levels below 60 dB.;
- Design of generators to meet applicable occupational noise levels;
- Identifying and designating high noise areas to ensure that personal noise protecting gear is used by workers all the time when working in such high noise areas (typically areas with noise levels >85 dBA);
- Deactivation and proper grounding of live power equipment and distribution lines according to applicable legislation and guidelines whenever possible before work is performed on or proximal to them;
- Provision of specialized electrical safety training to those workers working with or around exposed components of electric circuits. This training should include, but not be limited to, training in basic electrical theory, proper safe work procedures, hazard awareness and identification, proper use of PPE, proper lockout/tag out procedures, first aid including CPR and proper rescue procedures. Provisions should be made for periodic refresher training as necessary.

- Use of automated combustion and safety controls and proper maintenance of boiler safety controls;
- Implementation of start-up and shutdown procedures to minimize the risk of suspending hot coal particles (e.g., in the pulverizer, mill, and cyclone) during startup;
- Regular cleaning of the facility to prevent accumulation of coal dust (e.g., on floors, ledges, beams, and equipment);
- Removal of hot spots from the coal stockpile (caused by spontaneous combustion) and spread until cooled and ensure that loading of hot coal into the pulverized fuel system is not carried out;
- Use of automated systems such as temperature gauges or carbon monoxide sensors to survey solid fuel storage areas to detect fires caused by self-ignition and to identify risk points.
- Dust extraction and dust handling systems shall be installed to reduce fugitive dust emissions.

12.8 Greenbelt and Landscaping Plan

In compliance with their Safety Policy Statement, Orion group is committed to preserve green environment around the plant. Green spaces have been planned near the Administration building, Parking area, Dormitory Area, and Ash Disposal Area. A three-tier greenbelt has been proposed at various locations within the plant premises. OPDL-2 has proposed to develop green belt on 34% of the land procured for the proposed power plant.

The green belt developments will help in noise attenuation and also arrest particulate pollution to a small extent. Plants serve as a sink for pollutants, act as a barrier to break the wind speed as well as allow the dust and other particulates to settle. The plant species suitable for greenbelt development need to be selected based on the following criteria:

- Fast growing;
- Thick canopy cover;
- Perennial and evergreen;
- Large leaf area index;
- High sink potential;
- Efficient in absorbing pollutants without significantly affecting their growth; and
- Suitable for the local seasons.

12.9 Rain Water Harvesting Plan

Rain water harvesting can be defined as an activity of direct collection and storage of rain water as well as other activities aimed at harvesting and conserving surface and ground water. Rainwater harvesting aims at prevention of water loss due to evaporation and seepage through hydrological studies and engineering inventions, in order to utilize the rainwater most efficiently towards best use of water resources for sustainable development.

As per Bangladesh Metrological Department (BMD), the annual rainfall of Dhaka is 1900mm, which can be collected in form of roof top harvesting, underground tanks, ponds etc. The underground

tank may be constructed of masonry or R.C.C. structure suitably lined with water proofing materials so as there would be no scope for leaching water to contaminate the surface or ground water. The surface tank may be built of G.I. sheet, R.C.C. tank placed at a little higher elevation on a raised platform. To facilitate cleaning of the tank, an outlet pipe may be fitted and fixed in the tank at bottom level. Factors to be considered while designing the storage tanks include water demand, duration of dry season, catchment area available and rainfall.

12.10 Rehabilitation and Resettlement Plan

The proposed project will require acquisition of 130.00 acres of land that includes mostly private land. The land has been procured on willing buyer and willing seller basis and individual negotiations with the land holders. There will be no involuntary resettlement of the affected population due to the proposed project in the area. Hence forth, no physical displacement was required for the local communities due to the land procurement needed for the OPDL-2 Project and also not envisaged in the future. However, local people are subjected to economic displacement as a result of the Project, for which livelihood Restoration Plan has been prepared. LRP has been detailed out under section 12.13 *Livelihood Restoration Plan*.

12.11 Coal Washery

Coal washing will be a controlled practice; with only optimum washing will be undertaken. Continuous sprinkling of water on coal stock piles will be undertaken to enforce the dust suppression. The unloading system and conveyor system will be enclosed typed that would reduce generation of fugitive dust particles from coal. Adequate dust suppression system like fog type and water spray system will be installed in the material unloading areas. Run off from the coal Washery will be channelized to the centralized effluent treatment system. The crushers/pulverizers of the coal washeries shall be provided with enclosures fitted with suitable air pollution control measures.

12.12 Coal Yard Management

Management of coal plays an important role in determining the amount and nature of air emissions. Particulate matter can also be released during transfer and storage of coal. The following measure to be adopted for coal yard management and Coal stocking, handling, and other activities which generate considerable amount of coal dust.

- The loading and unloading equipment shall be used with a minimized height of drop to the stockpile to reduce the generation of fugitive dust;
- Wet control dust suppression will be provided for the coal unloading area to reduce the fugitive dust emissions;
- Automatic dust detectors will be provided in the coal yard and in case the dust level exceeds beyond a threshold value, water sprinkling will be carried out;
- The coal dust extraction system shall be designed to suck the dust laden air from the confined areas such as screening and belt feeders and at transfer points;

- The surface of coal storage yard will be RCC paved which will aid in cleaning of yard in more efficient way;
- Major portion of the coal dust received will be accumulated in the dust collection system provided in the coal yard which will limit the emission of suspended particulate matter
- Coal stockpiles shall be mechanically compacted to minimise air ingress and the potential for auto-ignition and loss of volatiles;
- There should be an automated monitoring and water spraying system. In addition, water must be applied on coal:
    - As it moves on conveyor belt
    - At transfer points
    - At stockpile
- Wind fences may be provided in open areas of coal storage; the coal storage area may be fenced with a 3-4m high wall;
- Provision of regular monitoring has to be kept for inspection proper pathway with entry and exit should be provided in stockpile area and conveyor belt.
- For the Coal Handling Plant with respect to mechanical & general aspect the specific codes/standards to be followed for the design of the systems:

S1038	Coal &Coke Analysis and testing
AS1332	Conveyor belting textile reinforced
AS4024	Conveyors safety requirements
AS3880	Safeguarding of machinery
AS1680	Bin flow properties of coal
ASTMD2234	Coal Sampling System
ASHRAE:2007	HVAC applications

12.13 CDM Intent

Carbon dioxide, one of the major greenhouse gases (GHGs) under the UN Framework Convention on Climate Change, is emitted from the combustion of fossil fuels. The total CO_2 production due to coal combustion during ultra-supercritical boiler operation has been estimated to be about 4.485 million tonnes/ year. As per assessment of coal technologies, ultra-supercritical boilers operate at higher steam temperatures and pressures and, therefore, are more efficient than subcritical boilers. Because of their efficiency, ultra-supercritical units can emit 10 percent to 20 percent less CO_2 than subcritical boilers. Recommendations to avoid minimize, and offset emissions of carbon dioxide are given below:

- Use of high performance monitoring and process control techniques,
- Good design and maintenance of the combustion system so that initially designed efficiency performance can be maintained;

12.14 Design of Ash Pond

An ash pond has been proposed for storing the formed ash pellets. The pond will be lined with a high Density Polyethylene (HDPE) Liner. The ash pond shall have a system for collection and treatment of rain water (percolate) having been into contact with the stored ash in the ash pond. A blanket of water shall be maintained over the ash pond to control fugitive dust emission. Gradual reclamation of ash pond will be practiced after its stabilization and can be used as recreational park. The floor of ass pond will be of CC or RCC to avoid any contamination of surface or ground water.

The total area available will be divided into two or more compartments so that anyone of the compartment can be in operation while other compartments were ash has already been deposited are allowed to dry and there after the height of the pond are further increased. Each compartment is required to have certain minimum area to ensure that there is adequate time available for settlement of ash.

12.15 Budget for EMP

The following table provides the capital cost and recurring cost of implementation of environmental management and monitoring measures, including installation of pollution control equipment, for both construction and operation phases. The Project cost is inclusive of cost for implementing Environmental Management Plan and installation of pollution abatement and mitigation measures

Table 12-3: Cost of ESMP Implementation

S. N.	Equipment Name	Capital Cost USD (Budgetary)	Recurring Cost USD per annum
A)	**Construction Phase**		
1	Provision of adequate drainage and bunds/ diversion dykes, water sprinkling etc. to prevent soil/raw material escape	60,000	8,000
2	Sanitation facility – provision of septic tanks and soak pit	8,000	800
3	Construction of suitable masonry bins with concrete floors for waste collection and for further disposal	3,500	800
4	Provision of tin sheets acting as noise barriers	7,000	1000
5	Miscellaneous expenses for construction phase ESMP implementation	1,20,000	60,000
6	Environment monitoring	-	100,000
7	Manpower for implementation of construction phase ESMP	Integrated in project cost	-
8	Land Acquisition	As per Valuation	-
	Sub Total (A)	***1,98,500***	***1,70,600***
B)	**Operation Phase**		
1	Sewage Treatment Plant (STP) (including conveying to STP and use of treated sewage in landscaping)	Integrated in project cost	35,000

S. N.	Equipment Name	Capital Cost USD (Budgetary)	Recurring Cost USD per annum
2	Electrostatic precipitator (ESP)	Integrated in project cost	50,000
3	Storm water construction	Integrated in project cost	10,000
4	Greenbelt and landscape development and annual maintenance	Integrated in project cost	80,000
5	Rain water harvesting system	Integrated in project cost	8,000
6	Acoustic enclosures and diesel storage for diesel generators	Integrated in project cost	1500
7	Solid wastes and hazardous wastes storage sheds (including impervious sheds for used oil storage) other than fly ash management	Integrated in project cost	85,000
8	Pollution monitoring from external agencies	Integrated in project cost	50,000
9	Environment, health and safety training for staff development and ESMP evaluation	Integrated in project cost	40,000
10	HSE Department monitoring, reporting, and statutory compliance	Integrated in project cost	110,000
11	Environmental HSE&S management team staff	-	150,000
	Sub Total (B)	**-**	***619,500***
	Total Cost (A+B)		**790,100**

12.16 Contingency Plans

The ESMP as described above in tabulate form consist of management measures to be taken during pre- construction, construction and operation phase. Following plans have been developed for the project in detail which comprises detailed management of the issues pertaining to proposed project:

- Contractor Labour Management Plan ;
- Waste Management Plan;
- Pest Management Plan;
- Environment and Social Monitoring Plan;
- Emergency Response and Preparedness Plan;
- Occupational Health and Safety Plan; and
- Livelihood Restoration Plan.

12.17 Construction Labour Management Plan

12.17.1 Introduction

Currently, the project site is being reclaimed by fill material (i.e., river bed sand) up to 2m to raise the site elevation prior to commencement of project construction activities. At present, grazing activities of livestock owned by the local inhabitants is predominantly being practiced on the project site.

Construction is likely to start after reclamation of the site, and will continue for a period of 45 months (two years and nine months). Operational Phase of the project will commence thereafter. The life of the project is expected to be twenty five (25) years. It is anticipated that around 3000 people will be employed during the construction phase belonging to different contractors with an average of 1000 people working at a time on site. There will be around 275 direct jobs during the operation phase of the project.

12.17.2 Objectives

The influx of labour will have both negative and positive impacts on the nearby community and local environment. The labour will be accommodated in the camp site, with limited interface with the nearby community. However the influx of migrant workers would lead to a transient increase of population in the immediate vicinity of the project area for a limited time. This would put pressure on the local resources such as roads, fuel wood, health facilities, community centres etc.

Hence, Construction Labour Management Plan (herein referred to as “CLMP”) is designed to demonstrate that:

- Local employment, one of the principal socio-economic benefits of the Power Project, is enhanced through effective procedures for recruitment, employment and training of personnel during all phases of the Project.
- Potential impacts associated with influx on the host population and receiving environment are minimized;
- Provision of safe and healthy working conditions, and a comfortable environment for labour;
- To ensure compliance with the IFC PS and national labour laws;

12.17.3 Scope

This plan shall be applicable to the construction labourers directly employed by OPDL-2, if any, all construction contractors engaged, and any other third parties associated with the proposed Project. The elements of the CLMP will be directly implemented by the contractors while overall management and responsibility will lie with OPDL-2.

12.17.4 Applicable Standards and Legislations

According to ***Bangladesh Labour Law of 2006 (BLL)*** - An employee or “labour” is defined as any person, including a trainee/probationer, whether the terms and conditions of his/her employment are expressly written or not, who is employed directly or through a contractor/agency, for any skilled, unskilled, physical, technical, business development or clerical job in any establishment or industry.

BLL also covers the areas of conditions of service and employment, youth employment, maternity benefit, health and hygiene, safety, welfare, working hours and leave, wages and payment, workers' compensation for injury, trade unions and industrial relations, disputes, labour court, workers 'participation in companies' profits, provident funds, apprenticeship, penalty and procedure, administration, inspection, etc.

On the International Labour Organization (ILO) core conventions, Bangladesh has ratified the following International Labour Conventions (ILCs):

- ILC 29 (Forced Labour);
- ILC 87 (Freedom of Association and Protection of the Right to Organize);
- ILC 98 (Right to Organize and Collective Bargaining);
- ILC 100 (Equal Remuneration);
- ILC 105 (Abolition of Forced Labour);
- ILC 111 (Discrimination in Employment and Occupation), and
- ILC 182 (Elimination of the Worst Forms of Child Labour).

IFC Performance Standards

International Finance Cooperation (IFC) ***Performance Standard 2- Labour and Working Conditions*** is specific to labour and working conditions. This Standard focuses on the protection of the basic rights of workers, fostering constructive worker-management relationships, as well as promoting fair treatment and the provision of a safe and healthy workplace.

IFC PS 4 – Community Health, Safety and Security carries health and safety through to the community environment. The objectives of the Performance Standard are:

- To minimise and manage health and safety risks to local communities; and
- To ensure that the project does not harm community health and safety.

12.17.5 Labour Requirement

The proposed project will entail the involvement of both skilled and unskilled labour. The labour requirements for the proposed project are expected to peak during the 2nd year of construction. The peak labour strength has been estimated to be about 3000. About 1000 people are envisaged to be working at a given time during construction phase. The approximate details of the labour requirements are presented in ***Table 12-4.***

Table 12-4: Labour Requirements

Labour Type	First Year	Second Year	Third Year
Unskilled Labour	400-600	1400-1600	1000-1200
Skilled Labour	200-400	1200-1400	600-800
Total Labour (Approximately)	1000	3000	2000

The contractor of OPDL-2 will recruit unskilled labour from project area. The remaining skilled labour strength shall be met from influx of migrant labour. However, these labourers will not be from the project area and the contractor will have to provide accommodation facilities for them. As to fulfil the above requirement, two labour camps are proposed to cater the migrant labour during the construction phase of the project.

12.17.6 General Requirements

OPDL-2 shall implement the following measures to minimise the potential negative impacts of worker camps and workers on local communities:

Minimise camp size: OPDL-2 shall minimise the size of the camps required as much as possible through proactive employment of local labour.

Complaints and incident reporting: A formal Complaints Procedure will be implemented to ensure timely and transparent response to complaints as received from labour.

Labour education: The workforce will be sensitized to local social and cultural practices through provision of an induction course for all employees that stipulates expected behaviour;

Labour behaviour in camp: A Camp Policy and Code of Behaviour governing appropriate behaviour in the camps to be kept in place and to be strictly enforced. OPDL-2 will define the "rules of engagement" between camp dwellers and community and shall be implemented by construction contractors for all engaged labours.

Labour Compensation and Accommodation: OPDL-2 shall ensure that labours are provided with benefits such as annual leave, weekly rest day, etc. Accommodation to be provided for the construction labour which cover facilities (including catering facilities, dining areas, washing and laundry facilities, recreation areas etc.) and supporting utilities to run the camp such as power and water supply.

12.17.7 Hiring and Recruitment Procedure

The Contractor shall, wherever possible, locally recruit the available workforce and shall provide appropriate training as necessary. The following general measures shall be considered for the workforce and construction campsites:

- The contractor shall not employ any person below the age of 18 years nor will have any forced labour;
- The construction labourers will be provided with documented information regarding their rights under national labour and employment law such as but not limited to Factories Act, Minimum Wages Act, Trade Unions Act and Workmen's Compensation Act.
- No discrimination shall be done by OPDL-2 or the construction contractor with respect to recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, job assignment, promotion, termination of employment or retirement, and disciplinary practices.
- The contractor to ensure that work hours are set at eight hours a day, 48 hours a week, with a weekly rest day for all engaged labours.
- Every labour is entitled for maximum of only two hours a day as Overtime (OT) work. OT pay is twice the hourly remuneration.
- Labour are entitled to rest and meal in a day as prescribed in *Bangladesh Labour Law, 2006* which are as follows:

  (i) One hour interval for over six hours works a day;

  (ii) Half an hour interval for more than five hour work; and

  (iii) One hour interval once or half an hour interval twice for more than eight hours works a day.

- OPDL-2 is mandated to observe equal wages for male and female workers for work of equal nature or value.
- A grievance redressal mechanism for workers shall be put in place by the contractor to raise workplace concerns. The workers will be informed about the grievance mechanism at the time of recruitment.
- OPDL-2 shall ensure that the primary contractors develop and implement a procedure to review the performance of their sub-contractors.

12.17.8 Worker's Accommodation

Two Labour camps have been proposed for accommodation of labour to be engaged for the construction phase of the project. OPDL-2 will supervise and monitor the activities performed by the contractor. The following measures will be provided:

- The labour will be provided with accommodation on twin sharing basis made of insulated material and locally available building material etc;
- The migrant workers with families shall be provided with individual accommodation comprising bedroom, sanitary and cooking facilities;
- For each worker, a minimum floor surface area of 4 to 5.5 m^2 shall be provided with a minimum ceiling height of 2.10m. about 15-20 % additional area shall be provided for circulation;
- The dwelling units will be supported by common latrines and bathing facilities duly segregated for male and female labour.
- Adequate number of toilets shall be provided in the accommodation facilities. A minimum of 1 unit to 15 males and 1 unit for 10 females shall be provided;
- The contractor shall provide a canteen facility for the construction workers and the food will be of appropriate nutritional value and will take into account religious/cultural backgrounds;
- All doors and windows shall be lockable and mobile partitions/curtains shall be provided for privacy. Facilities for the storage of personal belongings for workers shall be provided.
- Basic leisure and social facilities like provision of radio, TV or cinema to be provided for the workers in order to relax and socialise during their free time.
- Disposal of sewage will be made through a septic tank-soak pit arrangement;
- Dustbins shall be provided for collection of garbage and will be removed on a daily basis; and
- It is also required to provide first aid box in adequate numbers and an equipped dispensary with a patient-room, doctor and nursing staff.

12.17.9 Security

The contractor shall put in place the following security measures to ensure the safety of the workers. The following measures shall be incorporated:

- Access to the camp shall be limited to the residing workforce, construction camp employees, and those visiting personnel on business purposes;
- The construction campsites will be guarded and access will be controlled through the means of barricades;

- The contractor shall be responsible for deploying adequate number of guards under supervision of OPDL-2;
- Adequate, day-time night-time lighting shall be provided;
- The security personnel shall be provided with training to respect the community traditions and in dealing with;
- The campsites shall be provided with firefighting equipment and portable fire extinguishers.

12.17.10 Provisions for Drinking Water

The water demand for the labour camps has been estimated to be 90 KLD on the basis of 90 litres per capita per day (considering 1000 migrant labours residing in labour camp). The domestic water supply shall be made available by the contractor.

- Safe drinking water conforming to the Bangladesh Standard Specifications for drinking water shall be provided.
- The direct usage of water from streams (Meghna River and its channels) shall not be allowed and water shall be appropriately treated.
- OPDL-2 shall regularly monitor the quality of drinking water available in the labour camps. In case of non-compliance with the Drinking Water Specifications, additional treatment shall be provided or alternative sources of water supply shall be arranged.
- All tanks used for the storage of drinking water are constructed and covered as to prevent water stored therein from becoming polluted or contaminated.

12.17.11 Wastewater Generation

The labour camp will result in generation of wastewater. About 80% of water supply shall be generated as sewage/wastewater. The contractor shall provide septic tank and soak pit for disposal of sewage. Provision of watertight precast concrete septic tank to be ensured as the project area is situated in low lying areas of Meghna River Flood Plains. It is also recommended that the storm water and sewage system should be separate. The surface water drainage shall include all necessary gutters, down pipes, gullies, traps, catch pits, manholes etc.

12.17.12 Fuel Arrangement

The construction phase will involve engagement of large number of migrant people in the project area for a limited time. Hence, there will be requirement of fuel for canteen facilities that will be provided in the labour camps and additional fuel requirement for heating etc. The study area around the project site comprises of rural setup with rural population residing in scattered settlements. There is no forest area within 5km of the project site. Rural households in Bangladesh rely primarily on agriculture residues and animal dung. Fuel wood tends to be the dominant fuel in urban areas and is primarily used for cooking[1]. To ensure that the fuel need of labourers in the project area does not interfere with the local requirements, necessary arrangements for supply of fuel wood to the labourers shall be done by the contractor. OPDL-2 shall ensure that contractor purchase fuel wood only from authorized vendors during construction phase.

[1] http://www.fao.org/docrep/w7519e/w7519e08.htm

12.17.13 Solid Waste Management

The municipal solid waste generated from labour camps, mostly comprises of compostable wastes like vegetable matters and combustible waste like paper, cans, plastic and some non-degradable waste like glass/glass bottles. Improper disposal of solid waste will lead to environmental degradation and health hazards to labour as well as community.

The following measures shall be adopted by OPDL-2 for ensuring effective management of solid waste at the campsites:

- The solid wastes of domestic nature generated mainly in the labor sheds shall be collected and stored separately (i.e., without mixing it with construction waste/debris) in appropriate containers within the construction site.
- Separate bins with proper markings in terms of recyclable or non-recyclable waste shall be provided in the labour camps and kitchen premises in sufficient numbers for collection of garbage.
- Food waste and other refuse are to be adequately deposited in sealable containers and removed from the kitchen frequently to avoid accumulation.
- OPDL-2 shall identify the nearest municipal solid waste storage facility and tie up with the concerned urban local body for disposal of waste at frequent intervals.

12.17.14 Medical Facilities

Effective health management is necessary for preventing spread of communicable diseases among labour and within the adjoining community. The following medical facilities shall be provided by OPDL-2 at site for the construction workers:

- A first aid centre shall be provided for the labour within the construction site equipped with medicines and other basic facilities;
- First aid kits shall be provided in the labour camps. The kit shall contain all type of medicines and dressing material;
- A qualified and registered medical practitioner or Pharmacist shall be available during the working hours. Inventory of medicines shall be maintained by the Pharmacist and stocks will be replenished on regular basis;
- An ambulance shall be made available at the site for transportation of injured persons to the nearest Hospital.
- OPDL-2 shall identify and train an adequate number of workers to provide first aid during medical emergencies; and
- Regular health check-ups shall be carried out for the construction labourers every six month and health records shall be maintained.
- Labours should have easy access to medical facilities and medical staff; where possible, female doctors/nurses should be available for female workers; and
- Information and awareness of communicable diseases, AIDS etc. shall be provided to workers.

12.17.15 Inspection of Camp Facilities

Labour camps shall be inspected at frequent intervals to ensure that the construction camp and its facilities are well organized and maintained to acceptable and appropriate standards. The key areas are:

- Daily sweeping of rooms and camp premises shall be undertaken;
- Regular cleaning of sanitary facilities shall be undertaken;
- The kitchen and canteen premises shall be established under good hygiene conditions;
- Cooking or preparation of food shall be prohibited in accommodation quarters;
- Daily meal times shall be fixed for the labour;
- Smoking and alcohol consumption shall be prohibited in the workplace;
- Water logging shall be prevented at areas near the labour campsites and adequate drainage is to be provided;
- Checklists pertaining to the daily housekeeping schedule shall be maintained and displayed at camps, toilets and kitchen.

12.17.16 Grievance Redressal Mechanism

A Grievance Redressal Mechanism (GRM) shall be formulated for the construction labourers comprising of a review committee including representatives elected by labour and management representatives. A documented GRM shall have the following elements:

- Proper system for lodging grievances;
- Provision for raising anonymous complaints;
- Appropriate level of management for addressing concerns;
- Provision for timely action and feedback;
- Monitoring and review of grievances raised and action taken; and
- Scope for continual improvement of the system.

12.18 Waste Management Plan

12.18.1 Introduction

The construction and operation of the power plant will generate large quantities of waste which will need appropriate collection, transportation, primary treatment and disposal in an environmentally acceptable manner and as per the statutory requirements and guidelines provided by Department of Environment (DoE), Government of Bangladesh. The following section provides a waste management plan with an objective to reduce the environmental risk associated with waste generated and stored at project site.

