6.0 ENVIRONMENTAL MONITORING PROGRAM

6.1 Introduction

Regular monitoring of environmental parameters is of immense importance to assess the status of environment during project operation. With the knowledge of baseline conditions, the monitoring programme will serve as an indicator for any deterioration in environmental conditions due to operation of the project, to enable taking up suitable mitigatory steps in time to safeguard the environment. Monitoring is as important as that of control of pollution since the efficiency of control measures can only be determined by monitoring.

Usually, as in the case of the study, an Impact Assessment study is carried over short period of time and the data cannot bring out all variations induced by the natural or human activities. Therefore, regular monitoring programme of the environmental parameters is essential to take into account the changes in the environmental quality.

6.2 Environmental Monitoring and Reporting Procedure

Monitoring shall confirm that commitments are being met. This may take the form of direct measurement and recording of quantitative information, such as amounts and concentrations of discharges, emissions and wastes, for measurement against corporate or statutory standards, consent limits or targets. It may also require measurement of ambient environmental quality in the vicinity of a site using ecological/biological, physical and chemical indicators. Monitoring may include socio-economic interaction, through local liaison activities or even assessment of complaints.

6.2.1 Objectives of Monitoring

The objectives of environmental post-project monitoring are to:

- Verify effectiveness of planning decisions;
- Measure effectiveness of operational procedures;
- Confirm statutory and corporate compliance; and
- Identify unexpected changes.

6.3 Monitoring Schedule

Environmental monitoring schedules are prepared covering various phases of project advancement, such as constructional phase and regular operational phase.

6.3.1 Monitoring Schedule during Constructional Phase

The proposed power project envisages setting up of boilers, turbines and cooling towers, establishment of storage facilities for coal and ash. The construction activities require clearing of vegetation, mobilisation of construction material and equipment. The construction activities are expected to last for over five years.

The generic environmental measures that need to be undertaken during project construction stage are given in **Table-6.1**.

TABLE-6.1
ENVIRONMENTAL MONITORING DURING PROJECT CONSTRUCTION STAGE

Sr. No.	Potential Impact	Action to be Followed	Parameters for Monitoring	Frequency of Monitoring
1	Air Emissions	All equipments are operated within specified design parameters.	Random checks of equipment logs/ manuals	Periodic
		Vehicle trips to be minimized to the extent possible	Vehicle logs	Periodic during site clearance & construction activities
		Maintenance of DG set emissions to meet stipulated standards	Gaseous emissions (SO_2, HC, CO, NOx)	Periodic emission monitoring
		Ambient air quality within the premises of the proposed unit to be monitored.	The ambient air quality will conform to the standards for SPM, RPM,SO_2, NO_x, and CO	As per CPCB/ SPCB requirement or on monthly basis whichever is earlier
2	Noise	List of all noise generating machinery onsite along with age to be prepared. Equipment to be maintained in good working order.	Equipment logs, noise reading	Regular during construction activities
		Night working is to be minimized.	Working hour records	Daily records
		Generation of vehicular noise	Maintenance of records of vehicles	Daily records
		Noise to be monitored in ambient air within the plant premises.	Spot Noise recording	As per CPCB/SPCB requirement or on quarterly basis whichever is earlier
3	Wastewater Discharge	No untreated discharge to be made to surface water, groundwater or soil.	No discharge hoses shall be in vicinity of watercourses.	Periodic during construction activities
4	Soil Erosion	Protect topsoil stockpile where possible at edge of site.	Effective cover in place.	Periodic during construction activities
5	Drainage and effluent Management	Ensure drainage system and specific design measures are working effectively. The design to incorporate existing drainage pattern and avoid disturbing the same.	Visual inspection of drainage and records thereof	Periodic during construction activities
6	Waste Management	Implement waste management plan that	Comprehensive Waste Management	Periodic check during

Sr. No.	Potential Impact	Action to be Followed	Parameters for Monitoring	Frequency of Monitoring
		identifies and characterizes every waste arising associated with proposed activities and which identifies the procedures for collection, handling & disposal of each waste arising.	Plan should be in place and available for inspection on-site. Compliance with MSW Rules, 1998 and Hazardous Wastes (Management and Handling Rules), 2003	construction activities
7	Non-routine events and accidental releases	Plan to be drawn up, considering likely emergencies and steps required to prevent/limit consequences.	Mock drills and records of the same	Periodic during construction activities
8	Health	Employees and migrant labour health check ups	All relevant parameters including HIV	Regular check ups
9	Environmental Management Cell/ Unit	The Environmental Management Cell/Unit is to be set up to ensure implementation and monitoring of environmental safeguards.	Responsibilities and roles will be decided before the commencement of work.	During construction phase
10	Loss of flora and fauna	Re-vegetation as per Forest guidelines	No. of plants, species	During site clearance phase

6.3.2 Monitoring Schedule during Operational Phase

During operational stage, continuous air emissions from power boilers, wastewater treatment, non-hazardous waste such as ash, hazardous used oily wastes are expected.