12.18.2 Construction Phase

12.18.3 Waste Type

During the construction phase, various types of waste are likely to be generated:

Construction waste: Solid wastes such as left over construction material, equipment lubricants, sand, concrete, gravel, stone, bricks, plastic, paper, wood, metal and glass, asphalt, pipes, conduits, light steel material etc.

Hazardous waste: Some negligible quantity of hazardous waste may be generated during construction phase of the project comprising of spent oil and lubricants from DG sets (provided at site for power backup) and paint residues during painting of the buildings.
The movement of heavy machinery for site clearance, earth moving, transportation and building erection will also generate waste oil, hydraulic oil, lubricants, paints, degreasers and gearbox oil.

Municipal Waste and Sewage from Labour camps: The municipal solid waste generated from labour camps, will mostly comprise of compostable wastes like vegetable matters and combustible waste like paper, cans, plastic and some non-degradable waste like glass/glass bottles. Sewage will be generated from the temporary labour camps established at the site during construction phase.

12.18.4 Waste Handling, Management and Disposal

The concept of 3 Rest- Reduce, Recycle and Reuse will be adopted to manage the non-hazardous waste generated.

12.18.4.1 Construction Waste Management

- Efforts will be made to reduce the rate of waste generation by adopting efficient construction techniques and limiting waste generating activities. The measures for controlling construction waste may include limiting site clearance activities, planned stocking and gathering of construction materials and equipments, fencing around the construction yard, maintaining existing right of way to carry construction materials, adopting proper sanitation system for employees, banning of waste burning, and quality housekeeping.
- Construction and demolition (C&D) waste will be stored at the construction site in either skips or suitable containers and will be directly emptied at the notified disposal site/sites or transported to an available suitable facility.

- Stock piles of construction materials should be covered in order to protect them from wind and weathering action
- A designated place will be well labelled for waste stocking with appropriate impermeable linings.
- No waste will be stored on river bank or slope. No waste will be dumped into any of the water channels of Meghna River.
- For controlling run off from construction yard and liquid waste, appropriate measures such as provision of a garland drain will be made.
- Burning of waste material should be restricted

12.18.4.2 Quality housekeeping should be maintained by regular inspection and checking

- Initiatives must be taken to reuse and recycle of waste materials.

12.18.4.3 Hazardous Waste Management

- Efforts will be made to keep the non-hazardous waste and hazardous waste segregated at well-defined spaces.
- Hazardous waste will be handled and stored with highest care and safety. Used chemical barrels, waste oil/ used oil from construction machinery, DG sets, generated will be stored in HDPE containers/ drums placed in secondary containment with impervious liners. Such drums/ places will be well labelled.
- Rain protection and fire protection measures will be adopted at the storage spaces and also during transportation of such wastes.
- The collected hazardous waste will be disposed-off through a DoE approved vendor.

12.18.4.4 Municipal Waste Management

Separate bins with proper markings in terms of recyclable or non-recyclable waste will be provided in the labour camps and kitchen premises in sufficient numbers for collection of garbage. Preferably, a two-bin system (Green and Blue) will be installed to facilitate an organized waste management system. The collection and storage procedure will be displayed at identified locations for reference of all workers and contractors. Training on solid waste management procedures shall be part of the induction training for labour. Food waste will be collected separately in covered containers and disposed of in dug pits and covered with soil on daily basis.

It is planned that portable sanitary toilets will be installed at the camp sites. Provision will be made such that for every 10 persons, one toilet is installed. There will be separate toilets for men and women. It is estimated that about 180 KLD of waste water will be generated in peak construction phase from the two labour camps, housing a total of 1000 labours on an average.

The domestic sewage from the labour camps will be treated in a temporary Sewage Treatment Plant (STP).

12.18.5 Roles & Responsibility/ Documentation

- The Site Supervisor assisted with the EHS Manager will make sure that that all solid waste management measures are implemented during the construction phase.

- The EHS Manager will ensure that all the Contractors employed at Site follow good housekeeping practices and no waste stockpiles are seen at non-designated places.
- The EHS Manager to ensure that the housekeeping are well trained and informed about the handling, storage, packing (if any) and transportation of hazardous and non-hazardous waste.
- The EHS Manager to be responsible for obtaining all the consents/ approvals/ NOC related to handling of hazardous waste.
- The EHS Manager will maintain all record of all solid waste types generated on site, quantities and disposal method, recycling options and rates on construction site must be kept. The plant will maintain an inventory of all streams of Solid Waste.
- Site Supervisor in association with the EHS Manager will ensure that the entire construction planning is done in a way that there is minimum generation of construction wastes like concrete, mortars and cement grouts.

12.18.6 Operation Phase

12.18.7 Waste Type

During the operation phase, waste will be generated from different point sources like plant machinery, ESP, Administration building, dormitory buildings, workshops, stockyards, etc
The various types of waste likely to be generated during operation phase include:

12.18.7.1 Non-hazardous solid waste

The non-hazardous solid waste likely to be generated during the operation of thermal power plant includes:

i. **Residual industrial waste**, that is, fly ash and bottom ash-
   On combustion of 5500MT/day of coal at the proposed Power plant, a total of 495 ton of ash will be generated. Out of this, about 445.5 tones (90% of total ash) will be flyash and rest 49.5 tons (10% of total ash) will be bottom ash. About 445 ton of flyash will be trapped in the ESP, which will need to be subjected to consumptive uses within and outside the plant premises.
   Some waste will also be generated from the coal storage yard and belt conveyor facilities, which will need appropriate handling and management.
ii. **Kitchen waste** and general municipal waste generated from the canteen, administration building, dormitory buildings, general trash
iii. **Sewage** from Dormitory buildings and Administration office.
iv. **Inert construction / demolition materials**; refuse, such as metal scrap and used empty containers

12.18.7.2 Hazardous waste

The hazardous solid waste in the form of waste oil, spent ion exchange material and water pre-treatment clarifier sludge will be generated from the power plant.

12.18.8 Waste Handling, Management and Disposal

All kind of solid wastes generated on site will be disposed maintaining DoE's prescribed standards.

12.18.8.1 Flyash Management/ Utilization

From the electrostatic precipitator hoppers, flyash will be conveyed pneumatically (either vacuum system or pressure system) in dry form to storage silos. All efforts will be made for 100% utilization of fly ash during construction of road or embankments. Also, the nearby cement plants in the area will be contacted for a tie-up for sale of ash for its utilization in their plants.

The ash stored in the silos will be loaded onto the specially-designed trucks, through gravity flow. Purging with hot air will be done for dry dust free environment. These trucks will transport the ash to the nearby cement plants for its utilization. In case the cement plant is located beyond 5-7 km of the plant boundary; the fly ash will be transported in covered barges. The ash will be loaded to the barge using an inclined chute with hot air. With their given production capacity, these cement plants can utilise approximately, 2825 MT/ day of ash (25% of their total capacity).

It has been estimated that approximately 457.5 MT/day of flyash will be produced by the proposed Power Plant which can be 100% consumed by these four power plant.

The options for utilisation of residue ash such as use in brick manufacturing, clinker industries, cement industries, compaction purposes are also being explored. At initial stage, the generated ash will be used in land development within the project area.

12.18.8.2 Bottom Ash Management

A slag type wet bottom boiler will be installed in the proposed plant. The bottom ash will be kept in a molten state in the boiler and will be collected in the ash hopper which contains quenching water. When the molten slag comes in contact with the quenching water, it fractures instantly, crystallizes, and forms pellets. The ash pellets will be then stored in an HDPE lined ash pond. The dry bottom ash silo or container system shall minimum have a net capacity of 72 hours production.

12.18.8.3 Hazardous Waste Management

The hazardous and non-hazardous solid waste will be collected and stored in a segregated manner and will not be permitted to mix. Waste oil from pumps and machinery will be collected and stored in used oil barrels and shall be kept in a designated storage area. The contaminated soil and cotton rags will be disposed of at Captive Landfill or an approved secured Land fill as per the legal provision. The waste will be sold to DoE approved vendors. Following measures will be practiced at all times:

a. No scattering or dumping of wastes in the open
b. Segregation of waste in order to facilitate reuse and appropriate disposal
c. Waste bins should be kept on impermeable surfaces and within a contained area
d. All waste receptacles should be appropriately labelled and/ or colour-coded, if required.
e. All waste receptacles should be constructed of steel or other leak-proof material, stored on concrete surfaces; be covered at all times except during loading/ unloading; and provided with suitable weather protection to avoid seepage of rain water.
f. It shall be ensured that every storage location and collection point should be managed and inspected on a regular basis.

12.18.8.4 Municipal Waste Management

A waste storage place should be provided with efficient waste collection and disposal techniques. Solid Waste Storage spaces will be covered and secured.

The plant will provide colour-coded containers in the administration building, office spaces and dormitory area for storing and handling of different kind of Waste.
(a) Green Container - Biodegradable
(b) White Container – Recyclable
(c) Black Container – Other (Inorganic/Hazardous waste)

All metals, scrap and other recyclable materials shall be recycled to authorized dealers and records shall be maintained. The waste will be finally collected and handed over a licensed / authorised (by DoE) waste handler.

12.18.8.5 Sewage from Dormitories and Administration office

A 20 KLD sewage treatment plant will be installed to treat the sewage generated from the dormitories, office and administration building.

12.18.8.6 Management of Other industrial waste

Proper silos will be used to store coal to minimise flying coal dust. Also, a covered conveyor belt will also be used as a preventive measure. To control emission of fugitive dust within and around the coal handling plant and coal stockyard, dust suppression and extraction systems shall be installed.
A blanket of water shall be maintained over the ash pond to control fugitive dust emission.

12.18.8.7 Inert refuse/ Waste

The storage area for stocking waste will have paved flooring, containment bund and roof.

12.18.9 Roles & Responsibility/ Documentation

- The EHS Manager will maintain all record of all solid waste types generated on site, quantities and disposal method, recycling options and rates on construction site must be kept. The plant will maintain an inventory of all streams of Solid Waste.
- The EHS Manager will ensure that various streams of waste generated at site are not mixed together and are stored in a segregated manner. Wastes may be segregated into Biodegradable waste, Recyclable waste and Non-recyclable waste.
    - **Biodegradable waste**: food waste, dry leaves, etc. for composting and reuse.
    - **Recyclable waste**: paper, wood, cotton, reusable hardware, glass, metal scrap, etc.
    - **Non-recyclable waste**: Polythene and plastics which cannot be treated for reuse.
- The Site Supervisor assisted with the EHS Manager will make sure that that all solid waste management measures are implemented during the operation phase.
- The EHS Manager will ensure that all good housekeeping practices are followed and no waste stockpiles are seen at non-designated places.
- The EHS Manager to ensure that the housekeeping are well trained and informed about the handling, storage, packing (if any) and transportation of hazardous and non-hazardous waste.

- The EHS Manager to be responsible for obtaining all the consents/ approvals/ NOC related to handling of hazardous waste.

12.19 Pest Management Plan

12.19.1 Introduction

The Pesticide Management Plan intends to provide a safe and responsible method to use pesticides for control of pest anticipated to affect the project operations or activities. Use of pesticides at the proposed 635MW Dhaka Power Plant Site will be limited to the following activities:

- Landscape maintenance
- Control of pests in cargo area
- Pest control of terminal building and office areas

OPDL-2 will implement an integrated pest management process to manage the following at the project site:

- Reduction of synthetic organic pesticide
- Prevent and minimize impact on environment
- Prevent impact on human health

12.19.2 Need for Management

Use of pesticide is associated with risk of potential contamination of water bodies, causing long term and short term health hazards and hazards to other avifauna in and around the area. Development of a pesticide management plan lays down procedures for:

- Identification of pesticides to be used
- Handling and use of pesticides
- Mechanism to monitor
- Identifying alternatives to pesticides
- Training for employees

12.19.3 Type of Pesticides to be used

The following guidelines will be considered while selection of pesticides to be used at the proposed Power plant site:

- The pesticide use at the proposed power plant site will be limited and the choice of pesticide will be identified based on the local knowledge and need.
- Use of synthetic pesticides will be the last option and other local and biological measures will be explored initially.
- The pesticides will be sourced from a licensed manufacturer.
- The selection of pesticides will consider human toxicity, impact on environment and on other fauna and flora of the Island.
- OPDL-2 will ensure that all products that fall in World Health Organization (WHO) Recommended Classification of Pesticides by Hazard Classes IA (extremely hazardous) and IB (highly hazardous); or Class II (moderately hazardous) are not used for its activities at the proposed project site.

12.19.4 Storage of Pesticides

Proper pesticide storage helps prolonged chemical shelf life while protecting the health of people, animals and the environment. A number of conditions are essential for safe pesticide storage. Some of the measures for storage of pesticide are as follows:

- All pesticides will be shipped and stored in secure containers with clearly identifiable labels in English and local language.
- Pesticides will be protected from temperature extremes during transport.
- The labels on container will indicate the content, expiration date, health hazard and first aid measure in case of accidental exposure or ingestion.
- Pesticide will be stored in a locked and posted area.
- Pesticides will not be transported or stored in common with food or beverages (including potable water).
- Ventilation will be provided to the storage area to keep it relatively free from temperature extremes. Very high or low temperatures can cause pesticide deterioration.

12.19.5 Handling of Pesticide

Danger of exposure always exists whenever handling of pesticides is involved. The greatest risk lies in handling and applying toxic materials and in using concentrated pesticides. Therefore, the applicator must use safety measures and also be familiar with what action to take in the event of a spill, leak or unwanted exposure. The following safety aspects will be considered while handling pesticides:

- Review the label before opening the container and be familiar with the directions. Always wear protective clothing and equipment. Put them on before handling or opening a pesticide container.
- Wear a respirator or appropriate form of eye protection if any chance of pesticide inhalation or eye exposure exists.
- Do not eat, drink or smoke while handling pesticides.
- Pesticide handling area will be identified in an isolated area away from other people
- Pesticides should not be used in areas where a spill or overflow could get into coastal areas or any of the water supply pipelines, wells or tanks
- Use of pesticides in area close to storm water drain, existing wells and along the coastal area will be avoided and incorporate adequate precautionary measures to prevent runoff.
- Provide adequate ventilation and light in pesticide handling area.
- Do not tear paper containers to open them—use a sharp knife or scissors.
- While pouring from a container, keep the container at or below eye level and avoid splashing or spilling on your face or protective clothing.
- Do not use your mouth to siphon a pesticide from a container.
- In the event of any accident occurs, alert the Occupation Health and Safety Office
- Measure accurately, follow label instructions and use only the amount necessary.
- Triple-rinse pesticide containers (if applicable) as soon as they are emptied, some residues can dry and become difficult to remove later.
- Pour the rinse water into the application equipment being used to avoid disposal problems and product waste. Replace container caps and close bags. Return them to the pesticide storage area.

- Avoid use of pesticides if rain is expected.
- Also apply pesticides only when wind speeds are low.
- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- Any incidence of employee falling ill within 24 hours of using pesticides will be immediately notified to the Occupational Health and Safety head.
- Pre-employment and periodic medical examination of employee associated with pesticides will be undertaken.
- Periodically test soils for determining proper pesticide use.

12.19.6 Disposal of Pesticide

OPDL-2 will be responsible for proper disposal of pesticide wastes, such as unused chemicals and empty pesticide containers. Empty pesticide containers are a hazard to ignorant people and animals. Improper disposal of pesticides and rinse water can result in coastal water groundwater contamination and plant damage. Following measures will be ensured during pesticide disposal:

- Quantify and measure the pesticide requirement to ensure excess pesticide mixing to avoid disposal issues.
- Metal and plastic containers should be triple rinsed and the rinse water will be used in the application.
- The containers should be returned to the manufacturer for recycling, or rendered unusable.
- Outdated pesticides should be returned to the supplier or manufacturer whenever possible.

12.19.7 Alternative practice

Alternative mechanism as provided will be explored to minimize and avoid use of pesticides in landscaping activities at the OPDL-2 project site.

- Species-specific, pheromone-based traps or collared sticky cards can be used to trap insects.
- In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of (pruning equipment should be disinfected with bleach to prevent spreading the disease organism).
- Small mammals and birds can be excluded using fences, netting, and tree trunk guards.
- Use pesticides only if there is an actual pest problem (not on a regular preventative schedule).
- Do not mix or prepare pesticides for application near storm drains.
- Fumigation of terminal or other office area will be planned and informed well in advance.

12.19.8 Training

The employees will be trained on the hazards, precautions and procedures for the safe storage, handling and use of all potentially harmful materials relevant to each employee's task and work.

- Training will incorporate information from the Material Safety Data Sheets (MSDSs) for potentially harmful materials.
- All employees engaged and associated with pesticide handling will be trained in environmental, health and safety matters including accident prevention, safe lifting practices, the use of MSDSs, safe chemical handling practices, and proper control and maintenance of equipment and facilities.

- All applicators will be properly trained in handling, mixing, application and disposal of pesticides and product containers.
- All newly trained workers will work initially under the supervision of trained applicators.
- All personnel involved in pesticide handling or use will be trained in emergency response including:
    - Recognition of symptoms of pesticide poisoning
    - First aid procedures for pesticide poisoning
    - Notification of supervision and medical personnel
    - Proper response action for each reasonably foreseeable emergency plan
- The site Safety Officer will develop a training program for the pesticide applicators.

12.19.9 Reporting

- The Safety Officer will maintain a record of all pesticide related occupation illness, spill and other observations.
- Based on records, feedback will be provided by the Safety Officer for improvement in handling and use of pesticides

12.20 Occupational Health and Safety Plan

12.20.1 Introduction

Health and safety issues entailed in the project activities can be categorized under two aspects viz.

i. Occupational Health and Safety; and
ii. Community Health, Safety and Security.

The various potential health and safety issues/risks pertaining to the construction and operation phases of the project have been discussed earlier under the Impact Assessment chapter. A Health and Safety Plan (HSP) needs to be enforced by OPDL-2 to ensure effective implementation of various mitigation measures pertaining to the identified health and safety risks. The HSP has been formulated as per the requirements prescribed under:

i. IFC Performance Standards;
ii. IFC EHS Guidelines (General, Thermal Power Plants and Shipping);
iii. ECR 1997 as amended; and
iv. Applicable national labour laws viz. Bangladesh Labour Act, 2006 and Children's Act, 2013.

12.20.2 Health and Safety Risks

The various health and safety risks as discussed earlier entailed in the project construction and operation phases include the following:

12.20.3 Construction Phase

Occupational Health and Safety Risks

- Shocks and burns associated with electrical equipment usage;
- Possible retinal damage and photo keratitis risks to workers engaged in welding works;
- Ergonomic injuries due to improper working postures etc.;
- Slip and fall hazards associated with working at height (≥2m);
- Possibility of respiratory diseases as bronchitis, asthma, silicosis, asbestosis, cancer etc. to workers who are constantly exposed to particulate emissions in the form of dust, silica, fibres etc. as well as gaseous emissions such as fumes, smoke, acetylene etc. entailed in construction activities e.g., blasting, excavation, concrete mixing, cutting, welding etc.;
- Hearing damage to workers involved in high noise (≥80 dB(A)) activities like blasting, metal cutting etc.; and
- Other occupational hazards such as road accidents and injuries to negligence in PPE usage.

Community Health, Safety and Security Risks

- Accidents due to slip/fall in unguarded excavated areas;

- Spread of communicable diseases viz. HIV/AIDS, gonorrhoea etc. due to influx of migrant labour population;
- Spread of vector-borne diseases viz. malaria due to pervading unhygienic conditions; and
- Improper disposal of solid waste (municipal and construction waste) in around the construction site and associated health and safety risks.

12.20.4 Operation Phase

Occupational Health and Safety Risks

- Worker exposure to non-ionizing EMF radiation due to working in proximity to electric power generators, equipment, and connecting high-voltage transmission lines and associated health impacts;
- Occupational exposure to heat may occur during operation and maintenance of combustion units, pipes, and related hot equipment;
- Continuous exposure to noise from equipment viz. the turbine generators and auxiliaries; boilers and auxiliaries, such as pulverizers; diesel engines; fans and ductwork; pumps; compressors; condensers; precipitators, including rappers and plate vibrators; piping and valves; motors; transformers; circuit breakers; and cooling towers;
- Risks associated with working in confined spaces viz. coal ash containers, turbines, condensers, and cooling water towers;
- Electrical hazards entailed in electrical equipment usage;
- Fire and explosion hazards;
- Chemical hazards; and
- Inhalation of dust from coal and ash loading/unloading areas, storage area, fugitive emissions during coal and ash conveyance.

Community Health, Safety and Security Risks

- Groundwater contamination due to improper disposal of solid waste;
- River water contamination due to disposal of untreated sewage and/or effluent into the river and possible health hazards risk as river water is used by local community for cooking purposes; and
- Risks to local community due to influx of security personnel who are not aware of local cultural beliefs and sensitivities.

12.20.5 Objectives of HSP

The HSP requirements have been formulated under the two aforementioned aspects. The proposed plan aims to achieve the following objectives:

- Effective implementation of health and safety (H&S) risk mitigation measures;
- Avoid and/or minimise the impacts on workers and local communities' health due to various project activities;
- Ensure a safe and healthy working environment for workers; and
- Regular monitoring and reporting of health and safety issues to the senior management and taking appropriate corrective actions if required.

12.20.6 Scope

The HSP is applicable to all OPDL-2 employees, direct as well as contracted workers/labourers employed on the project site. It shall be applicable to both construction and operation phases of the Project. The responsibility of implementing and modifying the plan if necessary lies with OPDL-2.

12.20.7 Occupational Health & Safety Requirements

OPDL-2 shall implement the following measures to avoid or minimize and manage the potential identified occupational health and safety (OHS) risks, in order to ensure a safe and healthy working environment for the employees/workers throughout the project life cycle.

PRE-CONSTRUCTION PHASE

- Contractor bids shall be scrutinised and evaluated on the basis of their existing EHS policies, project track record for finalising the contractor for various works. Contracts shall be awarded to those who conform to the OHS requirements of OPDL-2.
- All contract documents for civil, mechanical and electrical works shall incorporate EHS requirements as *Conditions of Contract* in order to make the contractor clearly aware of the requirements;
- A robust and active onsite **H&S Management Team** shall be established as defined earlier in the HSE Management Organization Structure. OPDL-2 shall appoint competent Site-in-Charge personnel who work in tandem with the safety engineers and EHS supervisor from the contractor's team in order to ensure monitoring and reporting of OHS issues;

CONSTRUCTION PHASE

- OHS issues shall be monitored and reported to the senior management on a regular basis for assessing the efficacy in implementation of the Health & Safety Plan;
- An OHS awareness/training programme shall be undertaken by OPDL-2. Such programmes shall cover managers, contractors and workers in order to make them aware of the possible OHS risks and corresponding mitigation and reporting measures. Training programme shall include mock fire drill, PPE usage training etc.;
- Personal Protective Equipment (PPE) e.g., helmets, safety belts, welding masks, shock resistant rubber gloves, shoes, and other necessary protective gear shall be provided to workers handling welding, electricity and related components. Earplugs /earmuffs shall be provided to workers working near high noise equipment so that their exposure level is within prescribed limits;
- A PPE register shall be maintained to record periodic inspection of PPEs;
- An effective work permit system for hot work, electrical work, and working at height shall be ensured;
- All work at height shall be undertaken in daytime under sufficient sunlight;
- Personnel deployed for working at height shall be properly trained for temporary fall protection devices and use of personal fall arrest systems shall be ensured;
- The premises shall be equipped with adequate number of firefighting equipment (extinguishers, sand buckets and water drums) at strategic locations throughout the project site premises in

order to handle any possible fire outbreak. It shall be ensured that correct class of fire extinguishers are provided. The extinguishers shall be inspected for their date of expiry and replaced on expiry;
- Adequate First Aid equipment shall be provided onsite;
- Loading and unloading operation of equipment shall be conducted under the supervision of a trained professional to ensure adherence to proper ergonomics;
- All lifting appliances (cranes etc.) shall be thoroughly examined by a competent person, prior to engagement with the project. Lifting machinery shall be equipped with a legible, durable load chart that shows the manufacturer's recommended load configurations and maximum load weights;
- The contractor shall ensure that no person is engaged in driving or operating lifting appliances unless he is sufficiently trained, competent and reliable, possesses the knowledge of inherent risks involved in the operation and is medically examined periodically;
- A designated storage area with proper cover shall be provided for storage of High Speed Diesel (HSD). Such area shall be properly marked, situated away from welding and other construction activity area, and provided with flame proof electrical connection;

OPERATION PHASE

- Company as well as contractor owned vehicles operated in the project premises shall be maintained regularly. It shall be ensured that such vehicles comply with national traffic norms, are driven by licensed drivers, and are in possession of valid pollution under control (Puce) certificate issued by the Motor Vehicles Department as per the applicable national legislation.
- Warning signs shall be put up near excavated sites, diesel storage areas, high temperatures surfaces, hazardous waste storage areas etc.
- Equipment generating high noise (e.g., DG sets) shall be equipped with acoustic enclosures to ensure exposure of workers to noise levels within prescribed limits. Sound-insulated control rooms with noise levels below 60 dB (A) shall be provided.
- Overall hygiene shall be ensured on the premises through regular washing, mopping and cleaning to prevent accumulation of coal dust on floors, ledges, beams, and equipment;
- Dust extraction and dust handling systems shall be installed to reduce fugitive dust emissions;
- Adequate ventilation shall be provided in work areas to reduce heat and humidity;
- Adequate First Aid equipment shall be provided onsite;
- An accident reporting and monitoring record should be maintained. The objective shall be to minimize such occurrences in the future and attain zero accidents; and
- Accident compensation shall be provided to the workers/ worker's kin(s) as the case maybe as per the requirements of the national law.
- An EHSS (Environment, Health, Safety and Social) Audit shall be undertaken by a 3rd party audit agency on a yearly basis for assessing the project's compliance to the applicable legislations. An Audit Report and proposed corrective measures to be taken by OPDL-2 shall be submitted to US Ex-IM Bank.

12.20.8 Community Health, Safety and Security Requirements

It shall be ensured that besides the aforementioned mitigation measures, the following are implemented by OPDL-2 to avoid or minimise the impacts on community's health, safety and

security owing to project activities. The measures have been formulated as per the requirements prescribed under ***IFC PS 4: Community Health, Safety and Security***.

CONSTRUCTION PHASE

- A boundary wall shall be constructed along the periphery of the proposed project site in order to prevent straying of cattle into the site. Security personnel shall be deployed at various entry gates to monitor and record the entry and exit of vehicles, workers and employees. They shall also prevent any indiscriminate entry of local community into the project premises;
- Excavated areas shall be guarded and provided with warning signs to alert people moving nearby;
- Proper treatment and disposal of sewage generated from construction camps shall be done as untreated sewage poses increased risk of malaria and other vector-borne diseases to the labourers as well local communities. Fumigation of the local area shall be undertaken by OPDL-2 especially during monsoon;
- Water logging and open garbage dumps shall be avoided as they serve as breeding ground for mosquitoes. Overall hygiene and cleanliness of the area shall be maintained through regular cleaning, mopping and washing with disinfectants;
- Workers shall be trained for keeping their surroundings neat and clean;
- It shall be ensured that transmission of communicable diseases (malaria, cholera, typhoid, hepatitis A, HIV/AIDS, gonorrhoea etc.) associated with influx of project labour is avoided or kept to a minimum. Training programmes pertaining to the same shall be conducted by OPDL-2.
- Effluent shall be treated prior to disposal to the extent such that it's in compliance with prescribed discharge standards. It shall be ensured by OPDL-2 that effluent disposal does not degrade the river water quality as it's used by the local community for cooking purposes.
- Hazardous substance (e.g., used diesel oil) storage areas shall be properly demarcated and marked. Access to such areas shall be restricted and entry by outside public shall be prohibited;
- It shall be ensured that no untreated sewage and/or MSW generated from labour camps are disposed into the river or left out in the open in a way that the runoff can contaminate the river or ground water.
- It shall be ensured that MSW or hazardous waste landfills are properly lined in order to prevent ground water contamination due to leachate percolation as ground water is the only source of drinking water for the local communities.

OPERATION PHASE

- Security personnel shall preferably be recruited from the local community as they will be aware of local cultural beliefs and sensitivities. Otherwise, they shall be trained and sensitized about the local cultural scenario. Migrant labourers if any shall also be involved in such awareness programs;
- Site-in-charge appointed by OPDL-2 shall monitor and regularly report to senior management the issues pertaining to community health and safety;
- Health check-ups of workers as well as local community members shall be conducted by OPDL-2 at regular intervals to monitor their well-being. Such check-ups should also include vaccination against common diseases such as Hepatitis B, typhoid, cholera etc.; and

- Local community engagements shall be undertaken by OPDL-2 site team through public discussions at regular intervals for addressing their health and safety concerns. Such engagements shall also as serve as a tool for assessing the efficacy in implementation of mitigation measures and identifying the scope for their modification/ necessity of corrective actions if any.

12.20.9 HSP Implementation

The implementation of HSP can be classified into 4 stages namely:

- **PLAN:** This refers to formulating a HSP by the H&S Management team, tailored according to the potential occupational and community health and safety risks pertaining to the project activities.
- **IMPLEMENT:** Implementation of the mitigation measure requirements as suggested under the proposed HSP. The senior management i.e., Head Office Team of OPDL-2 shall supervise that the mitigation measures are implemented by Site Team in coordination with Contractor team.
- **MONITOR & REPORT:** The appointed Site-in-Charge shall be responsible along with EHS engineers, safety supervisors etc. for monitoring the implementation of mitigation measures. He/she shall report the results of the implemented measures on a regular basis to senior management staff. The documents or records that shall be maintained by onsite OPDL-2 staff for monitoring and reporting purposes include the following :
    1. Records of OHS trainings undertaken such as mock drill etc.
    2. PPE register
    3. First aid box records
    4. Work permit records for hot work, electrical work and work at height.
    5. Accident reporting and monitoring record.
    6. Detailed record of security personnel deployed onsite
    7. Records of health check-ups and vaccination exercises undertaken.
    8. Detailed record of community engagements including concerns raised, replies given by OPDL-2 staff and proposed actions to be undertaken.
    9. Audit reports of yearly EHSS Audits
- **DECISION MAKING:** The senior management staff shall assess the efficiency of implemented measures and decide if there's a need for additional measures. It shall include in the HSP, the additional measures as identified necessary. OPDL-2 shall interact with its onsite project staff on a regular basis to assess the extent to which proposed mitigation measures being implemented are effective, identify the scope for changes and subsequently take appropriate decisions.

12.20.10 Training Module

AECOM recommends that the following training programmes/modules shall be implemented by OPDL-2 onsite staff on a regular basis for apprising the project staff and workers about management of H&S risks entailed in the project activities. These are generic training programmes. OPDL-2 may customise the programmes and/or undertake additional training programmes pertaining to project activities as identified necessary. The implementation of training modules shall be supervised by OPDL-2 Head Office Team.

Table: Proposed Training Modules

S.No.	Training	Frequency	Description	Responsibility
1.	Induction Training on Health and Safety	-	All OPDL-2 staff and contractors at the time of joining/engagement	Site-In-Charge
2.	Tool Box Training	Daily	Held at each work location by foreman of contractor to discuss day's activities and specific hazards	Contractor
3.	Foreman Safety Training	Fortnightly	Review safety performance for week Discuss safety for upcoming operations	Contractor
4.	Mass Training	Monthly	Presentation of significant safety issues	Senior EHS Manager
5.	Special Job Hazard Training	Half Yearly	Training about safety measures to be incorporated related to specific jobs	Contractor
6.	Safety Bulletins	Weekly	Specific issues Visible through jobsite for constant awareness	Contractor
7.	Fire Safety	Half Yearly	Presentation of fire safety measures	Contractor
8.	Emergency Response Plan	Half Yearly	For emergency preparedness	Contractor/OPDL-2
9.	First Aid	Half Yearly		Contractor

12.21 Livelihood Restoration Plan Emergency Preparedness and Response Plan

12.21.1 Introduction

12.21.1.1 Purpose and Scope of the Livelihood Restoration Plan

Purpose

The purpose of the Livelihood Restoration Plan (LRP) is to ensure entitlements for the project affected communities and persons are prepared in a transparent, consistent and equitable manner, define the mitigation measures for possible economic displacement, identify the project affected families and persons that require assistance other than cash compensation to restore livelihoods and establish monitoring and evaluation mechanisms to implement it.

Scope of Work

The LRP is prepared by AECOM based on the following frameworks of undertaking a site visit and understanding the project life cycle and its impact on project affected communities through the conduct of holding focus group discussions with the project affected households and its surrounding areas.

The scope of the LRP will provide the following key components:

- Brief description of the applicable Standards and Regularity Requirements
- Identification of Project affected Area
- Benefits of the Project
- Potential Impact and Appropriate Mitigation Measures
- Public Disclosure and Consultation
- Livelihood Restoration Plan
- Procedures for Grievance Redressal Mechanism
- Arrangement for Monitoring and Evaluation
- Implementation Schedule

12.21.1.2 Livelihood Restoration Principles

The focus of the LPR is to ensure that the socio-economic status of affected households is improved. On the one hand, this will be undertaken by providing cash assistance or a transition allowance to provide relief from immediate loss of income, to certain vulnerable sections of the affected community. While on the other hand, to provide the affected households with options for income generating programs (IGP) and/or training facilities to enable them to rebuild their economic base. The mechanisms and amount of assistance will be determined by way of developing a family level assistance/ entitlement package that accounts for the losses suffered by the family as well as its ability to make effective use of the assistance. This will be undertaken by providing benefits under LRP to the most eligible persons in the affected household on the basis of their loss of asset and vulnerable groups among the affected households.

For the purpose of implementing the benefits under this livelihood restoration plan, the following principles or eligibility criteria will need to be adopted which includes:

- Loss of complete land holdings (agricultural land) to the project will be given utmost priority
- Loss of partial land holdings to the project will be given second priority
- Vulnerable groups amongst the affected households will also be given second priority
  - Vulnerable males and females above the age of 60 years
  - Women headed households
- Impact of the project on the surrounding areas

12.21.1.3 Limitations

The livelihood restoration plan developed by AECOM is based on a sample survey of 20% affected households and the focus group discussions conducted with the communities in the project affected village and its surrounding areas during the site visit.

During the course of information collection, AECOM has attempted to independently assess the potential affected communities within the limits of the established scope of work as described in the proposal.

The Assessment is based on the documents made available, discussions with stake holder and observations from the site survey conducted. Wherever AECOM has not been able to make a judgment or assess any process, it has highlighted that as an information gap and suggested a way forward.

12.21.2 Applicable Standards and Regularity Requirements

This section refers to the national laws, policies and regulations pertaining to livelihood restoration with respect to land acquisition in Bangladesh and IFC Performance Standard requirements.
As the said land required for the project is being based on a willing buyer/willing seller arrangement, the land laws in Bangladesh are not applicable in this case.

Since the Project is funded by US Ex-Im Bank, it has to comply with the World Bank Group/IFC Policies as well as the Equator Principles. The policies and principles related to land acquisition are described in the following:

The IFC Policies

For social aspects of the Project, certain basic documents of World Bank Group Policies and Guidelines were considered. These reference documents are as follows:

- IFC Sustainability Framework 2012 edition
- The Operational Policy (OP) 4.12 issued on December 2001,
- The Performance Standard 5: Land Acquisition and Involuntary Resettlement updated in January 2012,

- The Guidance Note 5: Land Acquisition and Involuntary Resettlement which is updated in January 2012
- IFC's Handbook on Preparing a Resettlement Action Plan utilized in the preparation of LRP

The main objective of these documents is to ensure that potential adverse impacts on the community are mitigated through planning. The basic aim of the policies are to satisfactorily compensate the loses of people who were obliged to displacement due to physical or economic reasons and, endeavouring as much as possible to enhance the living conditions and means of livelihood of the people who are affected by a project. Considering these core issues, the following policy objectives of OP 4.12 are taken into account:

(a) Involuntary resettlement should be avoided when feasible, or minimized, exploring all viable alternative project designs.

(b) Where it is not feasible to avoid resettlement, resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to enable the persons displaced by the project to share in project benefits. Displaced persons should be meaningfully consulted and should have opportunities to participate in the planning and implementing of resettlement programs.

(c) Displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher."(WB, OP 4.12, p.1)

In compatible with these principles, the Orion Power Unit-2 Dhaka Limited (OPDL-2) Project has avoided involuntary resettlement of the affected population. Thus, no physical displacement was required for the local communities due to the land procurement needed for the OPDL-2 Project. Rather, local people are only subjected to economic displacement as a result of the Project.

According to OP 4.12, where domestic law does not meet the standard of compensation at full replacement cost, compensation under domestic law is supplemented by additional measures necessary to meet the replacement cost standard. In order to meet this requirement, OPDL-2, paid compensation, through open and transparent negotiations with affected households as per the market prices.

In addition to these, the related policy frameworks require the Project Proponent to handle the process by taking the vulnerable groups into consideration. This vulnerability may be about social parameters such as elderliness, being a widow head of household and also may be about property based issues such as being a shareholder.

The Equator Principles

The Equator Principles Financial Institutions (EPFIs) adopted a set of policies issued in 2006 and developed for determining, assessing and managing social and environmental risk in project financing to ensure that the projects financed by the EPFIs are socially and environmentally responsible. Accordingly, they point out significance of the Principles to the borrowers, as being responsible for the planning and implementation of the Project activities so that negative impacts on

project-affected ecosystems and communities can be avoided where possible, and if these impacts are unavoidable, they should be reduced, mitigated and/or compensated for appropriately (EP, 2006, p.1).

According to the EPs, projects should be classified by potential risks and impacts and conform to the social and environmental performance standards of IFC. The standards will be used for the assessment of the risks and impacts resulting from the project and will also be assessed in compliance with the national laws and regulations. This assessment is needed to design and implement project specific action plans and management systems, which will help to describe necessary actions for implementation of mitigation measures.

The EPs state that for projects with significant adverse impacts, the process will ensure the free, prior and informed consultation with affected communities and facilitate their informed participation as a means to establish, to the satisfaction of the EPFI, adequately corporate response (EP, 2006, p.3).

12.21.3 Benefit of the Project through Corporate Social Responsibility

Inclusive of the potential positive impacts that will take place in the area due to the project activities, there are certain activities which will be undertaken by the project proponents as part of their corporate social responsibility (CSR) that will be initiated for the development of the area. A specific budget will be allotted by the project proponent to undertake the activities associated with proposed CSR activities. The benefits that can be meted out by the project proponents have been mentioned below.

- Alternate source of employment: The project besides creating direct employment for the population (study area villages), indirect employment opportunities in terms of contractors, transport of equipments, value added services, tertiary service sector and independent small scale enterprises will also be generated in the area. This will benefit the local population in the long term and create a source of generation of sustenance for them.

- Skill Development: Vacancies will be made available in the construction and operation phase for the population belonging to the study area villages. Direct and indirect jobs including construction jobs during the 45 month period will need to be filled. With these vacancies, skill development will be a major factor in making the population employable. Training centres catering to specific skill sets required for operating the thermal plant is necessary. The project proponent should be responsible in training individuals in the area to make them eligible to take up jobs in the thermal plant.

- Drinking Water Facilities: Water in the area being brackish, pure drinking water has been one of the main concerns of the people in the area (Study area villages). In the public hearing, the project proponents mentioned that they would invest in deep tube wells in the area to supplement the lack of drinking water facilities in the area.

- Social Forestry: As part of the project proponent's requirement of developing the area, a major aspect of their work would be focused on developing 30% green belt around the plant area. This can be initiated through the social forestry programme which would involve the participation of the local population (project affected village) in the management of this

programme, thus bringing about closer relationship between the local population and project proponent.

- Educational Services: With the trickling down of development effect to other sectors, educational services in the area would be eventually developed. The families of the people employed in the plant will move to the area thus, projecting development of schools and transport services to schools to other areas. This will indirectly benefit the local population of the study area villages as well. As part of the CSR initiative, the project proponent can provide services and aid to the existing schools in the area in terms of infrastructural aid, reading room, science camps, health camps, environmental camps and in addition, encourage the Government to open schools of high school level in the area.
- Health Services: The project proponent at the onset can provide services in terms of funds and medicines to the existing public health centres (PHCs) of the study area villages. In addition, to build up the existing PHCs, they can encourage the local population to take up courses in nursing, paramedics, pharmacy, mid wife etc. by shortlisting the candidates and funding their education. In addition, mobile health vans can be introduced in the area with a set of medical professionals accompanying it so that the neighbouring population can be benefitted by this step. In the long term, ambulances and diagnostic centres can be developed in the area as well.
- Vocational Centres for women: Vocational centres providing skills like tailoring, pickle making, mushroom cultivation, handicraft making etc. can be introduced in the area to give a platform to the women population to engage themselves in other areas besides household activities. This step will bring about women empowerment wherein effects will be noticed in areas like employability, education and health aspects thus, bringing them at equal par with their male counterpart. The prospects of women becoming decision makers by being financially independent will change the gender role in the community and secure their place in the workplace and family alike.

The proposed CSR activities should be planned every year along with the proposed budget detailing out the activities to be undertaken. These activities should be undertaken by a social division which should fit within the organizational structure of the project proponent. Collaboration with Non-Governmental Organizations (NGOs) in the villages should be undertaken to initiate the implementation of these activities and for its eventual success.

In addition, to the above mentioned benefits, it is important to inform the project affected households on how to invest their money in the area that would bring an annual return similar to their lost land. Once the households gain cash, the first response is to spend it. Household investment alternatives depend on how much cash the households gain for investment. It is important that households focus on at least two investment items in order to hedge possible losses due to a poor agricultural season or illness with livestock. In order to do this, households should be guided on an array of investments and land replacement options in the project area to avoid the risk of falling into poverty trap.

12.21.4 Livelihood Restoration Plan

12.21.4.1 Preparation

The OPDL-2 Project will need to undertake some preparatory activities prior to actual implementation of the LRP to ensure its effective execution. These preparatory activities will include, but not limited to identification of all the beneficiaries (here affected persons and households), share information and educate the affected persons and community on various Livelihood Restoration Plan (LRP) activities (training and vocational options, sources of funds, assistances by OPDL-2), Identification and engagement of agencies for providing training and/or financial assistance, identification and engagement of Non-Governmental Organization (NGO), etc. The details of the preparatory activities are described in the following sub-sections.

12.21.4.2 Livelihood Restoration Activities

The construction activities are yet to commence in the OPDL-2 plant. The construction activities are expected to be completed in 45 months. During the construction phase, a number of contractors will be engaged for undertaking various activities. The contractors will bring along skilled labour force. However, a large number of un-skilled and semi-skilled labour would also be required, the supply for which can be met locally from the vicinity of the project area. Moreover, such employment opportunities for un-skilled and semi-skilled labour are temporary in nature, as it will be available until completion of the construction phase. Thus, this opportunity is not sustainable and should not be considered as part of livelihood restoration. Yet, consorted efforts are needed in order to provide the members of the affected households with long term and sustainable sources of employment or such training facilities that will make them self-reliant and are able to engage themselves in self-employment.

As the land procurement process is still underway, a social survey is recommended to be undertaken once the land procurement process is completed so as to ascertain the total project affected households who have been affected due to the process of land acquisition. As per the current available data, 76 cumulative land titleholders have sold their land. Among these, there are both Muslim and Hindu affected households.

The focus of the Livelihood Restoration Plan is to provide options for vocational training programs for development of entrepreneurial skills for self-employment and/or employment opportunities to the most eligible persons on the basis of their educational qualifications and the most vulnerable among the affected households. Priority of this should be first given to the land contributors of project affected villages (Bhati Balakia and Char Balakia) and vulnerable groups among the affected households.
In addition, extension of these programs should be given on second priority to the surrounding areas around the project site.

The goal of the LRP is to concentrate on activities like creating a skilled labour force in the local communities near the Project area, offer employment opportunities in the region for unskilled labour force and skilled labour force, if available. Foster entrepreneurial activities and pave the way to encourage income generation from non-agricultural sectors which is unfamiliar to the Project Affected Village, minimize the adverse impact of land loss and create alternative mechanism to

ensure sustainable income sources for the Project affected Village, to advice the Project affected households to gain a return similar to agricultural income from land in order to avoid falling into poverty, to support the educational and health services and enhance elements of community building.

The list of activities that can be considered by the project proponents as part of the LRP has been detailed below,

Table 12-5 : Recommended Livelihood restoration measures

Livelihood	Technical Assistance	Business Assistance
Employment in OPDL-2's Munshiganj Thermal unit. Employment Preference to Project affected Families.	OPDL-2 shall give preference for employment within its thermal unit, to members of PAFs. In addition, OPDL-2 shall provide preference to members of PAFs, in all activities in the **livelihood development program**, as entailed below.	
Aquaculture Fishing is highly common in the project influenced area, and it is done as both, main and supplementary occupation. With Fish being a staple diet in Bangladesh, there is big market for river as well as sea produce. Tables 5.3 and 5.34 provide the list of common fish found in rivers adjoining area of project influence.	Short term course, comprising of weekly classes on technical know – how. Assistance in creating aquaculture ponds and its ambient mineral, nitrogen and oxygen levels. Supervision over maintenance of aqua culture ponds. Provision and technical knowledge of Special fish feed. Fish/ shrimp breeding techniques.	Provide a business and marketing strategy in the following manner: Assist in creating a Mauza based cooperative to manage the sale of fish/ shrimps. Assist the cooperative in pricing of produce. Connect the cooperative with market players. These could be factories that tin and preserve fish, prepare pickles or suppliers of frozen fish to markets. Assist the cooperative in managing accounts, profits and demands in the market.
Agriculture The common crops grown in the project influenced area are potato, mustard, sesame and peanuts. A substantial proportion (approx. 70%) of households in the area grow crops as either their main or secondary occupation.	Provide technical know – how on best farming practices such as crop rotation and in maintaining soil quality. Provide farmers technical knowledge on creating and using alternative fertilizers such as compost manure. Provide technical knowledge to farmers in harvesting water for their farms.	Assist farmers in procuring good quality seeds at minimal costs. Assist farmers in creating compost farms/ compost units. Assist farmers in connecting with purchasers, and sell produce at optimal costs. Assist farmers in pricing their produce.

	Provide farmers intuitional support for storing their farm produce (such as silos, freezers etc.)	
Traditional craft The following crafts are traditional to Bangladesh. - Shola Craft - Jamari work - Baluchhudi work - carpet weaving - Bamboo craft - Pottery work	Set up Craft centres in the project affected Mouza and equip it with required tools/ instrument/ machines for existing craftsmen. Provide short term courses to interested community members enhancing their skill set.	Provide a business and marketing strategy in the following manner: • Assist in creating a Mouza based cooperative to manage the sale of traditional craft. • Assist cooperative in procuring raw material at minimal possible cost. • Assist the cooperative in pricing of product. • Connect the cooperative with market players. These could be NGOs or government agencies that purchase and sell Bangladeshi Traditional craft. • Assist the cooperative in managing accounts, profits and demands in the market.
Non traditional work: Other than agriculture and fishing, the following occupations were reportedly preferred and followed by the Mouza youths. - Nursing - Stitching - Electrical works - Carpentry	Open training centres in affected Mouzas and run short term Diploma courses for interested community members (at minimal cost).	Provide preference to trained community members over outsiders in employment within project. Assist trained community members in procuring employment outside of project.

12.21.5 Public Disclosure and Consultation

The IFC's manual on stakeholder engagement[2], emphasises on the broader meaning of 'engagement' with stakeholders that are external to the company's core operation. It has strongly pushed for understanding 'engagement' as a continuous process between the company and the impacted community members, spanning over the life of the project and bringing sustainable development to the community. Hence, the paramount focus of the Stakeholder Engagement Plan is to provide OPDL-2 with measures and tools for efficient information disclosure, addressing grievances, identifying project relevant issues, assessment of community needs and livelihood restoration.

Finally, the Engagement Plan has been prepared with the intention of creating a continuous and clear process of communication between OPDL-2 and all its stakeholders and foster partnership amongst them in making the development beneficial for all.

[2] Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets.

12.21.5.1 Need for Stakeholder Engagement

Ex-Im Bank Requirements

Ex-IM Bank adopted the Organisation for Economic Cooperation and Development (OECD) '*Common Approaches for Officially Supported Export Credits and Environmental and Social Due Diligence*' in 2007 which was further revised in 2012 upon the recommendation of the Council on the Common Approaches. Adherence to the Common Approaches is intended to ensure consideration of the environmental effects of projects on a consistent basis among the major Export Credit Agencies (ECAs). Consequently, Ex-IM Bank's Environmental and social due diligence procedures and guidelines requires a Social Impact assessments study to be carried out prior to commencement of the project. More importantly this has to be followed by a Social Management plan, of which an important aspect is efficient stakeholder engagement.

Compliance with Equator Principles

Principle 2 of the Equator principle mandates an Environmental and Social Assessment for all Category A and Category B Projects, wherein the assessment documentation should propose measures to minimise, mitigate, and offset adverse impacts on the affected populations. **Principle 3** calls for compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues. Bangladesh being a Non-Designated Country, the Assessment process evaluates compliance with the then applicable IFC Performance Standards on Environmental and Social Sustainability (Performance Standards) and the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines).