The following attributes which merit regular monitoring based on the environmental setting and nature of project activities are listed below:

- Source emissions and ambient air quality;
- Groundwater Levels and ground water quality;
- Water and wastewater quality (water quality, effluent & sewage quality etc);
- Solid and hazardous waste characterisation (fly ash, bottom ash, oily wastes, ETP sludge, used and waste oil);
- Soil quality;
- Noise levels (equipment and machinery noise levels, occupational exposures and ambient noise levels); and
- Ecological preservation and afforestation.

The following routine monitoring programme as detailed in **Table-6.2** shall be implemented at site. Besides to this monitoring, the compliances to all environmental clearance conditions and regular permits from SPCB/MoEF shall be monitored and reported periodically.

TABLE-6.2
ENVIRONMENTAL MONITORING DURING OPERATIONAL PHASE

Sr. No.	Potential Impact	Action to be Followed	Parameters for Monitoring	Frequency of Monitoring
1	Air Emissions	Stack emissions from power boilers to be optimized and monitored	Gaseous emissions (SPM, SO_2, CO, NOx and Hg)	Continuous monitoring using on-line equipment during operation phase
		Stack emissions from DG set to be optimized and monitored	Gaseous emissions (SO_2, HC, CO, NOx)	Periodic during operation phase
		Ambient air quality within the premises of the proposed unit and nearby habitations to be monitored. Exhaust from vehicles to be minimized by use of fuel efficient vehicles and well maintained vehicles having PUC certificate.	$PM_{2.5}$, PM_{10}, SO_2, NO_x, CO and HC. Vehicle logs to be maintained	As per CPCB/ SPCB requirement or on weekly basis.
		Measuring onsite data of Meteorology	Wind speed, direction, temp., relative humidity and rainfall.	Continuous monitoring using on-line weather station during operation phase
2	Noise	Noise generated from operation of power boilers/cooing towers to be optimized and monitored Noise generated from operation of DG set to be optimized and monitored DG sets to generate less than 75 dB(A) Leq at 1-m from the source DG sets are to be provided at basement with acoustic enclosures	Spot Noise Level recording; Leq(night), Leq(day), Leq(dn)	Periodic during operation phase
		Generation of vehicular noise	Maintain records of vehicles	Periodic during operation phase
		Ambient Noise level on the plant boundary and nearby habitations to be monitored.	L_{day}, L_{night}, L_{dn}, L_{eq}	Monthly on the plant boundary and once in six month at the habitation.
3	Wastewater Discharge	No untreated discharge to be made to surface water, groundwater or soil.	Regular check ups	Periodic during operation phase
		Take care in disposal of wastewater generated such that soil and groundwater resources are protected	Discharge norms for effluents	Periodic during operation phase

Sr. No.	Potential Impact	Action to be Followed	Parameters for Monitoring	Frequency of Monitoring
		Compliance of wastewater discharge to standards	pH, TSS, TDS, BOD, COD & Temperature	Once in a week during operation phase
		Compliance of treated sewage to standards	Comprehensive as per GSR 422(E)	Once in a season
4	Drainage and effluent Management	Ensure drainage system and specific design measures are working effectively. Design to incorporate existing drainage pattern and avoid disturbing the same.	Visual inspection of drainage and records thereof	Periodic during operation phase
5	Water Quality and Water Levels	Monitoring used water quality, groundwater quality around ash pond and ground water levels	Comprehensive monitoring as per IS:10500 Groundwater level in meters bgl	Periodic during operation phase
		River water quality downstream to discharge	As per IS:2296	Once in a week
6	Work zone air contamination	Contaminants such as VOCs to be reduced by providing adequate ventilation	Monitoring of indoor air contaminants such as CO, CO_2 and VOCs.	As per CPCB/ SPCB requirement
7	Emergency preparedness, such as fire fighting	Fire protection and safety measures to take care of fire and explosion hazards, to be assessed and steps taken for their prevention.	Mock drill records, on site emergency plan, evacuation plan	Periodic during operation phase
8	Maintenance of flora and fauna	Vegetation, greenbelt / green cover development	No. of plants, species	Periodic during operation phase
9	Waste Management	Implement waste management plan that identifies and characterizes every waste arising associated with proposed activities and which identifies the procedures for collection, handling & disposal of each waste arising.	Records of solid waste generation, treatment and disposal	Periodic during operation phase
10	Soil quality	Maintenance of good soil quality	Physico-chemical parameters and metals.	Periodical monitoring at ash pond site
11	Health	Employees and migrant labour health check ups	All relevant parameters including HIV	Regular check ups

6.4 Monitoring Methods and Data Analysis of Environmental Monitoring

All environmental monitoring and relevant operational data will be stored in a relational database and should be able to link to GIS system. This will enable efficient retrieval and storage and interpretation of the data. Regular data extracts and interpretive reports will be sent to the regulator.