Subsequently an Environmental and Social Management System, for category A and B projects, has to be prepared in concordance with the **Equator Principle 4**. This includes an Environmental and Social Management Plan (ESMP) which shall address issues raised in the assessment study. Subsequently, **Equator principle 5** requires the client to demonstrate effective Stakeholder Engagement as an on-going process in a structured and culturally appropriate manner. This includes informed consent, information and participation process, tailored to the risks and impacts of the Project, the Project's phase of development, the language preferences of the affected Communities, their decision-making processes and specific needs of disadvantaged and vulnerable groups.

Compliance with International Finance Corporation's Performance Standards

The International Finance Corporation provides guidelines for enhancement of development and reduction of adverse risks, in the form of performance standards. The importance of stakeholder engagement can be seen underlined by **performance standard 1**, where the necessity of stakeholder analysis, information disclosure, consultation, informed participation and grievance redressal has been emphasised on. Stakeholder Engagement is also an important element towards achieving **PS 4** (safeguarding of community health, safety and security) and **PS 5** (physical and/or economic displacement resulting from land acquisition, land rights and land use rights of the project affected community). It may be noted that since there are no tribes or indigenous population within the project area of influence, performance standards 7 (Rights of Indigenous People) has not been triggered in this project.

It is in this context that the stakeholder engagement plan has been prepared; kept in tandem with the national policies and guided by the performance standards and Equator Principles. The plan has been prepared to be used as a tool for implementing and measuring development related programs, livelihood restoration and ensure constant communication amongst all stakeholders.

12.21.5.2 Components of Stakeholder Engagement

The IFC describes Stakeholder engagement as an umbrella term which encompasses a range of activities and interactions over the life of a project. These are divided into eight components as indicated below.

- Stakeholder Identification and Analysis
- Information Disclosure
- Stakeholder Consultation
- Negotiation and Partnerships
- Grievance Management
- Stakeholder Involvement in Project Monitoring
- Reporting to Stakeholders
- Management Functions

In addition to these, methods and timeframe used in an engagement process provide it a practical strategy and implementable as a plan. These have been discussed in detail in section 3.

12.21.5.3 Identification of Stakeholders

Stakeholders have been identified based upon levels of project related adverse impacts on them, interests in the project and their vulnerability; details of which are provided in Table 12-6: Table.

Table 12-6: Table Identification of Stakeholders

Stakeholders	Description	Summary of Positive Impacts	Summary of Negative Impacts	Degree of Impact
Land Sellers (Households who have contributed to project procured land)		Land was purchased on a willing buyer – willing seller basis, at a negotiated rate. The Land sellers have gained from compensation that they have received for their land.	The land sellers have lost a significant source of their livelihood.	Direct
Affected Sharecroppers (Sharecropping Farmers who previously worked on land procured for project)	Sharecropping is a unique system of barter wherein a farmer works in the field of another, in return for a share of the crop or another commodity. It is a form of barter since no money is exchanged for any service rendered. This group includes sharecroppers who would have been cultivating the project land, before it was procured, and due to lack of land rights were not entitled to compensation.	No specific Positive Impact	Affected sharecroppers may not only have lost s significant source of their livelihood, but also not been compensated for it.	Direct
Fishermen from project influenced villages	An estimated 35 percent of the population from the affected villages draws its main sustenance from fishing and allied activities. Not only do the local fishermen throw	No specific Positive impact	The fishermen from of Char Balakia, Bhati Balakia and Goail Gaon shall be impacted as their main source of livelihood is likely to suffer. The fish population is likely to be	Direct

Stakeholders	Description	Summary of Positive Impacts	Summary of Negative Impacts	Degree of Impact
	nets to catch fish, they create a form of natural nest with water hyacinth and bamboos to do aquaculture and meet the high demand of fish.		affected during the construction and operation phase of the project, due to increased commercial activity, and discharge of hot water into the river.	
Population from the affected villages.		The local population Shall gain from an increase in employment opportunities due to project inception. With onset of commercial activity, an increase in local businesses is expected. Access to essential amenities such as transportation, electricity, health care etc. is expected to improve and contribute to the overall development of the community. With the inception of the project, land valuation is expected to increase in the future.	The community members from Bhati Balakia, Char Balakia and Goail Gaon would be affected during both, construction and operation phase. The community is likely to face security and health issues from the migrant labour, in addition to pollution generated due to construction and operation activities. Gender issues may become compounded in this aspect. There shall also be a strain on the existing village utilities, such as drinking water, sanitation, food produce etc. The prices of daily commodities may also fluctuate due to influx of labour. Preference towards certain	Indirect

Stakeholders	Description	Summary of Positive Impacts	Summary of Negative Impacts	Degree of Impact
			communities over others for labour, business or CSR initiatives could result in communal disharmony.	
Vulnerable groups	This group includes marginal sharecroppers, marginal farmers, women headed households and disabled persons from the affected community.	This group can benefit due to the special focus on them for development activities. This would help improve their socio – economic status.	Difficulties in seeking agricultural labour work due to absence of cultivable land now. Might face aggravated economic hardships. May face discontentment, disharmony and/ or security issues from the influx semi skilled/ unskilled labour.	
Local Government organizations	These include the Union Parishad, local government engineering department and the village councils.	Responsibility of monitoring commercial activity and associated development in the project affected region. Opportunity of leveraging on project related development, to improve the overall quality of life in project affected villages.	Vigilance in making sure that rights of community, especially vulnerable groups, are not violated. Vigilance in making sure that required environmental standards are maintained and not violated.	Indirect
Local Non Government Organizations, Community		Possible opportunity of partnering with OPDL-2 towards implementation		Indirect

Stakeholders	Description	Summary of Positive Impacts	Summary of Negative Impacts	Degree of Impact
Based Organizations		of CSR / Livelihood Restoration plan.		

12.21.5.4 Methods of Stakeholder Engagement

There are several community engagement techniques that can be adopted for disseminating information, consulting them, ensuring their involvement in community projects, grievance redressing and gaining useful feedbacks on the engagement process.

12.21.6 Information Disclosure meetings & notices

Information Disclosure techniques include circulating notices to administrative officers, local leaders and other persons who shall disseminate the information to local people. In addition, the notices may be put up at public places, such as local schools, markets and government offices. The medium of language must be local; Bangla in this case, and easy to grasp.

12.21.7 Group Discussions

This involves group meetings tailored to suit the needs and convenience of stakeholders and could include meetings with the local self government members, traditional and religious leaders, one to one meeting with elected village leaders, Self Help Groups, the NGO etc. Group discussions are unstructured and unguided unlike focus group discussions, and are useful in understanding the opinions and ideas of participants.

12.21.8 Focus group discussions (FGDs)

The FGDs are effective in understanding the needs, understanding, perceptions and level of knowledge of stakeholder groups, as a precursor to launching development activities amongst them.

A group of people are channelled towards certain topics so that their perceptions, opinions, beliefs and attitudes pertaining to those topics may be understood. The FGDs need moderators who guide the discussion and ensure everyone has a chance to voice their opinion. At the same time natural group dynamics are allowed to culminate and become visible as attitudes and perceptions can then be observed. The ideal size of a group varies from 6 to 12.

12.21.9 Workshops

Although workshops are mostly conducted for capacity building, they may be combined with FGDs to help facilitate decision making, prioritizing of community needs and collectively bring solutions to sensitive social issues.

Like FGDs, workshops would be best suited to groups with whom some development activities such as trainings, capacity building, skill development etc are being done. FGDs and Workshops are ideal tools of engagement at later stages for community development.

12.21.10 Open days

The concept of open days makes the company denote one day of the week to the public and allows anyone to come to the site office and interact with senior level management directly. for

convenience sake, the company may keep the day same for every week It is an effective way of communicating a message that despite other means of communicating with OPDL-2, the community will additionally have access to the site office and opportunity to interact with senior level personnel. This method is useful in addressing one time complaints, sensitive issues and small grievances.

12.21.11 Participatory Rural Appraisal Methods

In Participatory Rural Appraisal (PRA) methods, simple methods using local tools to help community members tackle common issues and reach consensus on common matters.

A popular method is the Venn diagram (also called the *Chappatti* diagram) which is used to help rural communities prioritise their development needs. Another method is that of Polling, which facilitates a smooth decision making process. For example, 4 household utensils representing 4 different choices may be placed in a group meeting. Each participant may cast a vote with grain seeds/ chalk pieces provided to them beforehand.

These set of methods require time and patience, but can be very useful for focused development activities with women's self help groups, children etc. PRAs are excellent as an aid in facilitating community decisions over common resources.

12.21.12 Information Disclosure

Stakeholders have an understanding of the project environmental and social risks, impacts and opportunities when relevant project information is disclosed in an accurate and timely manner. In order to involve the stakeholders and to maintain an open communication process during the entire life of the project, the aim of disclosing information should be:

- To provide the local communities a schedule for the meetings and information on activities related to the proposed project activities along with the mechanism for their feedback.
- To enhance the knowledge of the communities about the proposed plant, the changes being incorporated and the expected performance.
- To publicise the company's commitment in ensuring the best practices in terms of environment protection and health and safety for workers and contractors.
- To make the public aware about the grievance redressal mechanism so that the feedback of the public can be accounted for and accordingly addressed.

In ensuring transparency and openness of information regarding the activities pertaining to the operating facilities and mine, Orion should implement the following steps:

- A one page information leaflet document in Bangla language is to be prepared and distributed in the villages located within the immediate vicinity of the proposed plant site area. The leaflet will contain information regarding the proposed plant and the number of months involved in the construction phase as well as indicate Orion's website and contact information lines for communication at the site offices.
- Orion will be responsible to display all information about the proposed project on the company's website. Information will be made available in Bangla and English.

The following documentation should be made available to the public and displayed on the website and in hard copies:
A) Summary of the Project
B) Stakeholder Engagement Plan (SEP), including Grievance Mechanism
C) Environmental and Social Action Plan (ESAP)

Additionally, the stakeholders that are directly involved in the activities of construction will be granted access to following information:
a) Contract Management Plan
b) Supply Chain Management Plan
c) Human Resource and Labour Management Plan
d) Environmental Impact Assessment (EIA) Report of the proposed plant
e) Environmental Decision of the Ministry of Environment and Forestry and relevant licenses
f) Company Environmental, Health & Safety and Social Policy including Company's contractor requirements.

This information will be directly provided to interested stakeholders in written format, including direct meeting in case of local authorities and local individuals.

12.21.13 Stakeholder Engagement Program

The consultation with the stakeholders will be conducted by the Social Specialist (based at the Corporate Office and reporting to the Environment and Health & Safety (EHS) Head at the Corporate Office) in co-operation with the EHS Officer, Community Liaison Officer and the Site Manager. Any grievances from the community relating to any issues that might arise from the project activities will be managed by the Community Liaison Officer based at the Site Office.

Consultations with the government agencies will be conducted as per the schedule that will be created with the EHS Officer and Site Manager. These stakeholders will be informed in advance of the planned project activities. The development of the facilities will be based on the EIA procedures and mitigation issues as mentioned in the ESIA study. Information on the on-going administrative procedures will be published at the communities following the requirements of the comments from the communities and environmental regulations.

Consultations with the internal stakeholders will be provided to workers separately from this document. At a minimum, communication will involve meetings, information boards and an intranet system.

Project related information will be posted on the informational boards at the proposed site office of the facilities and mine as well as at the Corporate Level. Information on the project milestones will be published in advance on the company's website to be available for the public and civil society organizations/ non-governmental organizations to comprehend the attitude of the external stakeholders. In addition, the company will publish information on the project in the local newspapers. Moreover, the disclosure of information package including the, ESIA reports; On-site environmental and nature inventories and monitoring results; Administrative decisions related to

the Project Annual Project-related reports shall be made available for the public review at the Union Parishad's Office the concerned villages.

In turn, if any issues are raised by the stakeholders, the company management will react accordingly in the shortest possible time.

The responsibility for the SEP implementation will be held by the EHS Head based at the Corporate Office in Dhaka. He will be supported by the Social Specialist (Corporate Level), EHS Officer and the Community Liaison Officer (both at the Site Level) of the Company.

A summary of the consultation activities that the company shall undertake as part of the Engagement Plan pertaining to the villages within the immediate vicinity of the manufacturing operating facilities and mine has been given below:

Table 12-7: Summary of the Consultation Activities

Stakeholder	Objective and Consultation Method	Proposed Timeline	Responsibility
Local Communities, Civil Society Organization (CSO), NGO's, Local Media at Proposed Plant	• Announcement of the proposed plant at Munshiganj, EIA report and progress of the work to be displayed at the Information Board of Union Parishad office / community building. • Website of the Company	September/October 2014	Community Liaison Officer from the Company and Local Administration (involving the Village Head and Union Parishad members and Chairman of project affected village and surrounding villages)
Government Authorities	Information meetings and consultations	On-going on a permanent basis	Company: EHS Head, Social Specialist, EHS Officer, Community Liaison Officer, Site Manager
Workers	• Internal meetings of employees and managers • Day to day contact	• On - going process on a permanent basis: quarterly and monthly, respectively • On-going process on a permanent basis	Company: EHS Head, Social Specialist, EHS Officer, Community Liaison Officer, Site Manager • EHS Officer
Contractors (Third Party)	• Meetings with contractors and their respective managers	On-going on a permanent basis: quarterly and monthly respectively	EHS Officer
Lenders	• Information on project status • Submission of annual reports, information on any project-related events that could potentially create an increased risk of project	On-going process on a permanent basis	Company: EHS Head, Social Specialist, EHS Officer, Community Liaison Officer and Site Manager

12.21.14 Plan of Activities

The stakeholder engagement process will be carried out at three levels, namely, project affected families, local community and local governing bodies. A summary of the proposed plans that can be initiated by Orion have been described below:

Table 12-8: Summary of the proposed plan of Activities

S.N	Key Stakeholders	Proposed Plan of Activities
1	Project Affected Families	• Guaranteed employment opportunities for one member of the PAF from concerned Village • Guaranteed employment opportunities to the women headed household of identified vulnerable group • Guaranteed employment opportunities to the identified agricultural labourers who have lost their jobs • Skill based training facility for the employed member of the PAF and displaced agricultural labourers • Contract work for small scale work associated with the proposed plant • Pension scheme for elderly person of identified vulnerable group • Scholarship for children • Micro credit facility for women belonging to the PAF • Activities as proposed in the Livelihood Restoration Plan
2	Local Community	• Announcement of vacancies (skilled/unskilled) at proposed plant • Announcement of contract work for small scale work associated with the proposed plant • Activities as proposed in the Livelihood Restoration Plan • CSR Activities - Construction of access roads - Health facilities - School facilities (middle/high/secondary schools) - Vocational training centres for women and youth - Drinking water facilities - Community forestry
3	Local Governing Bodies	• Compliance with legal requirements • Activities as mentioned in the LRP • CSR Activities

It is to be noted that the proposed plan of activities relating to the stakeholder engagement will amend depending upon the submission and approval of the ESIA report for proposed plant as well as the future planning of activities by Orion.

12.21.15 Grievance Mechanism

Grievance redressing is an important component of a healthy stakeholder – investor relationship. The mechanism needs to be just, fair, and robust to avoid being misused. In addition it should be able to provide the option of the complainant remaining anonymous if needed. Last, and most important, an effective mechanism should be able to ensure redressing and feedback within a responsible timeframe.

Grievances Management Team

A grievances Management team should be formed comprising of the social team and the site manager. In addition, for gender sensitive matters, a Redressal committee comprising of the Site Manager, Social Liaison team, and a female representative from an established NGO.

The Process

Lodging Grievances

The community may have several ways of lodging grievances.

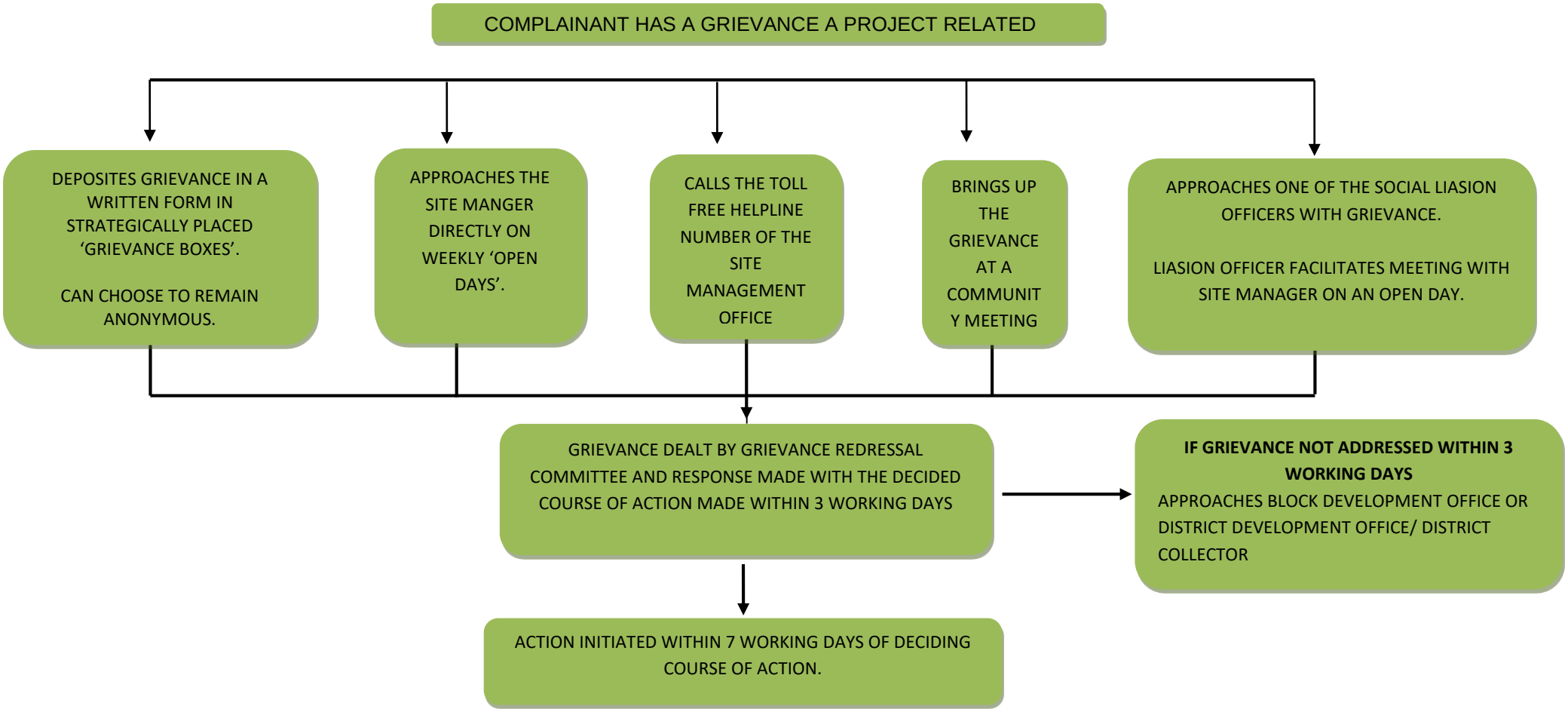
- The person with a grievance may approach one of the Social liaison Officers and convey it to him/ her. The liaison officer will in turn record it in writing and provide a 'receipt' to the complainant.
- Alternatively, the complainant may deposit the grievance as a hand written form in to a 'Grievance Boxes'. The grievances boxes shall be permanently at the site office and a common property structure, such as the government health centre, primary school or Mosque.
- The Site Manager and senior management may explore the option of having an 'Open day', where in the community members and other stakeholders have free access to their (Management's office) and can have meet him personally to discuss grievances.
- A third option would be indicating the grievance during a Community consultation meeting having it discussed openly there.
- A toll free helpline number can be made available to the community members. This number will be directly connected to the Site Manager's office.

Receipt and acknowledgement of Grievances

- For all grievances, the course of action shall be decided within 3 working days from the receipt of the grievance, and the feedback for the same conveyed either to the complainant or to the public, via a notice.
- Within 7 days of deciding and conveying the course of action, the required action towards redressal shall be initiated.
- If, under any circumstances, a feedback has not been given to the complainant within 3 working days, the wronged person may approach the union authorities with his/ her grievance.
- Similarly, upon non redressal of a grievance, the complainant may approach the block or the district authorities.

The grievance redressal mechanism has been illustrated in Figure 12-2:.

Figure 12-2: Grievance Redressal Mechanism



12.21.16 Monitoring and Evaluation

This section defines the methodology of internal and external monitoring, indicators and responsible groups for the monitoring and evaluation process, frequency of reporting, content of internal and external monitoring and integration of feedback from external monitoring into the Project implementation process.

12.21.16.1 LRP Monitoring Framework

The purpose of livelihood restoration monitoring is to ensure that measures developed for compensating losses due to the Project were effective in restoring Project affected household's living standards and income levels. In addition, the effectiveness of the grievance mechanism to be adopted by Orion will also be followed up. As part of the monitoring and evaluation process, changes in LRP procedures will be put into effect as needed.

For the OPDL-2 Project, Orion's Environmental and Social Group will undertake the LRP monitoring for the Project.

The monitoring and evaluation framework consists of three elements:

- Internal monitoring carried out by Orion's Environmental and Social Group;
- External monitoring undertaken by an independent consulting company; and
- A LRP Completion Audit.

Either for internal monitoring or external monitoring, IFC emphasizes on the importance of undertaking monitoring activities with a participatory techniques. The following techniques proposed by IFC for achieving participatory monitoring process are to be considered by Orion while designing its own internal monitoring system and outsourcing the external monitoring activity for the Project:

- Surveys
- Observations
- Group discussions
- In Depth interviews

Deciding on which participatory techniques are needed for project specific monitoring and using them require specific expertise. To be able to achieve this, Orion should build its own corporate capacity (i.e. through hiring an experienced consultant inside) or outsourcing this consultancy service under its own supervision to consider objective expert view, as well.

12.21.16.2 Internal Monitoring

Internal monitoring also known as monitoring of the project performance, measures the progress of activities, in other words, measures the performance of all the jobs of Orion in the LRP. OPDL-2's Social Team will be responsible for this process with support from appointed experts as necessary. Data collection tools should be developed for effective and efficient monitoring:

- Reports on meetings or interviews held for informing the stakeholders and/or consulting with them;

- Data collected by Orion during the land procurement process;
- Reports of field visits of the relevant experts; and
- Complaints Log and a Grievance Action From in the Electronic Information Network System at corporate level

Project monitoring will be initiated in parallel to the construction phase and will end with completion of external monitoring process. The focus points of the internal monitoring activity have been defined as follows:

- To follow-up land procurement process; meaning to ensure all land owners, whose lands are procured through willing seller/willing buyer negotiations or expropriation, receive compensation for their losses
- To ensure grievance mechanism is transparent and accessible for everyone,
- To deal with social problems by keeping in touch with local people and authorities, as well as the technical problems and to ensure Project Team overcomes the problems appropriately.

12.21.16.3 External Monitoring

External monitoring activities will verify the process defined in the LRP which is realized by Orion and its implementing partners (e.g., NGOs). External monitoring will be carried out by independent social expert(s).

Differences in socioeconomic, health, educational and cultural status before and after land acquisition will be identified and compared through defined indicators which include

- Changes occurred in the living standards of affected people;
- The number of skilled and unskilled Project affected households engaged in construction workforce;
- Additional support measures provided by Orion;
- A process of grievances and complaints; and
- The Extent of restoration for quality of life and living standards of Project affected households.

The aim of the LRP is primarily to avoid damaging the living conditions of local people (whether they are the ones who are directly or indirectly affected by the Project or not), and to restore people's livelihood. External (Impact) Monitoring activity will be undertaken in order to

- monitor regularly whether these mitigation or enhancement measures proposed are considered, and the relevant actions are put into practice or not;
- identify the deficiencies and,
- develop corrective and preventive actions for remedying the deficiencies

The external monitoring should be carried out via an experienced consultant on land acquisition and livelihood restoration. Data collection tools for this monitoring activity will include semi-annual reports for the first three years formed on the basis of monthly reports prepared by Project Team for internal monitoring, annual reports until the construction phase of the Project is completed, records of interviews held with Project affected households.

12.21.16.4 LRP Audit

The LRP completion audit which means finalizing both internal and external monitoring process of the Project, will be carried out after the completion of construction phase. This audit will be undertaken by Orion with support to be received from an external expert, if required. The LRP completion will provide final indication that the livelihood restoration is sustainable and no further interventions are required.

12.21.17 Time Schedule for Monitoring

The proposed time schedule for both internal and external monitoring is given in Figure 1-1. This proposed time schedule should be altered as per the approvals from Ministry of Environment and Forestry (MoEF) for the Project and the implementation of the activities.

Table 12-9: Monitoring Time Frame

	2014				2015				2016				2017				2018			
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
Land Procurement																				
Construction of Orion Project																				
Internal Monitoring																				
External Monitoring																				
Completion Audit																				

12.21.18 Staff and Responsibilities

In order to implement the monitoring process of the proposed LRP activities, there should be a plan to engage one independent expert who will work together with an assistant for external monitoring while Orion's team will be responsible for internal monitoring process. Their roles and responsibilities are defined in brief as follows:

- Orion's Environmental and Social Group, will be responsible for regular reporting for internal monitoring and following other actions defined for internal monitoring;
- An independent social expert on behalf of the funder will be engaged for reporting for external monitoring; and
- Orion staff will be responsible for evaluating monitoring reports prepared by authorized teams and provide information to the concerned stakeholder.

The table below shows the reporting responsibilities of Orion within the context of LRP.

Table 12-10: Reports of Internal and External Monitoring

Report	Content
Monthly report by site representative to Environment and Social Group	• Community liaison activities carried out. • Community liaison activities planned. • Grievances • Requests
Annual Report to the Lenders at the corporate level	• Disclosing information regarding economic,

for the first 3 years	social and environmental yearly activities.
Annual Report to the Lenders at the corporate level for the following year	• Disclosing information regarding economic, social and environmental yearly activities.

An overview of the LRP monitoring framework has been provided in Table below.

Table 12-11: Overview of the LRP Monitoring Framework

Monitoring Area	Indicators and Measures	Monitoring Frequency	Duration	Responsible Parties of the Monitoring
Efficiency and Effectiveness of LRP	• Progress in signing land acquisition agreements till completed. • Payment of compensation to the title holders till completed. • Number of title holders and parcels whose title deed transfer were completed by purchasing. • Amount of land procured for construction • Registrations of the number of contractors • Defined and working grievance system–number of grievances lodged/closed out. • Public consultation process defined –log of activities, number of meetings held. • Monitoring process defined –responsible teams appointed.	Monthly or quarterly	From Land Procurement to LRP Completion	OPDL-2's Social Team
Restoration of Living Standards	• Cash compensation to landowners – amount, number, total completed. • Compensation paid in line with agreed rates and time – number of payments in total. • Occasions where special needs of vulnerable groups addressed – number and type of aid/support. • Following up health and safety regulations for Orion employees – number of	Bi Annual (for the first three years in parallel to construction period) Annual (for the following year after the construction period)	From Land Procurement to Construction Completion	OPDL-2's Social Team Panel of Experts

Monitoring Area	Indicators and Measures	Monitoring Frequency	Duration	Responsible Parties of the Monitoring
	trainings gives, number of grievance about health and safety • Changes occurred in income and expenditure patterns of Project Affected Households before and after the project – amount or percentage of income increase.			
Community Assistance	• Perceptions of Project Affected Households (PAH) to the land acquisition process – observation and feedback collected through interviews. • Perceptions of Project Affected Households to the activities living standards restoration - observation and feedback collected through interviews. • Perceptions of PAHs to the activities of livelihood and income restoration - observation and feedback collected through interviews. • Perceptions of stakeholders to public consultation – observation and feedback collected through interviews.	Ongoing	From Land Procurement to LRP Completion	OPDL-2's Social Team An independent Social Expert
Public Consultation and Grievance	• Public consultation process defined –log of activities, number of meetings held, number of participants of public meetings, visits to local authorities or other local stakeholders, frequency of visits to project-affected households. • Types of grievances – number of lodged and closed grievances and	Ongoing	From Land Procurement to LRP Completion	OPDL-2's Social team An independent Social Expert

Monitoring Area	Indicators and Measures	Monitoring Frequency	Duration	Responsible Parties of the Monitoring
	outcomes.			

12.21.19 LRP Budget

As IFC states in its Handbook for Preparing a Resettlement Action Plan, "the LRP budget must include a justification of all assumptions made in calculating compensation rates and other cost estimates and must take into account both physical and cost contingencies."

In line with World Bank/IFC's description, the budget should include actual costs for all resettlement activities including development, implementation, monitoring and evaluation of LRP and other contingencies. The total cost allocated for LRP development and implementation should include the following items:

- Consultancy services for detailed social LRP survey and public consultation;
- Land acquisition administration costs including expenses for land appraisal and transaction costs for the lands acquired;
- Land acquisition payments for privately-owned lands purchased and expropriated;
- Cash compensation for vulnerable groups of project affected households;
- Additional expenses for project-specific activities such as workshops on technical training;
- Additional expenses for social support activities such as repair of local school buildings, health care services, etc.;
- Additional social issues for monitoring;
- Internal and external monitoring activities;
- A contingency for potential extra land acquisition costs, dust damage to crops, possible repair and maintenance of local structures or other social support activities over the life time of the Orion Project.

All budgeted costs will be met by Orion. The costs that will be planned for development and implementation of LRP will not only include the payments done until now but also planned budget for forthcoming expenses that may occur during construction and operation processes. In addition to these direct costs, LRP budget should involve management costs as well.

12.21.20 LRP Implementation Schedule

Activities mentioned in the Implementation Schedule for the OPDL-2 Project are grouped as planning and preparation, LRP implementation including construction, monitoring and evaluation activities. These activities run throughout the periods of pre-construction, construction and operation.

For the OPDL-2 Project, the preparation of the LRP should be initiated with the land procurement process. Although public information and consultation activities was initiated after some parcels of land were purchased by Orion, a continuous consultation process should be carried out throughout the project cycle to maintain transparency and accountability of the activities carried out.
In the figure below, the proposed LRP Schedule has been given,

Table 12-12: Implementation Schedule of LRP

	2014	2015	2016	2017	2018
Planning & Preparation					
Public Consultation and Disclosure					
LRP Preparation and Approval					
Procurement of Land					
Construction Activities					
Nomination of Construction Contractors					
Preparation of Construction Site					
Construction					
Monitoring and Evaluation					
Internal Monitoring					
External Monitoring					
Completion Audit					

13. Risk Assessment

In the proposed power plant, the main activity is power generation using coal as fuel. However in the process, some chemicals are to be handled and stored. The major chemicals handled and stored by power plant include chlorine, ammonia solution, LDO/HFO and HCl. This chapter identifies the risks associated with handling of chemicals and fuels in the proposed power plant.

13.1 Consequence Analysis

Consequence analysis was carried out to identify the root cause and potential consequence. Apart from the hazard assessment, remedial measures for safety were also suggested.

Chlorine

Chlorine is a gas at ambient temperature and pressure. Its boiling point at 1 atmosphere pressure is -34.1°C. It is a greenish yellow gas with irritating pungent smell. It is heavier than air and its molecular weight is 70.9. Chlorine poses a major health hazard if human beings are exposed to higher concentration. Chlorine is non-combustible in air but most combustible materials will burn in chlorine as they do in oxygen. Flammable gases and vapors will form explosive mixtures with chlorine.

Hazards from chlorine come from loss of containment which may be leakages, pipe rupture or vessel rupture. As liquefied chlorine is released under pressure it forms a liquid pool and then evaporates. A substantial release will then form a vapour cloud. A considerable amount of mixing with air occurs during evaporation. As the cloud travels under the influence of wind, it disperses and its concentration becomes further diluted and at some distance concentration becomes non-hazardous.

The concentration which is immediately dangerous to life and health (IDLH) value for chlorine is 10 ppm (29 mg/m^3). Chlorine is received and stored in steel cylinder of 926 kg (called a tonner) under a pressure of 10 kg/cm^2. The tonners are pressure tested once in two years by suppliers. The standard fitting on the tonner include valve, fusible plug and valve protection hood. Preliminary hazard analysis of chlorine is presented in ***Table 13-1.***

Table 13-1: Preliminary Hazard Analysis

Type of accident	Systems element or event that can lead to a major accident	Health hazard	Explosion hazard	Fire hazard	Disaster hazard
Spreading of chlorine gas	Leakage from valve, plug cylinder mouth	High concentration of liquid chlorine causes serious skin burns. Chlorine gas is extremely irritating to eyes and respiratory tracts 10-20 ppm (V/V)	Reacts explosively with many common chemicals including C_2H_2, NH_3 gas, flue gas, hydrocarbons, and hydrogen.	Noncombustible in air but combustible substance will burn in chlorine forming clouds.	Dangerous when heated emits toxic fumes, reacts with water or stream to produce fumes of hydrogen chloride-toxic and corrosive.
Explosion	Bursting of cylinder				

Chlorine is stored under ambient temperature and pressure in liquid condition.

Causes of major accidents

Following are the points where chlorine leakages may take place:

- Failure of Liquid outlet valve
- Failure of Gas outlet valve
- Body leakage of a corroded cylinder

13.1.1.1 Any leakage in the gas pipeline Consequence Analysis

In order to find risk involved due to leaking of chlorine, two conditions were considered. One relates to catastrophic rupture of storage tank and another to leakage from the tank (cylinder).

Catastrophic rupture: The catastrophic rupture scenario is designed to model an incident in which the vessel is destroyed by an impact, a crack or some other failure which propagates very quickly. The release is assumed to form a homogenous mass, expanding rapidly in all directions.

Leak: Vessel releases material from the vapour side via a hole in the body of the vessel. After the discharge calculations, the cloud moves downwind. It is modeled until the cloud concentration drops below harmful toxic thresholds. The conditions were studied at extremely stable and neutral atmospheric stability conditions.

Results

IDLH value of 10 ppm is reached within 900-1000 m for D and F stability classes respectively in the case of catastrophic rupture.

13.1.1.2 Mitigation: Chlorine Handling

For chlorine tonners handling and storage following mitigation measures are suggested to ODPL:

- Chlorine leak detection system to be installed in the area surrounding the chlorine tonners storage yard;
- Provision of water curtain all around the chlorine tonner storage yard to keep the ambience cool and prevent escape of chlorine;
- Provision of chlorine suction system connected to a chlorine neutralization system by having sufficient provision of caustic soda solution for circulation in the chlorine neutralisation system;
- Installation of flow control valves at strategic locations to prevent excess flow of chlorine with multiple control points;
- Ensure chlorine tonner storage is away from any heat or combustible material storage source;
- Provision of personal protective equipment including canister face mask, safety goggles, aprons, hand gloves, safety hat, safety shoes;
- Provision of emergency shower stations located near the area of human intervention;
- Provision of a lined underground pit of size 2.5 m x 1.5 m x 1.5 m (containing alkaline water) within chlorine tonner storage area. In case of any leak detected in the tonner, the tonner can be rolled down in such tank to avoid situation of its leak spreading in ambient air; and
- Follow up disaster management plan for evacuation of personnel engaged at site at identified safe assembly area.

13.2 Risks associated with Storage of Light Diesel Oil (LDO)

The plant will have LDO/HFO storage for use in boiler as a start-up fuel, flame stabilization and during low load operation. The tanks will be provided in bund. The risks associated with the fuel oil storage and handling include the following.

13.2.1 Pool / Dyke Fire

If there is outflow from the tank due to any leakage from tank or any failure of connecting pipes or valves, oil will flow outside and form a pool. Where the tank is surrounded by a dyke, the pool of oil will be restricted within that dyke. After sometime, the vapour from the pool can catch fire and can cause pool or dyke fire.

13.2.2 Tank and Bund Fires

A tank fire is essentially treated as pool fire; the difference being of liquid surface with elevated flame and is surrounded by a metal wall. Hence, at a given distance, the thermal radiation will tend to be lower than for a pool fire at ground level. The effect distance for tank fires will be limited to the tank contained in a bund. The fire risk will remain within the site only.

A bund fire may occur following the catastrophic release of liquid from a tank, overfilling or piping failure and subsequent ignition of the material. In this case, full surface bund fires are considered where the flammable material covers the surface of the whole bund. Smaller bund fires may occur due to small leaks into the bund, but can be controlled quickly. The effect distance for a bund fire will be limited to 3m from the bund wall, which is confined to the site boundary.

13.2.3 Bund Overtopping

It is possible that some material may escape over the bund wall following the initial surge of the released material (due to catastrophic tank failure). It is estimated by several researchers (*Trbojevic and Slater, Wilkinson's and UK HSE)* that 10-50% of liquid would escape over a square dyke following truly catastrophic failure of a tank. In the event that bund overtopping occurs due to explosion in tank, the pool fire can extend beyond the bund. It is expected that the spill would discharge into the storm water drains to be provided around the storage tank dyke at the storage site. The liquid spill is expected to be contained within the site boundary and not extend off-site.

13.2.4 Tank or Bund Fires escalation

In the event of any tank fire or bund fire, the on-site and off-site emergency plan will be activated, and this will include evacuation of people from the site and surroundings. Assuming a burning rate of 0.034 mm/s, the tank on fire will continue to burn for several hours (approximately 73 hours to nearly empty full tank of 9 m height).

13.2.5 Smoke

The combustion products of fuel oil include carbon dioxide, oxides of nitrogen and sulphur. Incomplete combustion will generate black smoke and hazardous gases including carbon monoxide. The exposure of CO_2 and CO causes hyperventilation and toxic narcosis respectively. The occupants

of any high-rise buildings in the vicinity of the tank storage area could be exposed to smoke effects following a tank or a bund fire. However, there are no high-rise buildings planned in the vicinity of the LDO/HFO storage tanks within the power plant.

13.2.6 Associated Health and Safety Risks

Other health and safety risks of particular concern during operation of thermal power plants are:

Noise: Noise sources include the turbine generators and auxiliaries; boilers and auxiliaries, such as pulverizers; diesel engines; fans and ductwork; pumps; compressors; condensers; precipitators, including rappers and plate vibrators; piping and valves; motors; transformers; circuit breakers and cooling towers.
Non-ionizing radiation: Workers may have a higher exposure to electric and magnetic fields (EMF) than the general public due to working in proximity to electric power generators, equipment and connecting high-voltage transmission lines.
Heat: Occupational exposure to heat occurs during operation and maintenance of combustion units, pipes, and related hot equipment.
Electrical hazards: Energized equipment and power lines can pose electrical hazards for workers at thermal power plants.
Fire and explosion hazards: Thermal power plants store, transfer and use large quantities of fuels; therefore, careful handling is necessary to mitigate fire and explosion risks. In particular, fire and explosion hazards increase as the particle size of coal is reduced. Particle sizes of coal that can fuel a propagating explosion occur within thermal dryers, cyclones, bag houses, pulverized-fuel systems, grinding mills, and other process or conveyance equipment.
Dust: Dust is generated in handing solid fuels, additives, and solid wastes (e.g., ash). Dust may contain silica (associated with silicosis), arsenic (skin and lung cancer), coal dust (black lung), and other potentially harmful substances. Use of small quantities of pesticides/ insecticides for use in control of pests and insects in the office area, greenbelt development can pose potential risk to human health.

13.3 Emergency Response Plan

13.3.1 Background

Orion Power Unit-2 Dhaka Limited (herein referred to as “OPDL-2”) is in the process of establishing a 635 (Net) MW coal based Thermal Power Plant (herein referred to as “Project”). It is located within Hoessendi Union of Gazaria Upzila (Sub-district) in the central Zila (District) viz., Munshiganj Zila of Bangladesh. Currently, the project site is being reclaimed by fill material (i.e., river bed sand) up to 2m to raise the site elevation prior to commencement of project construction activities. At present, grazing activities of livestock owned by the local inhabitants is predominantly being practiced on the project site.

13.3.2 Purpose

The purpose of the Emergency Preparedness and Response Plan (EPRP) is to establish and maintain procedures to identify potential emergencies and prevent or address potential foreseeable accidents/emergency situation during both construction and operation phases of the project.

13.3.3 Scope

The scope of the EPRP will be applicable to all project activities associated with the construction and operation phases of the 635 MW Coal Based Thermal Power Plant of OPDL-2. The elements of the EPRP will be directly implemented by the contractors and their sub-contractors, with OPDL-2 having overall management and responsibility. OPDL-2 needs to monitor and review the implementation process of EPRP on regular basis.

13.3.4 Objective

The focus of EPRP is to establish a range of plausible emergencies that can take place and emphasize the tasks required to respond to a particular emergency. The objective of emergency response has been enumerated below:

- Perceiving early inputs of emergency conditions so as to limit impact on personnel, community, assets and environment;
- Define and identify the probable emergency situations for the project specific to its activities, operations, vicinity and geographic location;
- Identify the immediate responses to emergency situations with effective communication network and organized procedures;
- Safeguard personnel to prevent injuries or loss of life by:
    - Protecting personnel from the hazard;
    - Evacuation, whenever necessary;
    - Minimize the impact of the incident/event on the project, community and the environment by:
        - limiting the hazard as far as possible;
        - limiting the potential for escalation; and
        - Localizing the spread of impact.

13.3.5 Risks Associated with Project Activities

Identification of causes and types of emergencies is the primary task for planning of risk assessment. Emergencies can happen because of the nature of chemicals handled and also the nature of process involved during construction and operation phase of the project.

13.3.5.1 Construction Phase

Construction is likely to start after reclamation of the site, and will continue for a period of 45 months (two years and nine months). Operational Phase of the project will commence thereafter. The life of the project is expected to be twenty five (25) years.

The construction activities will entail civil works such as site clearance and levelling works along with development of material storage yards, plant structures, boilers, generators, turbines, storage tanks, welding/cutting, installation of heavy machinery, pumps and mechanical and electrical installations

construction of access roads, foundations and erection of boiler units. Following potentially hazardous areas and activities have been identified at the construction site:

- Fuel storage areas
- Gas Cylinder storage areas
- Kitchen premises in labour camps
- Electrical installations – improper laying of cables
- Scaffolds
- Confined spaces
- Use of heavy vehicles and machinery such as cranes, JCB, trucks etc.

It is likely that during the course of construction phase several emergency situations such as fire and explosion, structural collapse, electrical hazards, chemical hazards, etc. might arise. Such situations will need to be handled in a systematic manner by the OPDL-2 management in order to prevent casualties.

13.3.5.2 Operation Phase

Following potentially hazardous areas and activities have been identified during operation phase of the project, which are likely to lead to emergency situations such as fire, explosion, release of gases, etc.:

1. Plant Sections causing ***Fire*** as an emergency- Potential Sources of Fire

   a) Coal Handling Plant and conveyor.
   b) Cable in galleries and cable trays in all plant sections.
   c) Fuel oil handling and oil tanks in main plant.
   d) Leakage of fuel from storage areas
   e) Ammonia leakage;
   f) Transformer oil.
   g) Burner area in boilers
   h) Blasting in boilers.

2. Plant Sections causing ***Explosion*** as an emergency

   a) Accidental initiation of explosives;
   b) Boiler or Transformer (oil cooled)
   c) Coal dust in mills and boilers

3. Plant Sections causing ***Bursting Hazards of Pipe Lines and Vessels*** as an emergency

   a) Steam pipes due to high pressure/temperature
   b) Acid and alkali pipelines

4. Plant Sections causing ***Hazards Due to Release of Gases and Dusts*** as an emergency

   a) Pulverized coal dust from mills and associated piping and flue gases.
   b) Fly ash and flue gases from stack, ash ponds, ESP hoppers and bottom ash system.

c) Coal dust generated in transfer points.
d) Flue gases from the ducts in the plant area.

5. Plant Sections causing ***Release of Liquids*** as an emergency

a) Fuel oil tanks in fuel oil handling section.
b) Ash dyke (bund failure).

13.3.5.3 External and Meteorological Emergences

Other emergency situations that are likely to occur in the project area thus affecting construction and operational activities of the Project are as listed below:

1. ***Floods*** as an emergency

a) Due to breach of ash dykes
b) Natural flood as plant is proposed to be constructed on bank of River Meghna.

2. ***Social Unrest*** as an emergency

a) Unsafe and unhealthy working conditions provided to labours;
b) Non-payment of wages and disrupted terms of employment;
c) Discrimination between local labour and migrant labour on various grounds (recruitment, benefits, accommodation, equal opportunity etc.);

3. ***Terrorist Threats/Bomb Threats***

d) Boiler house/chimney
e) T.G. areal control room etc.,
f) Residential complex

4. ***Strike***

g) Any part of the plant or entire plant

5. ***Earthquake*** as an emergency

The site for proposed plant lies in Seismic Zone II where the possible maximum earthquake magnitude in Richter's scale is 8.0.

13.3.5.4 Release of toxic gases, blasting and explosion and potential sources of fire

Explosion Hazard Areas

a) Turbo Generators
b) Transformer (oil cooled)
c) Boiler
d) Coal dust in Mills and boilers

Bursting of Pipe Lines & Vessels – Areas

a) Steam pipes due to high pressure / temperature
b) Acid / Alkali and tanks
c) H2 Gas Cylinders
d) Compressed air header
e) Compressed air receivers

Release of Gases / Dust- Areas

a) Chlorine in Water treatment plant
b) Hydrogen in Turbo Generator area of Main plant and H2 plant
c) Pulverized Coal dust from mills and associated piping and flue gases
d) Coal dust in transfer points of CHP. Crushers, Water tipplers and Mill area
e) Flue gases from the ducts

Release of Chemicals – Areas

a) Chemical tanks and Chlorine toners in water treatment plant
b) Acid & Alkali storage tanks in WTP
c) HCL tanks at ETP
d) Fuel oil tanks in fuel oil handling section

13.3.5.5 Seism tectonic

A seismic zoning map of Bangladesh has been proposed in 1979 by Geological Survey of Bangladesh (GSB) as presented in ***Error! Reference source not found.*** dividing the country into three seismic z one which was accompanied by and outline of a code for earthquake resistant design. As per the Map, the study area occurs in the seismic zone II where the possible maximum earthquake magnitude in Richter's scale is 8.0. The suggested Basic Horizontal Seismic co-efficient for this zone is 0.05.

The potential emergencies due to seism tonic activities can be structure failures. All buildings shall be design for earthquake. The coefficient of horizontal acceleration shall be for the appropriate seismic zone as per Bangladesh National Building Code (BNBC). Damping in structures shall be done according to BNBC and Bangladesh standards. All buildings shall be design for earthquake according to National Building Code of Bangladesh, 1993 or later new information in Bangladesh on this issue. The coefficient of horizontal acceleration shall be for the appropriate seismic zone as per BNBC.

13.3.5.6 High Risk Zones and Locations

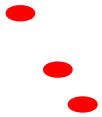
a) Coal handling plant
b) Main plant (Boiler, Turbo Generator, Oil Tanks)
c) Water Treatment plant
d) Switchyard including sub-station and transformers
e) Cable Galleries
f) Fuel oil handling plant

g) Store where hazardous, flammable and explosive material are stored

13.3.5.7 Location of Risk prone Installation in the layout plan

High risk zones like boilers, coal storage area, ash disposal area, switch yard during operation phase of the project has been marked in the figure below.

Figure 13-1: Project Layout with marked high risk points and Safe Assembly Zones (SAZs)



13.3.6 Risk Management Plan

This section establishes the general requirement to counter any level of onsite emergency and risks arisen for the proposed project during construction and operation phase.

13.3.6.1 *Warning alarm systems*

A distinctive and perceivable alarm system for emergency action or safe evacuation will be provided. Specific requirements may apply if the alarm system includes telephones/manual operations, the workplace has 10 or fewer employees, or alarms serve more than one purpose. It is to be ensured that all equipment used for alarm systems is approved and spare components are available.

13.3.6.2 *Surveillance*

Surveillance programs need to be deployed in form of mock drills with a definite frequency.

13.3.6.3 *Training Programs*

Following training are proposed to be imparted to the employees, including members of ERT on periodic basis:

Table 13-2: Training Programme

Sl. No.	Training	Description	Frequency
1	Mock Drills	Training on handling fire emergency situations and medical emergencies.	Quarterly
2	Awareness Program for Community	Awareness program for surrounding community on emergency response procedures	Bi-annually

13.3.6.4 Response (Contingencies)

Emergency Classification

Severity of accident and its likely impact area will determine the level of emergency and the management plan required for appropriate handling of the emergency. Emergency levels and the action needed for each level are indicated below:

Level 1 Emergency

A local accident with a likely impact only to immediate surroundings of accident site, such as, local fires and limited release of toxic or inflammable materials. The impact distance may not be more than 250 m from the site of primary accident and may require evacuation of the building/area where accident occurred and utmost the adjacent buildings. At the proposed power plant, minor fires and minor release of chlorine may cause Level 1 Emergency.

Level 2 Emergency

A plant level accident with impact distance upto 1000 m for potential threats to life and property requiring the evacuation of all plant personnel except the emergency response personnel. The demarcated limited area outside the plant may also have to be evacuated. Larger fires, release of

large quantities of inflammable or hazardous materials may belong to emergency Level 2. At the proposed power plant, minor release of chlorine for long time and pool fire in HFO/LDO tanks dykes can be considered as Level 2 Emergency.