6.4.1 Air Quality Monitoring and Data Analysis

6.4.1.1 Stack Monitoring

The emissions from all the stacks shall be monitored regularly. The exit gas temperature, velocity and pollutant concentrations shall be measured. Any unacceptable deviation from the design values shall be thoroughly examined and appropriate action shall be taken. Air blowers shall be checked for any drop in exit gas velocity.

6.4.1.2 Workspace Monitoring

The concentration of air borne pollutants in the workspace/work zone environment shall be monitored periodically. If concentrations higher than threshold limit values are observed, the source of fugitive emissions shall be identified and necessary measures taken. Methane and non-methane hydrocarbons shall be monitored in oil storage area once in a season. If the levels are high suitable measures as detailed in EMP shall be initiated.

6.4.1.3 Ambient Air Quality Monitoring

The ground level concentrations of $PM_{2.5}$, PM_{10}, SO_2 and NO_X in the ambient air shall be monitored at regular intervals. Any abnormal rise shall be investigated to identify the causes and appropriate action shall be initiated. Greenbelt shall be developed for minimising dust propagation. The ambient air quality data should be transferred and processed in a centralised computer facility equipped with required software. Trend and statistical analysis should be done.

6.4.2 Water and Wastewater Quality Monitoring and Data Analysis

To ensure a strict control over the water consumption, flow meters shall be installed for all major inlets. All leakages and excess shall be identified and rectified. In addition, periodic water audits shall be conducted to explore further possibilities for water conservation.

Methods prescribed in "Standard Methods for Examination of Water and Wastewater" prepared and published jointly by American Public Health Association (APHA), American Water Works Association (AWWA) is recommended.

6.4.2.1 Monitoring of Wastewater Streams

All the wastewater streams in the project area shall be regularly analysed for flow rate and physical and chemical characteristics. Such analysis is carried out for wastewater at the source of generation, at the point of entry into the wastewater treatment plant and at the point of final discharge. These data shall be properly documented and compared against the design values for any necessary corrective action.

6.4.2.2 Monitoring of Groundwater

The monitoring of groundwater is the most important tool to test the efficiency of ash pond performance. This is indispensable as it provides detection of the presence of waste constituents in groundwater in case of leachate migration. In this programme, water samples are taken at a predetermined interval and analysed for specific pollutant expected to be in the leachate. For early detection of leachate migration, if any, it is suggested to construct piezometers around the ash pond site.

In addition to piezometers, monitoring wells should be installed to a depth of at least 3-m below the maximum historic groundwater depth. Based on assumptions and data about the characteristics of leachate to be generated, approximate permeability of soils in the zone of aeration and direction and velocities of groundwater flow, the maximum probable aerial extent of contaminant migration can be estimated as a basis for establishing the position of monitoring wells.

A minimum of two ground monitoring wells should be typically installed at ash disposal facility: one up-gradient well and one down-gradient well. It is suggested to collect water samples and analyse. Records of analysis should be maintained.

6.4.3 Noise Levels

Noise levels in the work zone environment such as boiler house, cooling tower area, DG house shall be monitored. The frequency shall be once in three months in the work zone. Similarly, ambient noise levels near habitations shall also be monitored once in three months. audiometric tests should be conducted periodically for the employees working close to the high noise sources.

6.5 Reporting Schedules of the Monitoring Data

It is proposed that voluntary reporting of environmental performance with reference to the EMP should be undertaken.

The environmental monitoring cell shall co-ordinate all monitoring programmes at site and data thus generated shall be regularly furnished to the state regulatory agencies.

The frequency of reporting shall be on six monthly basis to the local state pollution control board officials and to Regional office of MoEF. The Environmental Audit reports shall be prepared for the entire year of operations and shall be regularly submitted to regulatory authorities.

6.6 Infrastructure for Monitoring of Environmental Protection Measures

A well-equipped laboratory with consumable items shall be provided for monitoring of environmental parameters in the site. Alternatively, monitoring can be outsourced to a recognized reputed laboratory.

The following equipment and consumable items shall be made available in the site for environmental monitoring or alternatively the monitoring can be outsourced by engaging a reputed authorised environmental laboratory.

Air Quality and Meteorology

High volume samplers, stack monitoring kit, personal dust sampler, central weather monitoring station, spectrophotometer (visible range), single pan balance, flame photometer, relevant chemicals as per IS:5182.

Water and Wastewater Quality

The sampling shall be done as per the standard procedures laid down by IS: 2488. The equipments and consumables required are:

BOD incubator, COD reflex set-up, refrigerator, oven, stop watch, thermometer, pH meter, distilled water plant, pipette box, titration set, dissolved oxygen analyser, relevant chemicals.

Noise Levels

Noise monitoring shall be done utilising an integrating sound level meter to record noise levels in different scales like A-weighting with slow and fast response options.