Level 3 Emergency

An accident involving a very serious hazardous situation and with likely impact extending well beyond the plant boundary limit, such as, major fire, very large release of hazardous or inflammable material and explosion of large quantity of explosive materials. Major fires will usually have the triggering effect resulting in the propagation of explosion. In a Level 3 emergency, evacuation of surrounding population around the plant periphery up to a distance of 1000 m may sometime become necessary.

13.3.6.5 *Support (Logistics and Manpower)*

A range of support services like adequate number of first aid kits, ambulance van should be present at the site. All fire fighters and first aiders should be identified prior to the start of operation of the plant and details to be presented in table below.

Table 13-3: Details of Fire Fighters and First Aiders

S.No	Name of Employee	Photograph	Designation	Working Location	Contact Details

13.3.6.6 *Personal Protective Equipment*

The workplace will be assessed for hazards that are present or likely to be present. Select and ensure the use of PPE based on the workplace assessment. It should be verified that each affected employee has received and understood the required training through a written certification. Employees/workers must demonstrate the ability to use PPE prior to performing work requiring its use.

13.3.6.7 *Chain of Commands*

a) Verify status of all items in “First on Scene” checklist;
b) Notify appropriate organizations and personnel, as per requirements;
c) Assemble job personnel and count heads. Share basic information about incident with
d) job personnel;
e) Avoid speculation regarding cause of accident and commence the work with a Safety
f) meeting;
g) Direct media inquiries to be directed to the corporate spokesperson;

h) Gather/verify available information - What happened? Where? Who was involved? How did it occur?
i) Document incident in writing and with digital camera;
j) E-Mail to Project and Corporate Office.

13.3.6.8 Reporting System

Reporting system for implementation of emergency response plan has been depicted in Figure 13-1 and has been explained in section 13.37- Organizational Set Up.

13.3.6.9 Evacuation

Construction of exit Routes: *T*he number of exit routes should be adequate based on the number of employees, the size of the building, its occupancy, and the arrangement of the workplace. The width of exit routes must be sufficient to accommodate the maximum permitted occupant load.

Medical services and first aid: It will be ensure by the project management that medical personnel are ready and available for advice and consultation on the overall employee safety and health condition in the workplace. Trained personnel and adequate first aid supplies will be provided to render first aid when a medical facility is not in near proximity to the workplace. In case of likely exposure to injurious or corrosive materials, suitable facilities for immediate emergency use will be provided.

13.3.6.10 Fire/ Hazard Fighting

Portable fire extinguishers: Portable fire extinguishers based on the class, size, and degree of workplace fire hazards will be selected and distributed. The extinguishers will be mounted, located, and identified so that they are readily accessible in an emergency and employees are not subjected to potential injury.

1. ***Emergency Contact Numbers:*** An Emergency Contact List (the closest ambulance service, hospital or other source of medical attention, police, fire department, and emergency squad (if any) including reporting instructions to be conspicuously posted to facilitate prompt communication.
2. ***Emergency Action Plans:*** Specific emergency action plans needs to be prepared for each identified emergency. At a minimum, the plan must include
    - Escape procedures and escape routes;
    - Procedures for those who remain to conduct critical operations prior to evacuation;
    - Procedures to account for employees after evacuation;
    - The rescue and medical duties of employees;
    - The fire and emergency reporting procedures, and
    - Who to contact for further information or explanation about the plan.

The Emergency Action Plans will be communicated to all workers and systematically reviewed but not less than every 6 months.

13.3.6.11 Ammonia Leakage

Ammonia dosing will be required to condensate system, wherein leakage of ammonia can occur. The following measures to be taken to avoid any kind of leakage:

- Ensure that all containers, piping, valves, and fittings contacting ammonia are constructed of iron, steel or other ammonia-compatible materials, as ammonia is corrosive to even trace amounts of copper, zinc silver, and many of their alloys.
- Check that the ammonia contains at least 0.2% water to prevent stress corrosion of the recommended compatible materials;
- Install tank pressure gauges and safety valves on ammonia gas storage tanks for pressure relief. Install leak detectors if facilities are unstaffed for periods of time;
- Ensure that adequate training is provided to all facility employees concerning the safe handling, storage, and use of ammonia; and
- Ensure that the proper protective equipment is easily accessible in case ammonia is released. Train employees in the proper use of the equipment.

13.3.6.12 Emergency Response during Coal Transportation

It will be the responsibility of the Supervisor to check and contact all people under their control and relay to them the following information as briefly as possible:

- The nature of the emergency;
- The route to be travelled to the designated emergency evacuation assembly area;
- All the persons to be provided with appropriate PPEs like shoes to avoid slipping, mask and goggles to avoid coal dust;
- All the personnel will be provided with duty cards bearing work instructions on it and emergency contact numbers;
- A checklist is to be duly filled before and after completion of coal transportation.
- All shipping and loading operations will cease in the event of a tropical cyclone or other adverse weather conditions;
- All barges and ships will be fitted with global positioning system (GPS), radar, and/or other electronic navigation systems to minimize the potential for grounding or collisions;
- Existing navigation marks and aids on the river, particularly “leading marks,” will be reviewed and improved to help barge and ship masters navigate the river under all conditions. Lighted navigation marks will be installed or upgraded to ensure safe 24-hour operation;
- All vessels will carry appropriate spill containment and treatment equipment; and
- All vessels will be subject to a regular maintenance program to ensure proper functioning of steering and navigation systems, and to preserve the structural integrity of the hull, fuel tanks, etc. Proper maintenance will reduce the potential for grounding, collisions, and fuel and oil leaks.

13.3.6.13 *Communication Network*

A hazard communication program should be developed and implemented. It is to be ensured that material safety data sheets for each hazardous chemical used and the hazard communication program are available to workers in the workplace.

13.3.6.14 *Verification of Activities*

Activities should be verified before its commencement to avoid any kind of emergency. The various check points has been presented in table below.

Table 13-4: Check Points for Emergency Preparedness

S.No	Check Points	Yes/No
1	Whether mock fire / emergency response drills are held	
2	If yes, periodicity of emergency response drills	
3	Mock drills cover all types of probable emergencies	
4	Details of water storage available with Mutual Aid member including District Fire Service and mechanism to utilize the same in the said location well documented in the On Site emergency Plan.	
5	Periodicity of safety training for officers, staff, contractor workers, and security personnel mentioned in the On Site emergency Plan.	
6	Whether all unsafe developments and likely risks are deliberated in the meetings and appropriate steps are recommended for eliminating such risks.	
7	Whether performance and shortcomings observed during recent mock disaster drills form part of the discussions in safety committee meetings	
8	Whether Work Permit System has been implemented	
9	Whether work permits are issued for hot work, cold work, electrical work and vessel entry jobs	
10	Whether work permits are duly closed at completion of the stipulated jobs, duly certified by the supervising officer.	

13.3.7 Organisational Set up

13.3.7.1 Emergency Response Team (ERT)

This section provides the organizational framework suggested to handle different levels of emergencies and identifies the key personnel that will be responsible for managing any emergency situation. An Emergency Response Team (ERT) will be set up initially for construction phase and the same will be revised for commencement of plant operations. The Emergency Response Team (ERT) at the operating site under its control will have the following role:

- Control the emergency and render the site safe by the application of local resources; and
- Support the local response effort by co-ordinating additional equipment, personnel, and other external resources for the direct response effort.

The ERT will be headed by a Site Incident Controller and will comprise of following personnel:

- Fire/ Safety Officer;
- Evacuation Officer;

- Communication/Liaison Officer and;
- Medical Officer.

13.3.8 Roles and Responsibilities of ERT

The role of the members of Emergency Response Team (ERT) is as detailed below:

13.3.8.1 Site Incident Controller (SIC)

The Site In charge of Coal Site Team will act as Site Incident controller who will supervise the members of Emergency Response Team. The responsibilities of SIC are enumerated below:

- Set up Emergency Control Centre (ECC) to direct emergency operations with the help of other team members;
- Determine the severity of an emergency; declare appropriate emergency level and changing the emergency level, if considered essential;
- Marking of Safe Assembly Zones (SAZs) within the site in consultation with Evacuation Officer and informing all the employees present at the site;
- Determine most probable course of events by continuously reviewing and assessing the developments;
- Direct the safe shutting down of the plant in consultation with other officers, if necessary;
- Ensure proper evacuation and treatment to injured personnel;
- Liaison with District Administrative Authorities, Police, Fire Brigade and other agencies, if necessary;
- Look after safe operation of the plant and rehabilitation of affected persons; and
- Declare all clear situations after the emergency is over.

13.3.8.2 Fire/ Safety Officer

- Reports to Site Incident Controller and assist him in all matters;
- Arrange first aid to the casualties and other emergency equipments;
- In post-accident condition to gather information on the material /equipment involved in the accident and its danger potential, its effect on humans and environment;
- Assist Site Incident Controller in maintaining the emergency equipment and in conducting / evaluating mock drills; and
- All the fire fighters shall work under his guidance at the time of emergency.

13.3.8.3 Evacuation Officer

- Proceed to emergency area and report to Site Incident Controller and acts as per the instructions;
- Consult the Safety Officer of the site for evacuation of the employees;
- Advice all the employees expect emergency response team to assemble at SAZ;
- To perform head count at SAZ and shall record names;
- Proceed to the emergency area and report to Site Incident controller the after getting the information regarding emergency through telephone or through messengers;
- He handles all the transmission to the emergency control center and dispatched from it, including those to outside agencies and technical information source;
- As per the Site Incident Controller's instructions, he will pass information to other members, if required.

13.3.8.4 Communication/Liaison Officer

- As soon as he receives the information he should proceed to the Emergency Control Center and report to the Site Incident Controller;
- Co-ordinate with all the outside agencies who offer assistance to an emergency response supporting team;
- Keep information on the various agency representatives and where and how to contact them;
- Ensure that casualties received adequate attention and the alternate transport, when in need;
- When emergency is prolonged he shall co-ordinate with evacuation officer to arrange for the relief of rescue or firefighting personnel and organize refreshments or catering facilities;
- Responsible for evacuation of the nearby village people, if situation warrants.

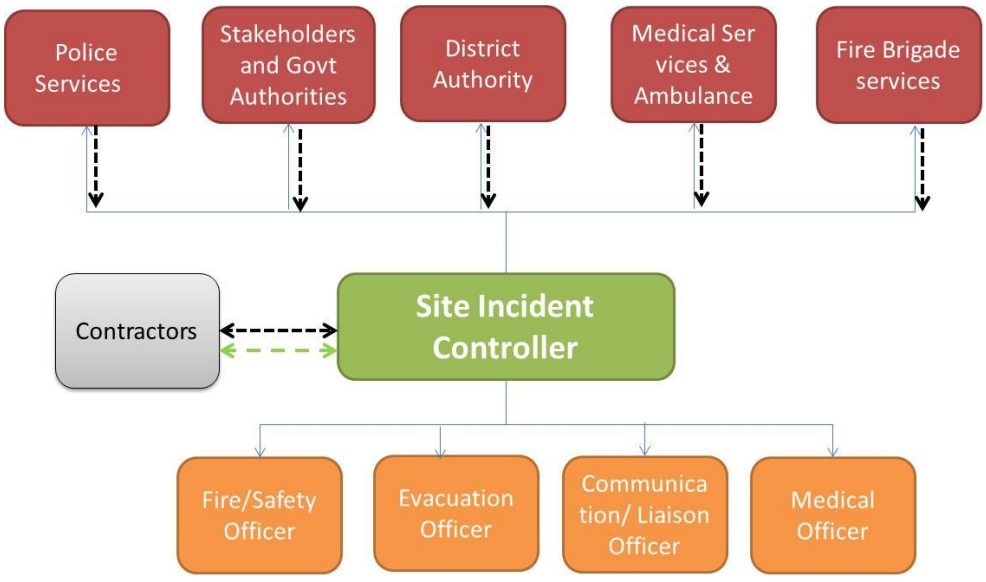
13.3.8.5 Medical Officer

- On receipt of information keep him ready and alert his staff to attend serious and urgent cases;
- Responsible for providing first aid to those injured/ rescued and making that they are promptly transported for further treatment, if required;
- Arrange for medical supplies at the site;
- Familiar with antidotes for specified materials.

13.3.8.6 Role of Contractors

- Under an emergency situation, the contractor's supervisor will take steps to:
- Notify the Site Safety Officer immediately;
- Protect the lives/health of employees;
- Safeguard information and company assets (equipment, tools);
- Communicate and delegate the first two priorities in a controlled manner that reduces confusion, and
- Commence an appropriate response to the emergency event as directed by Site Incident Controller

Figure 13-2: Organogram for Emergency Response Plan



13.3.9 Control Structure

Emergency Control Centre is the point from which the Site Incident Controller directs the movements of Personnel and Equipment during an Emergency. Contents of Emergency Control Centre:

a) External telephone line and a list of relevant telephone numbers.
b) Internal telephone and telephone list of Emergency Assembly Points.
c) List of Emergency Control Team, who must be called showing addresses and telephone numbers.
d) Emergency Controller's Red & White Helmet.
e) A list of all persons (by title) responsible for groups of employees.
f) Logs and Emergency Controller's checklist.
g) Emergency lighting.
h) Copy of the emergency plan.
i) List of persons trained in First Aid & Fire Fighting.
j) List of safety cabinets and their contents & locations.
k) Battery operated torches.
l) Detailed site plan.
m) First aid equipment including stretchers (in surgery).

13.3.10 Assembly Point

It is a place containing an internal telephone and paging system, where people can wait in a group during emergency to receive instructions from the Emergency Controller. Assembly points have been marked in ***Figure 13-1.*** Three Safe Assembly Zones (SAZs) has been identified within the plant premises to aid evacuation during emergency services. These are:

- Near Main Gate- Evacuation from areas of switch yard, control room, fire station and Guard Room
- Near Transformer Building – Evacuation from areas of control building and common monitoring basin
- Near Administrative Building- Evacuation from areas of canteen and parking areas.

13.3.11 External Communication

It will be done by Site Incident Controller. The following persons and offices may be given updated information as necessary and ask for necessary help.

a) SDO
b) Police
c) Fire Brigade
d) Nearby Hospital
e) Factory Inspector
f) Local Media
g) District Magistrate

13.3.12 Responsibility Matrix

The responsibilities assigned to the various persons have been presented in table below.

Table 13-5: Responsibility Matrix

S.No	Key Person	Responsibilities
1	Site Incident Controller	• Set up Emergency Control Centre (ECC) • Determine the severity of an emergency; • Marking of Safe Assembly Zones (SAZs); • Direct the safe shutting down of the plant in consultation with other officers, if necessary; • Liaison with District Administrative Authorities, Police, Fire Brigade and other agencies, if necessary; and • Declare all clear situations after the emergency is over.
2	Fire/ Safety Officer	• Arrange first aid to the casualties and other emergency equipments; • Assist Site Incident Controller in maintaining the emergency equipment and in conducting / evaluating mock drills; and • All the fire fighters shall work under his guidance at the time of emergency.
3	Evacuation Officer	• Proceed to emergency area and report to Site Incident Controller and acts as per the instructions; • Advice all the employees expect emergency response team to assemble at SAZ; • He handles all the transmission to the emergency control center and dispatched from it, including those to outside agencies and technical information source;
4	Communication and Liaison Officer	• As soon as he receives the information he should proceed to the Emergency Control Centre and report to the Site Incident Controller; • Co-ordinate with all the outside agencies who offer assistance to an emergency response supporting team; • Keep information on the various agency representatives and where and how to contact them;
5	Medical Officer	• On receipt of information keep him ready and alert his staff to attend serious and urgent cases; • Responsible for providing first aid to those injured/ rescued and making that they are promptly transported for further treatment, if required; • Arrange for medical supplies at the site;
6	Contractors	• Commence an appropriate response to the emergency event as directed by Site Incident Controller; • Under an emergency situation, the contractor's

		supervisor will take steps to: • Notify the Site Safety Officer immediately; • Protect the lives/health of employees

13.3.13 Onsite Emergency Response Initiation

In case of all emergencies, the Emergency Response Team will swing into immediate action without losing time in order to save human life, to mitigate the impact on the environment and to safeguard commercial consideration of the project and the community. The response to an emergency situation will be as per the following five phases:

- **Discovery and Notification**: An event with an imminent threat of turning into an accident must first be discovered and notified the same to the Site Incident Controller, who will eventually inform Safety Officer.

- **Evaluation and Initiation of Accident Control**: Based on the evaluation of available information, the Safety Officer will make a rapid assessment of the severity of the accident and initiate the best course of action.

- **Suppression and Counter Measures**: Action will first be taken to contain and control the accident by eliminating the causes which may lead to the spread of accident. Workers/personnel will be advised to remain on the scene until help arrives. If not, safe evacuation of area will be done.

- **Clean-up and Disposal**: After the accident is effectively contained and controlled, the cleanup of the site of the accident and safe disposal of waste generated due to the accident will be undertaken.

- **Documentation**: All aspects of accidents must be documented for subsequent analysis of accident for prevention in future, damage estimation, insurance recovery and compensation payment (if made).

13.3.14 Reporting Hierarchy within Organization and liaison with Authority

Reporting hierarchy within organization has been explained section 12.3 HSE Management Organization Structure of the report.

13.3.15 Physical Barrier , Alarm System and Access Controls

OPDL-2 to ensure the implementation of following provisions.

- Provide a distinctive and perceivable alarm system for emergency action or safe evacuation.
- Specific requirements may apply if the alarm system includes telephones/manual operations, the workplace has 10 or fewer employees, or alarms serve more than one purpose.

- Ensure that all equipment used for alarm systems is approved and spare components are available.
- Provide rescuers access to all permit spaces from which rescue may be necessary, so that appropriate rescue plans are developed and rescue operations practiced.

13.3.16 Public Safety and Education Programme

Information is to be made available to the public on a periodic basis on how they will be notified and what their initial actions should be in an emergency (e.g., listening to a local broadcast station and remaining indoors), the principal points of contact with the news media for dissemination of information during an emergency (including the physical location or locations) are established in advance, and procedures for coordinated dissemination of information to the public are to be established.

13.3.17 Support required for external porting and areas

All the people identified in organogram for implementation of emergency response plan will be responsible for Laisioning with the relevant port authority and BITWA for any emergency during transportation of coal during construction phase.

13.3.18 External Events Perceived

a) Unsafe and unhealthy working conditions provided to labours;
b) Non-payment of wages and disrupted terms of employment;
c) Discrimination between local labour and migrant labour on various grounds (recruitment, benefits, accommodation, equal opportunity etc.);
d) Threats due to Bomb and Terrorists

13.3.19 Meteorological Extreme Events

Floods as an emergency

a) Due to breach of ash dykes
b) Natural flood as plant is proposed to be constructed on bank of River Meghna.

Earthquake as an emergency

The site for proposed plant lies in Seismic Zone II where the possible maximum earthquake magnitude in Richter's scale is 8.0.

13.3.20 Rehearsal

Drills should present a variety of Emergency scenarios and designed to challenge each segment of the organisation. Limited scale drills are useful and should be used by Site Incident Controller to train

his own team and other employees of the plant. Plans should be made to have periodic mass casualty exercises. These exercises should attempt to simulate as closely as \possible a fire, explosion, or toxic agent release and comparison of the prescribed time lines and the actual received. Each Mock Drill should be recorded with observations and deficiencies to be rectified within 24 hours. To have better results it is suggested to involve all sections with in the industry, nearby industries, fire services, medical, police personals etc.

13.4 Risk Mitigation Measures

13.4.1 For Fuel Storage

Adequate preventive maintenance and robust safety management and security systems will be provided to prevent leaks from the storage facility. Secondary containment of adequate capacity (125%) will be provided to contain loss of containment in case of leaks / failure of the storage tanks. The risk mitigation measures for the LDO storage include the following:

- Fuel storage areas to be provided with bund of adequate capacity to contain any spill. The valve meant to drain any rainwater from the bund must be kept in close position.
- Ensure physical inspection of the bund before every shift changeover
- Regular refreshing training of the personnel and arrangements
- Periodical review and updating of Disaster Management Plan;
- Reliable Communication system to be made available at the site and contact number of external agencies including, police, District Magistrate, Doctors, hospitals etc. to be made available at the site.
- Provision of First Aid and Ambulance to be made available at the plant site round the clock

13.4.2 Other Risks

OPDL-2 will provide appropriate training to the workers and staff in environmental, safety, and health aspects and will provide necessary protective measures to workers to minimize safety risks.

Occupational EMF exposure will be prevented or minimized through the preparation and implementation of an EMF safety program including:

- Training of workers in the identification of occupational EMF levels and hazards;
- Establishment and identification of safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure, limiting access to properly trained workers;
- Implementation of action plans to address potential or confirmed exposure levels that exceed reference occupational exposure levels developed by international organizations such as the International Commission on Non-Ionizing Radiation Protection (ICNIRP), the Institute of Electrical and Electronics Engineers (IEEE);
- Personal exposure monitoring equipment to be set to warn of exposure levels that are below occupational exposure reference levels (e.g., 50 percent);
- Action plans to address occupational exposure may include limiting exposure time through work rotation, increasing the distance between the source and the worker, when feasible, or the use of shielding materials.

- The Project is to ensure that use of pesticides and insecticides is taken up by personnel only after proper training and use of personal protective equipment.

Prevention and control measures to address heat exposure at thermal power plants will include:

- Regular inspection and maintenance of pressure vessels and piping;
- Provision of adequate ventilation in work areas to reduce heat and humidity;
- Reduction of the time required for work in elevated temperature environments and ensuring access to drinking water;
- Shielding of surfaces where workers come in close contact with hot equipment, including generating equipment, pipes etc;
- Use of warning signs near high temperature surfaces and personal protective equipment (PPE) as appropriate, including insulated gloves and shoes.

Additional mitigation measures for occupational noise include:

- Provision of sound-insulated control rooms with noise levels below 60 dB(A);
- Design of generators to meet applicable occupational noise levels;
- Identification and marking of high noise areas and areas that require that personal noise protecting gear is used all the time when working in such areas, typically areas with noise levels >85 dB(A).

Measures to prevent minimize, and control electrical hazards at thermal power plants include:

- Installation of hazard warning lights inside electrical equipment enclosures to warn of inadvertent energization;
- Use of voltage sensors prior to and during workers entrance into enclosures containing electrical components;
- Deactivation and proper grounding of live power equipment and distribution lines according to applicable legislation and guidelines whenever possible before work is performed on or proximal to them;
- Provision of specialized electrical safety training to those workers working with or around exposed components of electric circuits. This training will include, but not be limited to, training in basic electrical theory, proper safe work procedures, hazard awareness and identification, proper use of PPE, proper lockout/tagout procedures, first aid including CPR, and proper rescue procedures;
- Provisions will be made for periodic retraining as necessary.

Measures to prevent minimize, and control physical hazards from fire and explosion at thermal power plants include:

- Use of automated combustion and safety controls;
- Proper maintenance of boiler safety controls;
- Implementation of startup and shutdown procedures to minimize the risk of suspending hot coal particles (e.g., in the pulverizer, mill, and cyclone) during startup;
- Regular cleaning of the facility to prevent accumulation of coal dust (e.g., on floors, ledges, beams, and equipment);
- Removal of hot spots from the coal stockpile (caused by spontaneous combustion) and spread until cooled, never loading hot coal into the pulverized fuel system;

- Use of automated systems such as temperature gauges or carbon monoxide sensors to survey solid fuel storage areas to detect fires caused by self-ignition and to identify risk points.
- Measures to prevent minimize, and control physical hazards from chemical hazards at thermal power plants use of sodium hypochlorite in place of gaseous chlorine may be opted. Measures to prevent minimize, and control occupational exposure to dust in thermal power plants include:
- Use of dust controls (e.g., exhaust ventilation) to keep dust below applicable guidelines or wherever free silica levels in airborne dust exceed 1 percent.

14. Environment and Social Monitoring Plan

The section below furnishes the monitoring program for the proposed thermal power project in accordance to the regulatory requirements (*Table 14-1*).

Table 14-1: Environment and Social Monitoring Plan

Sl.no	Sources / Locations	Parameters	Frequency
1	**Stack Emission Monitoring**		
1.1	Online automated stack monitoring equipment to be installed	O_2, PM, SO2, NOx, CO_2, HC, CO, Flow Rate and Temperature	Continuous
2	**Ambient Air Monitoring**		
2.1	Two sampling locations as per prevalent wind direction of the season	SPM, $PM_{2.5}$, PM_{10},SO_2,NO_x,CO, O_3	Twice in a week for 24 hours each at each location (twice a year)
2.2	Dust Monitoring at Coal storage yard and flyash storage area	$PM_{2.5}$, PM_{10}	Quarterly
3	**Meteorological Monitoring**		
3.1	One location within the project site	Wind speed, Wind direction, Relative humidity, Temperature and Rainfall	Continuous on hourly basis
4	**Noise Monitoring**		
4.1	Monitoring at locations at project site and campsite	LAeq (Night), LAeq (day), LAeq (24 hourly)	24 hours continuous and quarterly
5	**Water Quality Monitoring**		
5.1	Surface Water at two - three points of Meghna River	pH, Dissolved Oxygen, Biological Oxygen Demand, Total Coliforms and electrical conductivity	Annually
5.2	Waste Water at discharge points	Physical and Chemical parameters as specified in Schedule 10 of ECR, 2007	Annually
5.3	Ground Water at Coal storage yard and fly ash storage area	Physical, Chemical and Biological parameters of drinking water standards as specified in Schedule 3 of ECR, 2007	Annually
6	**Waste Monitoring**		
6.1	Solid Waste	Fly ash characteristics	Annually
7	**Ecological Monitoring**		
7.1	Flora and Fauna Monitoring	Abundance and Frequency of species	Annually
7.2	Aquatic Monitoring at two to three points of Meghna River	Abundance and Frequency of species	Annually
8	**Workers Health and Safety Monitoring**		
8.1	Monitoring of point sources such as turbine generators and diesel generator sets	Noise in dB(A) measured at 1 m distance from the point source	Quarterly
8.2	Occupational Health and Hygiene within project site	Exposure to chemicals, heat stress, occupational noise and indoor air quality	Annually

Sl.no	Sources / Locations	Parameters	Frequency
9	**Social Aspects**		
9.1	Land procurement	Compensation paid, utilization of compensation	Quarterly
9.2	Grievance Redressal	Grievances raised, actions taken, number of grievance cell meetings	Bi-annually
9.3	Proposed CSR Activities	Implementation of proposed CSR activities (number of tube wells provided, scope of generation of employment opportunities for locals, etc.)	Bi-annually

14.1 Action during Abnormal Operating Conditions

Abnormal conditions during operation phase can lead to any type of emergency situations like fire, explosion, release of gases, etc. To deal with such type of emergencies, an emergency Repsonse Team is to be formulated, which has been detailed out in section 13.4 of Chapter 13 of ESIA report.

14.2 Budget for Monitoring

Table below present the yearly budget allocated for the monitoring of environment and social aspect during various phases of the project.

Table 14-2: Budget Allocated for Environment and Social Monitoring Plan

Sl.no	Sources / Locations	Parameters	Yearly Budget Allocated (BDT)
1	**Stack Emission Monitoring**		
1.1	Online automated stack monitoring equipment to be installed	O_2, PM, SO2, NOx, CO_2, HC, CO, Flow Rate and Temperature	89,18,500*
2	**Ambient Air Monitoring**		
2.1	Two sampling locations as per prevalent wind direction of the season	SPM, $PM_{2.5}$, PM_{10},SO_2,NO_x,CO, O_3	2,54,000
2.2	Dust Monitoring at Coal storage yard and flyash storage area	$PM_{2.5}$, PM_{10}	12,700
3	**Meteorological Monitoring**		
3.1	One location within the project site	Wind speed, Wind direction, Relative humidity, Temperature and Rainfall	1,27,000
4	**Noise Monitoring**		
4.1	Monitoring at locations at project site and campsite	LAeq (Night), LAeq (day), LAeq (24 hourly)	20,300
5	**Water Quality Monitoring**		
5.1	Surface Water at two - three points of Meghna River	pH, Dissolved Oxygen, Biological Oxygen Demand, Total Coliforms and electrical conductivity	38,100
5.2	Waste Water at discharge points	Physical and Chemical parameters as specified in Schedule 10 of ECR, 2007	38,100

Sl.no	Sources / Locations	Parameters	Yearly Budget Allocated (BDT)
5.3	Ground Water at Coal storage yard and fly ash storage area	Physical, Chemical and Biological parameters of drinking water standards as specified in Schedule 3 of ECR, 2007	10,100
6	**Waste Monitoring**		
6.1	Solid Waste	Fly ash characteristics	10,800
7	**Ecological Monitoring**		
7.1	Flora and Fauna Monitoring	Abundance and Frequency of species	1,01,600
7.2	Aquatic Monitoring at two to three points of Meghna River	Abundance and Frequency of species	25,000
8	**Workers Health and Safety Monitoring**		
8.1	Monitoring of point sources such as turbine generators and diesel generator sets	Noise in dB(A) measured at 1 m distance from the point source	10,100
8.2	Occupational Health and Hygiene within project site	Exposure to chemicals, heat stress, occupational noise and indoor air quality	Included in project cost
9	**Social Aspects**		
9.1	Land procurement	Compensation paid, utilization of compensation	Included in project cost
9.2	Grievance Redressal	Grievances raised, actions taken, number of grievance cell meetings	Included in project cost
9.3	Proposed CSR Activities	Implementation of proposed CSR activities (number of tube wells provided, scope of generation of employment opportunities for locals, etc.)	Included in project cost

- *This equipment can be procured from Emerson, U.S.A or Huntsman, Germany (based on AECOM's understanding)*

14.3 Monitoring Guidelines

It is recommended to undertake environmental monitoring through a government approved/ recognised laboratory. The monitoring locations will be identified and finalized by the Site In charge in consultation with the monitoring agency.

The collection of samples shall be carried out as per the standard guidelines and compared with the applicable standards. The monitoring report shall include the following:

- Sampling locations (description, including nearest village and geographical coordinates and map showing location);
- Date and time of sampling;
- Sampling procedures followed;
- Analysis procedures followed;
- QA/QC procedures;
- Observations and analysis of the results.

14.4 Reporting of ESMMP

This ESMMP is an environment management tool which needs to be reviewed periodically to address any changes in the organization, process or regulatory requirements. This ESMMP would be reviewed after receiving all the necessary clearances and permits to include their requirements. The ESMMP shall be reviewed and updated every six months.

Following a review, the Senior VP (Technical) after discussion with Site-In charge and EHS Manager are responsible for making the amendments in the ESMMP and seeking approval from the senior management. The amended ESMMP would be communicated to all the staff that are responsible for its implementation.

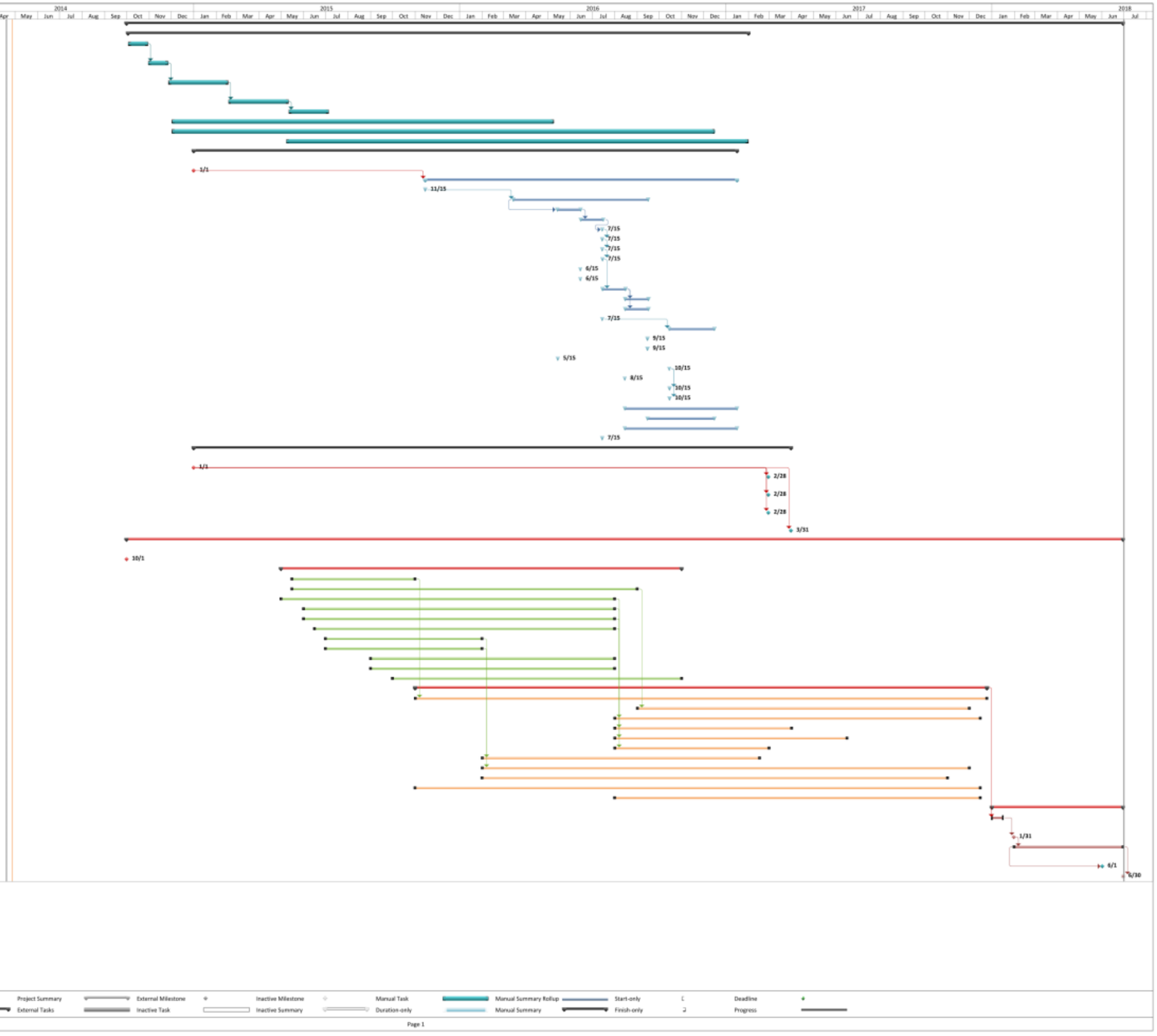
Implementation status of the all management plans should be monitored and documented regularly. Monthly monitoring report should be prepared based on regular inspection and should be submitted to the Site in-charge of the Plant of the Power Plant.

15. Work Plan

The approximate months required for completion of construction phase of the project is 44 months. The construction phase is envisaged to be completed by July, 2018. A detailed work plan of implementation of activities like BTG Engineering Package, Boiler Design, Manufacturing & Supply, Turbine & Generator Manufacturing & Supply, Construction, Erection & Commissioning, erection and Unit commissioning has been presented in ***Figure 15-1.***

Figure 15-1: Detailed Work Schedule

ID	Task Name	Duration	Start	Finish
1	**630 MW Power Project**	**1368 days**	**Wed 10/1/14**	**Sat 6/30/18**
2	**BTG Engineering Package**	**851.98 days**	**Fri 10/3/14**	Tue 1/31/17
3	No. 1 Package BTG Supplier (CD1, MD1 & ED1)	0.92 mons	Fri 10/3/14	Thu 10/30/14
4	No. 2 Package BTG Supplier (CD2 & MD2)	0.92 mons	Thu 10/30/14	Thu 11/27/14
5	No. 3 Package BTG Supplier (CD3, MD3 & ED2)	2.76 mons	Thu 11/27/14	Tue 2/17/15
6	No. 4 Package BTG Supplier (MD4)	2.76 mons	Tue 2/17/15	Mon 5/11/15
7	No. 5 Package BTG Supplier (ED3)	1.84 mons	Mon 5/11/15	Sun 7/5/15
8	Purchasing BTG/EPC	17.49 mons	Tue 12/2/14	Mon 5/9/16
9	Manufacturing BTG/EPC	24.86 mons	Tue 12/2/14	Fri 12/16/16
10	Delivery BTG/EPC	21.17 mons	Fri 5/8/15	Tue 1/31/17
11	**Boiler Design, Manufacturing & Supply**	**746 days**	**Thu 1/1/15**	**Sun 1/15/17**
12	NTP for Boiler Supplier	0 days	Thu 1/1/15	Thu 1/1/15
13	**Delivery**	**428 days**	**Sun 11/15/15**	**Sun 1/15/17**
14	Foundation anchore bolt	0 days	Sun 11/15/15	Sun 11/15/15
15	Structural Steel	6.17 mons	Tue 3/15/16	Thu 9/15/16
16	Furnace Wall	1.07 mons	Sat 5/14/16	Wed 6/15/16
17	Header	1.04 mons	Wed 6/15/16	Sat 7/16/16
18	Link and Connector	0 days	Fri 7/15/16	Fri 7/15/16
19	Superheater Tube	0 days	Fri 7/15/16	Fri 7/15/16
20	Reheater Tube	0 days	Fri 7/15/16	Fri 7/15/16
21	Economizer tube	0 days	Fri 7/15/16	Fri 7/15/16
22	Pressure parts hanger	0 days	Wed 6/15/16	Wed 6/15/16
23	Buckstay	0 days	Wed 6/15/16	Wed 6/15/16
24	Air Duct	1.07 mons	Fri 7/15/16	Mon 8/15/16
25	Gas Duct	1.07 mons	Mon 8/15/16	Fri 9/16/16
26	Duct Damper & Expansion joint	1.07 mons	Mon 8/15/16	Fri 9/16/16
27	Inner casing	0 days	Fri 7/15/16	Fri 7/15/16
28	B.R.I.L(including Outer Casing)	2.07 mons	Sat 10/15/16	Thu 12/15/16
29	Burner & Windbox	0 days	Thu 9/15/16	Thu 9/15/16
30	Coal Air piping	0 days	Thu 9/15/16	Thu 9/15/16
31	Coal Silo	0 days	Sun 5/15/16	Sun 5/15/16
32	Pulverizer	0 days	Sat 10/15/16	Sat 10/15/16
33	Fuel Oil piping & Firing System	0 days	Mon 8/15/16	Mon 8/15/16
34	Ignitor & Scanner Air Piping	0 days	Sat 10/15/16	Sat 10/15/16
35	Mill Seal Air Piping	0 days	Sat 10/15/16	Sat 10/15/16
36	Vendors	5.14 mons	Mon 8/15/16	Sun 1/15/17
37	Electrical, I & C Equipment	3.07 mons	Thu 9/15/16	Thu 12/15/16
38	Interconnection piping	5.14 mons	Mon 8/15/16	Sun 1/15/17
39	Blowdown Tank	0 days	Fri 7/15/16	Fri 7/15/16
40	**Turbine & Generator Manufacturing & Supply**	**820 days**	**Thu 1/1/15**	**Fri 3/31/17**
41	NTP for TG Supplier	0 days	Thu 1/1/15	Thu 1/1/15
42	Steam turbine LP Hood Manufacturing & Supply	0 days	Tue 2/28/17	Tue 2/28/17
43	Steam turbine HP/IP Casings Manufacturing & Supply	0 days	Tue 2/28/17	Tue 2/28/17
44	Steam turbine HP/IP/LP Rotors Manufacturing & Supply	0 days	Tue 2/28/17	Tue 2/28/17
45	Generator Manufacturing & Supply	0 days	Fri 3/31/17	Fri 3/31/17
46	**Construction , Erection & Commissioning**	**1368 days**	**Wed 10/1/14**	**Fri 6/29/18**
47	EPC Contract Signed	0 days	Wed 10/1/14	Wed 10/1/14
48	**Civil Construction**	**550 days**	**Fri 5/1/15**	**Mon 10/31/16**
49	Boiler Foundation	5.64 mons	Sat 5/16/15	Sat 10/31/15
50	STG Building	15.8 mons	Sat 5/16/15	Wed 8/31/16
51	Coal Handling System	15.27 mons	Fri 5/1/15	Sun 7/31/16
52	Cooling Water System	14.24 mons	Mon 6/1/15	Sun 7/31/16
53	Water Treatment System	14.24 mons	Mon 6/1/15	Sun 7/31/16
54	Central Control Building	13.74 mons	Tue 6/16/15	Sun 7/31/16
55	Switchyard	7.17 mons	Wed 7/1/15	Sun 1/31/16
56	Flue Gas System	7.17 mons	Wed 7/1/15	Sun 1/31/16
57	Fuel Oil System	11.17 mons	Tue 9/1/15	Sun 7/31/16
58	Ash Handling System	11.17 mons	Tue 9/1/15	Sun 7/31/16
59	Other Structers	13.24 mons	Thu 10/1/15	Mon 10/31/16
60	**Erection**	**785 days**	**Sun 11/1/15**	**Sun 12/24/17**
61	Boiler	26.17 mons	Sun 11/1/15	Sun 12/24/17
62	STG	15.2 mons	Thu 9/1/16	Thu 11/30/17
63	Coal Handling System	16.73 mons	Mon 8/1/16	Fri 12/15/17
64	Cooling Water System	8.1 mons	Mon 8/1/16	Fri 3/31/17
65	Water Treatment System	10.63 mons	Mon 8/1/16	Thu 6/15/17
66	I & C System	7.07 mons	Mon 8/1/16	Tue 2/28/17
67	Switchyard	12.7 mons	Mon 2/1/16	Wed 2/15/17
68	Flue Gas System	22.3 mons	Mon 2/1/16	Thu 11/30/17
69	Fuel Oil System	21.3 mons	Mon 2/1/16	Tue 10/31/17
70	Ash Handling System	25.87 mons	Sun 11/1/15	Fri 12/15/17
71	Other Equipments	16.74 mons	Mon 8/1/16	Fri 12/15/17
72	**Unit Commissioning**	**180 days**	**Mon 1/1/18**	**Fri 6/29/18**
73	Boiler Light up and steam blowing	0.5 mons	Mon 1/1/18	Mon 1/15/18
74	General start up	0 days	Wed 1/31/18	Wed 1/31/18
75	Trial Operation & Reliability Run Test	5 mons	Wed 1/31/18	Fri 6/29/18
76	Completion of Performance Test	0 days	Fri 6/1/18	Fri 6/1/18
77	COD	0 days	Sat 6/30/18	Sat 6/30/18



16. Project Benefit with Benefit-Cost Analysis

Costs and benefits must be estimated for the entire period of the project. Hence forecasting is a key part of the process of valuing costs and benefits. Constraints on meeting the objectives should be identified to ensure that all alternatives examined in the analysis are feasible. Constraints may be:

• Financial (for example, budget limits);
• Distributional (for example, requirements relating to the distribution of project benefits among individuals or groups);
• Managerial (for example, limits on the quantity and/or quality of staff available to implement the activity);
• Environmental (for example, environmental protection standards which must be met); and of other types.

Three separate values have been drawn from Cost Benefit Assessment which are:

- **Net Present Value:** This is obtained by subtracting the discounted costs and negative effects from the discounted benefits.
- **Benefit Cost Ratio**: This is derived by dividing the discounted costs by the discounted benefits.
- **Internal rate of return (IRR):** The average rate of return on investment costs over the life of the project.

According to the financial analysis undertaken for the project, total benefits obtained from the project are 8214.7 million USD, which will acquire over the project life cycle. Net present value has been calculated by offering discounted rates of 14%, 12% and 10% respectively. The results have been detailed in table below:

Table 16-1: Financial Analysis of the Proposed 660 MW Thermal Plant

Total benefits from the project	8214.7 USD		
Discount rated offered	**Value 1 at 14%**	**Value 2 at 12%**	**Value 3 at 10%**
	14%	12%	10%
Net Present Value (NPV)	174.4 USD	415.72 USD	755.45 USD
Benefit to cost ratio	1.20 USD	1.49 USD	1.88 USD
Project IRR -	15.57%		

Sensitivity Analysis

Sensitivity analysis evaluates how a single variable of production will effect on the total production process. Sensitivity analyses have been conducted to identify which variables have the most impact on the success of a new power plant project and to assess the degree of sensitivity for each variable. Coal cost has been considered as one of the variable which can have a plausible significant effect on the discounted net present value.

Table 16-2: Sensitivity Analysis considering the coal cost

Description	Unit	Option-1	Otion-2- Contingency Increased by 5%
Total Cost	BDT/MW	100	100.85
	USD/MW	1.25	1.26
Cost of Energy (Electricity)	Levelised (BDT/Kwh)	0.045	0.047
	Variable (BDT/Kwh)	0.043	0.045
Coal Cost	Variable (BDT/Kwh)	120.08	126.084

Project Benefits and Cost

16.1 Project Benefits

This section shall include benefits accruing to the locality, neighbourhood, region and nation as a whole. It should bring out details of benefits by way of:

16.1.1 Boost to Power Sector

The supply of electricity has a great positive impact on Gross Domestic Product (GDP) and is one of the key indicators to measure the economy of a country. There has been an increase in the demand for electricity in the recent years as a result of industrial development and population growth. The proposed project will generate 635 MW net to the present electricity availed to the population of Bangladesh. The per capita generation is 236 KWH (Ministry of Power, Energy and mineral resources; Access on 23-11-2011) which will tend to increase due to upcoming project in the region of Munshiganj. Ensuring the supply of electricity may trigger the regional development directly or indirectly.

16.1.2 Socio Economic Benefits

The proposed is likely to have positive impact on the nearby surrounding resulting in overall development of the area. The prospective benefits have been enumerated below:

Infrastructure Development: Coming of high investment projects in the area will lead to improving the education levels and in achieving secure jobs that will lead to income generation. This will lead to demands for development or up-gradation of existing infrastructure in the education sector. This will subsequently improve the infrastructure in the education sector. Similar phenomenon is expected in the health sector as well.

Employment Generation: The upcoming of project will benefit the local population in the long term and create a source of generation of sustenance for them. The project besides creating direct employment for the population (study area villages), indirect employment opportunities in terms of contractors, transport of equipments, value added services, tertiary service sector and independent small scale enterprises will also be generated in the area.

Boost to Local businesses: With onset of commercial activity, increase in demand of local produce, fish, prawns, poultry and dairy products is anticipated to increase and these local businesses shall grow in the process. This will inadvertently mean more money for the local population.

16.2 Project Cost

The total cost of the project has been estimated at USD 784.8 Million (equivalent to BDT 63,568.77 Million). The cost for pollution control abatement measures will be USD 1.98 Million. The cost of the project and means of finance is mentioned in *Table 15.1*

Table 0-1: Project Cost

S.No.	Particulars	Amount in BDT MN	Amount in USD Mn
1.	Land and Site Development	87.48	1.08
2.	EPC and Others	52368.9	646.53
3.	Jetty & Coal Handling	2388.69	29.49
4.	Preliminary and Pre-operative expenses	296.46	3.66
5.	Contingencies	1555.2	19.2
6.	Pre- Funded DSRA	516.78	6.38
7.	Interest during Construction	3427.92	42.32
8.	Finance Cost	2766.96	34.16
9.	Pollution Control and Management	160.38	1.98
	Total Project Cost	**63568.77**	**784.8**

16.3 Budget Allocation for ESMMP

The following Table 0-2 provides the capital cost and recurring cost of implementation of environmental management and monitoring measures, including installation of pollution control equipment, for both construction and operation phases.

Table 0-2: Cost of ESMMP Implementation

S. N.	Equipment Name	Capital Cost USD (Budgetary)	Recurring Cost USD per annum
A)	**Construction Phase**		
1	Provision of adequate drainage and bunds/ diversion dykes, water sprinkling etc. to prevent soil/raw material escape	60,000	8,000
2	Sanitation facility – provision of septic tanks and soak pit	8,000	800
3	Construction of suitable masonry bins with concrete floors for waste collection and for further disposal	3,500	800
4	Provision of tin sheets acting as noise barriers	7,000	1000
5	Miscellaneous expenses for construction phase ESMP implementation	1,20,000	60,000
6	Environment monitoring	-	100,000
7	Manpower for implementation of construction phase ESMP	Integrated in project cost	-
8	Land Acquisition	As per Valuation	-
	Sub Total (A)	***1,98,500***	***1,70,600***
B)	**Operation Phase**		
1	Sewage Treatment Plant (STP) (including conveying to STP and use of treated sewage in landscaping)	Integrated in project cost	35,000
2	Electrostatic precipitator (ESP)	Integrated in project cost	50,000

S. N.	Equipment Name	Capital Cost USD (Budgetary)	Recurring Cost USD per annum
3	Storm water construction	Integrated in project cost	10,000
4	Greenbelt and landscape development and annual maintenance	Integrated in project cost	80,000
5	Rain water harvesting system	Integrated in project cost	8,000
6	Acoustic enclosures and diesel storage for diesel generators	Integrated in project cost	1500
7	Solid wastes and hazardous wastes storage sheds (including impervious sheds for used oil storage) other than fly ash management	Integrated in project cost	85,000
8	Pollution monitoring from external agencies	Integrated in project cost	50,000
9	Environment, health and safety training for staff development and ESMP evaluation	Integrated in project cost	40,000
10	HSE Department monitoring, reporting, and statutory compliance	Integrated in project cost	110,000
11	Environmental HSE&S management team staff	-	150,000
	Sub Total (B)	**-**	***619,500***
	Total Cost (A+B)		**790,100 (61137938 BDT)**

Advanced technical measures have been adopted to control the pollution from the power plant and regular monitoring of the ambient environment will be carried out for ensuring a health environment. Pollution abatement measures will be implemented specifically to manage air emissions and fly ash generated. Adequate flue gas cleanings systems will be installed so that the emissions are well below the allowable limited. An electrostatic precipitator (ESP) will be installed to effectively remove the small particulate matter. All the DG sets will have acoustic enclosures limiting the noise to a maximum of 75 dB at one meters distance. A central effluent treatment plant with the facilitation of Central Monitoring Basin (CMB) has been planned to collect, treat and dispose all the plant effluents. Various management plans has been formulated to for sustainable operation of the project has been detailed out in ***Chapter no 12*** of the Report.

17. Public Consultation

17.1 Introduction

Development projects are planned based on the availability of exploitable natural resources. Upon commissioning these act as growth foci. This attracts flow of finances, investments, jobs and other livelihood opportunities, which brings in people from different cultural and social background. Such planned activities not only provide impetus to the local economy but also bring about a multi-dimensional economic, social and cultural change. Most often it has been observed that such development projects are commissioned in economically and socially backward areas, which are inhabited by some of the indigenous populations. Commissioning of development project invariably brings about a number of desired and undesired impacts along with it.

The proposed Munshiganj Thermal Power Project (635MW) being developed by the Orion Power Bangladesh is located on the banks of River Meghna in Munshiganj District. A detailed social impact assessment and stakeholder engagement and consultations were undertaken to understand the overall social and economic status of the people residing in the vicinity of this project. This comprehension would help planners to make an assessment of the baseline conditions and likely overall impacts of the proposed project on socio-economic environment and thus minimize these impacts.
The total land requirement for the upcoming project is an estimated 130 Acres, of which is private land holdings. In all, the project land shall encompass areas belonging to two villages – Char Balakia and Bhati Balakia. Together, these villages form the revenue Mouza of Char Betaki.

17.2 Scope and Objectives of the Study

The social assessment included information collected including demographic information, economic activities, literacy profile, land use, infrastructure resource, economic facilities, cultural heritage, life style and other value system.

The following methods were used as minimum requirement but not restricted to the following as and when required:

- Sample survey of 20% of households within 2 Km radius of the plant site.
- Stakeholders consultation: It will be carried out with the Project Affected Household (PAH)

Delineation of Preliminary Stakeholders –

- The type of stakeholders, and
- Their connection and influence levels on the project.

Some of the key stakeholders that were consulted and a comprehensive list of stakeholders along with a tailored engagement tool were prepared prior to the start of the consultation process. Limited stakeholder consultations: Different stakeholder groups were consulted to understand:

- Their concerns with regard to the project,
- Their expectations in terms of benefits,
- Compensation,

- Entitlements and other advantages.

The consultations included:

- Consultation with relevant government officials like DOE, Department of Forestry and others as are found to be relevant
- Consultation with NGO officials as is locally available
- Consultation with local community leaders
- Large public consultation meeting with the all types people (Local people, NGO representatives, Political leaders, government officials and others as are available)

17.3 Study Area

The study area delineated for this social impact assessment and community and stakeholder consultations was limited to the villages within a radius of 3 km around the proposed project site, besides the project affected villages.

17.4 Study methodology

A detailed social impact assessment and stakeholder engagement and consultations were undertaken to understand the overall social and economic status of the people residing in the vicinity of this project site, as well as in the affected villages. This section entails the study approach and methodology adopted to undertake this assessment.

17.4.1 Desk Based Review

A desk based review was undertaken and existing documents and data were studied to get a preliminary understanding of the project area and the project influenced population. These included national census (2011), UN reports on development, and socio economics, and the Initial Environment Examination report (2012) of the proposed project site.

17.4.2 Questionnaires & Interview Schedule

Based on the desk based research and assessment of the previous IEE report, a questionnaire was prepared. It was designed to capture demographic characteristics, literacy levels, occupational patterns, societal set up, access to basic amenities and socio - economic status of respondents and project relevant details such as community apprehensions, expectations and understanding of proposed project. The questionnaire included both closed-ended and open-ended sections and the respondents were additionally asked to rate their development needs on priority scale of 1 to 10.

The same questionnaire was used to conduct and facilitate Group discussions.

17.4.3 Community Consultations

Community consultations were held at two project influenced villages, Bhati Balakia and Char Balakia, the rationale being that these have closest proximity to the project site.

17.4.3.1 Methods Adopted for Consultations

Individual interviews and informal group interviews were conducted amongst naturally gathered groups, where in the responses that emerged, were frank and debated upon. In addition Focus Group Discussions were held at all three locations. The locations and dates of community consultations have been provided in *Table 16.1.*

Table 17.1: Community Consultations: Locations and Dates

Sr. No	Location	Mouza	Date	Consultation Method
1.	Bhati Balakia village	Char Betaki	12th February, 2014	Individual Interviews, Group Interviews Focus Group Discussion
2.	Char Balakia Village	Char Betaki	13th February, 2014	Individual Interviews, Group Interviews Focus Group Discussion
3.	Shaheed Nagar (extent ion of Char Balakia village)	Char Betaki	13th February, 2014	Group Interviews Focus Group Discussion

17.4.3.2 Observation, Side Notes and Triangulation[3]

Observations were made on village conditions, type of houses, access to essential utilities, sanitation facilities, socio economic conditions and communal harmony. These were used to corroborate the primary and existing secondary data (census). Side notes were taken during public consultations on non-verbal cues of the participants and any communal undercurrents and all information was triangulated as much as possible to maintain accuracy and validity.

17.4.4 Analyses

Diverse Samples were taken from the affected population for consultation and these represented women, persons from different age groups, occupations and socio economic strata. The consultations were stopped when saturation in responses was seen. All content was scanned through and studied for commonality in words, trends and information. Side notes and observation records were corroborated to obtain findings. In addition, MS Excel was used to quantify the responses.

[3] Triangulation is a technique that facilitates validation of data through cross verification from at least different sources of data.

17.5 Project Influenced Area: Public Consultations

This section contains results from stakeholder consultations that were carried out by AECOM and Adroit Environmental Consultants Limited, during site visit. The respondents were selected from the villages falling within a 3 km radius of the proposed plant and collectively formed a sample, which represented approximately 20% of the total influenced households. In addition, this section details the outcome of the Public Hearing held by Orion Group to apprise the community of the project.

17.5.1 Consultations by AECOM

As already mentioned, individual interviews and informal group interviews were conducted amongst naturally gathered groups, where in the responses that emerged, were frank and debated upon. In addition Focus Group Discussions were held at all three locations, viz., Bhati Balakia village, Char Balakia Village and Shaheed Nagar (extent ion of Char Balakia village). The details of the consultations are elucidated in the following paragraphs. A sample social survey questionnaire has been annexed as ***Annexure D.***

17.5.1.1 Education and Literacy Levels

In both, Bhati Balakia and Char Balakia, everyone interviewed and spoken to was found to be literate and educated till at least 5th standard. This was found to be common even amongst the oldest generation, and indicates good literacy coverage in the villages. In Shaheed Nagar, the literacy levels were assessed to be lower, across both genders, and women were unwilling to speak to the study team.

During consultations, it was felt that literacy levels amongst women were relatively high, at least till the primary level. When asked if women worked outside of their homes, respondents replied that it was common for educated women, who had completed masters or bachelors, to go to Dhaka or Sonargaon to take up work.

17.5.1.2 Access to Health Care

It was evident that access to good health care is limited because of poor transportation connectivity and logistics. Both villages have a primary Health centre. However, the centres are only manned by a compounder and are only open a few days a week. For any major ailment or emergency, health care services have to be sought from either government or private hospitals at Sonargaon or Hosseindi.
Community consultations further revealed that internationally funded and managed health intervention programmes such as the Polio immunization, were routinely conducted. However, other government run programmes such as STOP TB, child immunization, Antenatal care for pregnant women and other outreach programmes, were not available at village levels. Women reported to going to Sonargaon for antenatal checkups during pregnancy, and for services such as family planning, delivering babies and immunization of children. In Shaheed Nagar, however a reported 70% to 80% of births took place at home, often without follow up with a medical practitioner.

For smaller ailments and symptoms such as coughing, fever, diarrhoea, skin rashes, small accidents etc, the villagers either take medicines from the PHC compounders or go to a non-physician village -

doctor. Incidentally, these were the most common ailments prevalent in the community. Amongst women, gynaecological problems and post birth complications were common.

17.5.1.3 Drinking Water facilities

An estimated 90 % of households in both villages source drinking water from tube well. For other purposes such as washing, cleaning, bathing and household chores, water is taken from the river. Tube wells were found to be either household owned or community owned, and other than form Shaheed Nagar, there were no reports of government installed tube wells.

17.5.1.4 Sanitation facilities

Almost all houses had sanitary pit latrines, with access to tap water nearby. These were corroborated with observations made during village walk through. In Shaheed Nagar, however, the majority of houses did not have proper latrines and respondents reported to *"everyone resorting to open defecation."*

17.5.1.5 Transport Facilities and connectivity

The two villages are situated on a small island and surrounded by river Meghna, thereby limiting the access by roads. The island is not connected by either bridges or regular boat ferry services. Very few people in the village own motorised boats, and no one reported to owning a speed boat. The nearest towns and market centres lie in Sonargaon, Hosseindi and Narayanganj. Sonargaon lies at a distance of 8 km from Bhati Balakia and 5 km from Char Balakia, while Narayanganj is approximately 20 km away from both villages. There is no public transportation service or government assisted logistics program in the project influenced villages currently. The boat fare is expensive and can range from 80 to 100 Taka one way.

17.5.1.6 Access to Other Amenities

All houses, irrespective of their economic status used open *Cholas* or mud ovens for cooking. Make mention of source of fire-wood, coal, etc, its adequacy, availability, etc. A few houses had gas stoves and LPG cylinders as well.

Figure 17.1: Most houses had open Choolhas as means for cooking

The nearest Veterinary hospital is approximately 10 km away, in Barbechor, but is of little utility since one needs a boat ride followed by a bus ride to reach there. In addition, the hospital does not have any ambulance. A second veterinary hospital is located in Sonargaon.

17.5.1.7 Occupation Patterns, Work force Participation and economic status

The primary occupation of village dwellers appears to be agriculture and allied activities, followed by fishing. Poultry and cattle rearing are done for personal consumption. In Char Balakia, it emerged that approximately 50% of population drew their income primarily through agriculture, and about 30% from fishing. The main crops grown are potato, mustard, sesame and peanuts. An average monthly household income was difficult to ascertain since it depended on the occupations, number of earning members in a family and the family assets. However, the income fell within the range of 7,000 Taka to 20,000 Taka for a family of 5 to 8 persons.

Fishermen made a monthly earning of anywhere between 5,000 to 15,000 Taka. It was reported that Prawn and “Hilsa” or “Ilish” drew the best prices in the market. The local fishermen were found to be indulging in a unique form of aquaculture, where in they accumulate the rampantly growing water hyacinth and bound it by tall bamboos erected in the river bed. Eventually fish and other aquatic life agglomerates there, breeds and grows in number. This type of culture is popularly known as Pulse fishing and provides a substantial catch for fishermen every couple of weeks.

A large number of village youth migrate to other countries to work as unskilled and semi-skilled labour. The villagers quoted Saudi Arabia, Qatar and other Gulf countries, as the countries to where the youth migrated to most commonly.

Women in the community traditionally do not work outside of their homes and most women look after household chores, poultry and cattle while male members of their families draw income through formal work. Nevertheless, few women, amongst those educated till college and university levels, were reported to working in nearby towns like Hosseindi and Sonargaon in Felds of education and nursing. Both villages have active Self Help Groups amongst women and banks like BRAC, ASHA, and GRAMEEN assist them with microfinance loans. The loan rates quoted by respondents varied from 10 to 15 %. When asked for the purpose that Self Help Groups provided loans for, women responded with “mostly medical emergencies, marriages, household repairs and deaths”.

There are no vocational training centres in the vicinity and any skill such as embroidery, weaving, stitching and carpentry etc. is learnt from individual persons in the village. The nearest vocational training institutes are in Sonargaon and Hosseindi.

17.5.1.8 Details of Land Procured

Although land details such as type of land and crop cultivated in the 6 months prior to procurement were unavailable for review, community consultations and satellite imaging indicate the procured land was formerly utilized for farming. The land was procured on a willing buyer willing seller basis, and the compensatory amount was decided mutually between Orion Group and Land contributors. Barring 2 or 3 individuals, all respondents who had contributed land, were found satisfied by the compensation.

Figure 17.2 : Irrigation ridges in the procured land indicate that the land was formerly used for agriculture

All of the 130 acres required for the project, was procured from villagers on negotiated and mutually decided rates. Villagers informed that the rates were higher than the prevailing market rates.

17.5.1.9 Needs felt by Affected Community

During consultations, the respondents were asked to indicate the needs of their community that they felt needed highest priority, and rate them based on priority (1 being the highest and 10 being lowest). The most felt needs were for better medical facilities and improved infrastructure in terms of roads and connectivity. These were followed by employment opportunities and access to electricity. Potable water was a need felt by everyone and villagers went on to the extent of indicating that the ground water was high in iron and arsenic content and that this was causing gastrointestinal ailments in children.

Agricultural and skill development were also mentioned, with the rationale that without a technical skill set training, the youth was unable to find well-paying jobs locally. The demand for unskilled and semi-skilled labour was being easily met. In addition, with the advent of this project the local youth would stand chance of employment in the technical section, as compared to security and labour.

17.5.1.10 Community's perception of Project

Amongst the respondents, it was seen that not all community members were aware of the project components. However, there were sections that were well appraised about the project's associated benefits and risks. The community's apprehensions and expectations have been summarised in Table 6.7. The list is not based on priority of points.

Table 17.2 Community's Apprehensions and Expectations

Community's apprehensions	Community's expectations
• Those who had contributed all of their land for the project were concerned over their economic well-being due to absence of their main source of income. • Men folk had reservations that the company might select outsiders over local populace to work in its plant. • A small proportion of people were worried about the safety of women in the village due to influx of outside labour • Fishermen were concerned that the plant may have an effect on the fish population due to discharge of hot water and *"other pollutants".*	• Better Employment Opportunities, both unskilled and skilled, especially for members of Project affected families. • Improved, cheaper transportation and connectivity • Likely boost to local businesses because of the project. With onset of commercial activity, increase in demand of local produce, fish, prawns, poultry and dairy products is anticipated to increase. • The community expects medical facilities as a part of the company's CSR, and tie up with ongoing government health schemes, such as those in immunization, mineral supplementation etc.

Figure 17.3 Consultations with community members

17.5.2 Consultations by Adroit Environmental Consultants Limited

For the upcoming project, Adroit Consultants, Bangladesh carried out Social Surveys in addition to their meteorology, air, water, noise and soil quality monitoring. Adroit personnel undertook community survey on two occasions, one simultaneously with AECOM staff and the second during

the public hearing held by Orion Group on 15th February 2014. Table 6.8 entails the findings of their study.

Table 17.3: Findings of Consultation by AECL

Nature of Question	Responses			
	Respondents from project influenced villages		Attendees of Public Hearing	
Proportion of people Informed about OPDL-2	Yes	100%	Yes	100%
	No	0%	No	0%
Information About Environment Pollution	Yes	95.65%	Yes	97.76%
	No	4.35%	No	2.24%
Possible types of Pollution may that the proposed facility could produce	Water	47.83%	Water	36.58%
	Air	39.13%	Air	47.01%
	Sound	13.04%	Sound	16.42%
Proportion of persons having land in the project site.	Yes	100%	Yes	40.30%
	No	0%	No	59.70%
Types of crops grown on the land	Rabi	86.96%	Rabi	24.63%
	Aush	0%	Aush	0%
	Amon	0%	Amon	0%
	Boro	0%	Boro	0%
	Fish	13.04%	Fish	15.67%
	N/A	0%	N/A	59.70%
Proportion of persons having lost profession upon land procurement.	Yes	39.13%	Yes	8.96%
	No	60.87%	No	31.34%
	N/A	0%	N/A	59.70%
Proportion having received their specific price for the land.	Yes	100%	Yes	30.30%
	No	0%	No	0%
	N/A	0%	N/A	59.70%
Proportion expecting probability of new profession due to project inception	Yes	91.30%	Yes	94.78%
	No	8.70%	No	5.22%
Proportion of persons who think there is a probability of economic growth due to project inception.	Yes	95.65%	Yes	99.25%
	No	4.35%	No	0.75%
Overall opinion regarding the project.	Continue the Project	100%	Continue the Project	100%
	Stop the Project	0%	Stop the Project	0%

17.5.3 Public Hearing by Orion Group

The IFC Performance Standards requires effective community engagement through consultation with local people in project affected area for dissemination of project related information and consultation with communities on matters that directly affect them. The project proponent as part of it regulatory obligation to the Bank, has to conduct a public disclosure meeting in order to apprise the resident population in the project affected area about the project and address their concerns regarding the same. In accordance with the IFC standards and Bangladesh's national legislations, Orion Group conducted a Public Hearing for OPDL-2 on February 15, 2014 at the proposed project

site. The primary purpose of the hearing was disclosure of project related information and addressal of any queries, concerns or grievances. The event witnessed a footfall of approximately 300 local people. The meeting was convened by Mr. Md. Mosharraf Hossain, Vice president (Coal Business Development) of Orion Group.

The key members present at the event included top management officials from Orion Group, Hossaindi Union Chairman, BPDB representatives, DoE officials, local political figures, community leaders such as the Hossaindi High school headmaster etc. Two representatives each from AECOM and Adroit Environmental Consultants Limited (AECL) were also present at the event. List of the attendees with their contact details has been annexed as ***Annexure E.***

Figure 17.4: Public hearing proposed OPDL-2 site, Munshiganj

OPDL-2 representatives talked about Bangladesh's economical and electricity scenario and the necessity of coal fired power plants in the country. They presented details about the proposed projects, boiler technology, environmental safeguards that have been incorporated in the project design, possible impacts and corresponding mitigation measures to minimize environmental pollution during project operations. Proposed infrastructural development and Corporate Social Responsibility (CSR) activities to be undertaken by OPDL-2 were also briefed about by the OPDL-2 representatives. AECOM representatives briefed the local people about their scope of work whereas AECL representatives were responsible for conducting individual opinion from local people through questionnaire surveys.

The key issues and concerns raised by the local people during the hearing and the responses given by OPDL-2 representatives have been summarised in *Table 16.4*. Other than these, generic issues such as development of villages, setting up of *madrassas* and mosques, employment of local people, setup of hospitals etc. were voiced by attendees. All queries raised during the event were answered by Mr. Mosharaf and other OPDL-2 representatives.

Table 17.4: Key Issues and Responses

S.No	Key Issue	Response
1.	A local political leader suggested the development of a road from the proposed site to Meghnaghat Power plant. He also requested OPDL-2 to	OPDL-2 plans to develop roads from Comilla Vidyut Palli Samiti to project site which shall be accessible to the local villagers. OPDL-2 intends to setup schools with well qualified faculty members near the project site for providing education to

S.No	Key Issue	Response
	setup primary and secondary level schools, and *madrassas* in the vicinity of the project site. The local children have to cross the river to go to secondary schools located in Naryanganj. Consequently, many students opt out from studying after attaining primary education.	children of workers who will be employed during the project construction phase. Such schools shall also be accessible to the villagers and the cost of education will be entirely borne by OPDL-2.
2.	Mr. Abdul, Hossaindi Union Chairman raised concern about pollution from the proposed project since it is a coal based thermal power project. He urged OPDL-2 to provide employment to the people who have sold their land to the company since the lands were agricultural in nature and served as their major source of income. He also emphasized that OPDL-2 shall stick to the wages they had promised to pay to the workers.	The proposed power project will operate on ultra-supercritical boiler technology. This has a higher efficiency as compared to conventional coal based power plants which are subcritical in nature. The fly ash generated will be removed by usage of ESPs which have a removal efficiency of 99.98%. The project layout has also incorporated a greenbelt development which shall be done over 30% of the land area. The project construction phase requires approximately 3000 workers. OPDL-2 has promised that it shall give priority to local people for employing them as workers, especially those who have sold their lands to the company. The local people will be hired as unskilled or skilled labourers as per their competence.
3.	The General Secretary of Gozaria reiterated on the aforementioned issues. He also expressed his concern about the effect of the project effluent disposal on fishes present in the Meghna river since fisheries are the biggest source of income for the local communities apart from agriculture.	OPDL-2 has planned to install screens in front of the intake channel to prevent the entry of fishes into it. DoE has prescribed that effluents from power plants shall be discharged at a temperature less than 40°C during summers and 45°C during winter season. However, OPDL-2 shall follow the IFC standard which has prescribed a maximum effluent temperature of 36°C. O By implementing the two aforementioned measures, OPDL-2 shall ensure minimum damage to fishes present in the river.
4.	A villager raised concerns about blockage and subsequent drying up of a river canal that passes through the project site as well as a village. The village people are dependent on the canal for fishes which support their livelihood. He also mentioned that the villagers have to travel at least 1.5 km to the river to collect water as the canal is drying up.	OPDL-2 reassured that there will be no blockage of any canal and it will remain unhindered even within the power plant premises. He explained that current decrease in water flow in the canal can be attributed to the shortage of rainfall.
5.	A villager raised issues about misrepresentation of land and incomplete payment of compensation to the landowners who sold their land.	OPDL-2 has been advised to check the land records carefully to identify the actual landowners and rollout compensation to them. In some cases, the actual landowner may not have survived and mutation has taken place. Such cases do not get immediately reflected in the revenue records. Hence, OPDL-2 is advised to ensure extra scrutiny in such cases and verify credentials of landowners and mutation documents before

S.No	Key Issue	Response
		rolling out compensation.
6.	A villager raised concern over the provision of quality drinking water and accommodation facilities for workers to be employed during construction phase.	OPDL-2 has planned to provide accommodation equipped with potable water facilities for 3000 workers during the construction period. A Water Treatment Plant (WTP) shall be setup for treating the river water to drinking water standards which shall subsequently be provided to the workers.

18. Conclusion and Categorisation

The gap between installed capacity and maximum generation of electricity in Bangladesh is increasing over the years, creating pressure on supply of electricity. The official statistics of the Power Ministry of Bangladesh shows that the power generation capacity at the beginning of 2014 is 10,264 MW including 500 MW import from India. In lieu of this, the government of Bangladesh has designed a strategy to overcome the crisis and meet the ever increasing demands for power. The Government has plans to generate about 15,000 MW of power, out of which 58% of power will be generated from the private sector. The 635 MW coal-fired power plant proposed by Orion Power Unit-2 Dhaka Limited in Munshiganj district will make a significant contribution to reducing the electricity supply–demand gap in the country.

The plant will use ultra-supercritical steam technology, which will provide greater efficiency than conventional subcritical coal-fired power plants and require relatively lower coal consumption. Coal fired thermal power is the most cost-effective form of base load power generation available for the country. The Project will adopt best technology and design practices to minimize the impact on air quality. This involves the use of low NOx burners and high efficiency electrostatic precipitators to minimise particulate matter emission. Flue gas emissions are expected to meet IFC emission guidelines for new thermal power plants, with the net impact on ambient air quality predicted to be within the prescribed limits in the project's airshed.

The ambient air quality with respect to sulphur dioxide (SO_2) and nitrogen oxides (NOx) is expected to remain below the prescribed IFC (World Bank) guidelines. The Project related incremental contribution to particulate matter in ambient air is expected to be in the range of 0.6 - 0.9 µg/m^3. However, the baseline particulate matter in the area has been observed to be high (i.e. exceeding the prescribed norm) owing to the area's proximity to cement manufacturing plants, market areas and busy ship routes which experience high traffic.

The Project will utilize once through cooling system, which leads to a lower net water requirement of 110,000m^3/hour, due to lower evaporation loss as compared to closed cooling water system. The water will be drawn from Meghna River and used water will be discharged back into the river after cooling. Hence the use of water will not affect existing local water users. The project will have minimum ecological impacts as the project will develop more than 30% of the land under greenbelt.

A project specific Environmental and Social Management and Monitoring Plan has been proposed for implementation by ODPL and its contractors. The plan will be overseen, monitored, and audited by ODPL on periodic basis. ODPL will ensure that the suggested mitigation measures and management plans developed for the project as part of this ESIA study is effectively implemented by the Project during its entire life cycle in order to minimize the environmental and social impacts unavoidably associated with the Project. ODPL will also ensure that the Project conforms to all the legal, regulatory and policy objectives and also ensure that all the necessary permits are obtained and renewed from time to time.

As per US Exim Bank's environmental categorization of projects, all thermal power plants greater than 140 MWe have the potential to cause significant adverse impacts and are categorized under Category A. Hence, based on the requirement of US Exim Bank and the findings of this ESIA study, the proposed 635 MW Dhaka power plant is categorized as "**Category A"** project.