CHAPTER -VIII

ENVIRONMENTAL MANAGEMENT PLAN

1. Power is a wheel industrial and agricultural growth of the country. It adds to the economic development and improves the quality of life. Electricity is a clean form of energy at the point of consumption. However its generation in a coal-fired power station has some adverse impact on the environment. A number of safeguards should be built-in during the design phase itself to minimise these adverse impacts. After the plant has become operational, effective planning is required to prevent any adverse impact on the surrounding environment.

2. The chapter deals with the Environmental Management Plan for construction and operational phase of the proposed 4000 MW (Nominal) coal based power plant of Coastal Gujarat Power Ltd. (CGPL). The construction and operation phase environmental management plan has been aimed to achieve the following objectives:

- To ensure that the environmental control systems installed at the plant and are operating satisfactorily.
- To ensure that quality of pollutants discharged from the plant is within the stipulated standards.
- To ensure that pollutants concentration in the surrounding area does not exceed the NAAQS.
- To monitor impacts on the surrounding environment and the effectiveness of mitigation measures during the construction and operation.

CONSTRUCTION PHASE ENVIRONMENT MANAGEMENT PLAN

3. The following construction engineering practices are recommended to minimise construction phase environment impacts:

a) Proper disposal of construction wastes.
b) Adequate erosion control plans to minimise soil erosion.
c) Minimise noise by using appropriate noise control measures.
d) Spraying of dust suppressants at regular intervals.
e) Sedimentation pond and peripheral drains for the runoff water from the construction site.

OPERATION PHASE ENVIRONMENT MANAGEMENT PLAN

4. Important features of the Environment Management Plan are the following:

a) Environment management cell
b) Ambient air and noise quality monitoring
c) Water quality monitoring
d) Meteorological data collection
e) Afforestation program
f) Periodic preventive maintenance & Occupational safety and health

ENVIRONMENTAL MANAGEMENT CELL

5. The major environmental considerations involved in the construction and operation of the thermal power station, will be taken up by a full-fledged multi disciplinary Environmental Management Division (EMD) with key functions of environmental, safety and occupational health for management of the entire plant and surrounding environment.

6. The EMD will comprise a team of environmental engineers, chemists, horticulturists, safety specialists and well-trained staff for operation and maintenance of pollution control equipment. Staff training programmes in the areas of environment, ambient air, water quality monitoring, solid waste management, noise abatement, safety and health aspects would be conducted. The pollution control equipment would be provided with spares and maintenance facilities. Staff would be trained to operate ESP and other pollution control equipment at optimum efficiency. Power plant developer will have to develop Environmental Management Division (EMD) headed by a very senior manager assisted by a team of engineers, chemists, operating staff etc. This EMD will take up additional responsibility of environmental functions related to proposed mega power plant.

ENVIRONMENTAL MONITORING PROGRAMME

7. An environmental monitoring programme is required to provide scientifically defensible information for determining the status of the environmental quality of the surrounding area of the power station and to check whether the levels of critical pollutants are within the environmentally acceptable limits. This will help to obtain an early warning of unacceptable environmental conditions so that control measures can be taken immediately. It also helps to determine in a timely fashion, changes in the local environmental quality.

AIR MONITORING

8. The air quality-monitoring programme consists of ambient air quality monitoring, stack gas emission monitoring, occupational exposure and meteorological investigations. The schedule of monitoring programme is given in Table - VIII.1.

a) Ambient Air Quality Monitoring

An ambient air quality monitoring programme for ground level concentrations of SO_2, NO_x and SPM will be carried out on a regular basis throughout the year at selected monitoring stations.

b) Stack Emission Monitoring

Continuous stationary monitors will be installed to measure opacity, SO_2 , NO_x and SPM concentrations in the flue gas discharged through the stack. Suitable sampling ports will be provided at the stack for in-situ monitoring of these parameters.

c) Occupational Exposure Monitoring

Worker exposure to dust from ash and coal, to toxic gases (e.g. SO_2, and NO_x) leaking from boilers and to excessive noise levels will be monitored around the work place by spot detection instruments.

d) Meteorology

The wind speed, wind direction, solar radiation, relative humidity and rainfall will be monitored continuously using respective meteorological instruments installed at suitable location. The data will be continuously recorded as well as processed for further action.

9. The meteorology, stack emission and ambient air quality monitoring will be conducted considering the mega power plant while optimising the number of monitoring stations and equipment.

Table - VIII.1
Air Quality Monitoring Schedule

Parameters	*Purpose*	*Frequency*	*Equipment*
SPM	Ambient Air quality monitoring	Twice in a week for 24 hours each at each station	Respirable dust Sampler (RDS)
SO_2	Ambient Air quality monitoring	Twice in a week for 24 hours each at each station	Respirable dust Sampler (RDS)
NO_x	Ambient Air quality monitoring	Twice in a week for 24 hours each at each station	Respirable dust Sampler (RDS)
SPM, SO_2, NO_x,	Stack emission	Continuous	In-situ continuous monitors
SPM, SO_2, NO_x	Occupational exposure	Once in a month	Portable spot detectors
Noise level	Noise	Once in a week	Noise level meter
Wind speed & wind direction and solar radiation	Meteorological investigation	Continuous on hourly basis	Anemometer with data logger and printer facility
Relative humidity and temperature	Meteorological investigation	Continuous on hourly basis	Thermohygrograph
Rain fall	Meteorological investigation	Continuous on hourly basis	Rain gauge

WATER QUALITY MONITORING

10. The water quality monitoring programme consists of parameters monitoring prior to discharge, water quality monitoring near sea intake and outfall structure, nearby surface water and ground water will also be covered. The monitoring schedule for treated water generated from various sources and the parameters to be analysed are shown in Table - VIII.2.

Table - VIII.2
Water and Wastewater Monitoring Schedule

Waste Water Sources	**Frequency of Analysis**	**Parameter of Examination**
Boiler blow down	Weekly	Temperature suspended solids, oil & grease, dissolved solids, copper, iron etc.
Water treatment plant effluent	Daily	pH, suspended solids COD, BOD, dissolved solids
Ash pond effluent	Weekly	pH, suspended solids, oil & grease, dissolved solids, heavy metals like chromium, zinc, iron, manganese, aluminium, nickel, phosphate etc.

11. The assessment of sea water, surface and ground water quality (e.g.) drinking and irrigation wells, ponds, tube wells etc.) of surrounding areas will be carried out at different locations, within 5 km radius of the proposed power plant once in a month. The parameters to be monitored will include dissolved solids, oxygen level, bacterial contamination and heavy metals.

POST PROJECT MONITORING OF MARINE ENVIRONMENT

12. Post project monitoring for marine environment should be carried out in order to ensure that the environmental quality is maintained. Specially trained staff should be employed to undertake the monitoring work in a control laboratory of the plant or this work could be assigned to any research Institute having expertise in collection and analysis of sea water and sediment samples in offshore and intertidal region.

13. Any damage to seaweed or nearby mangrove areas should be immediately investigated, eventual damage assessed and remedial measures adopted.

Sampling Site

14. The sampling area should cover the discharge point as well as other locations affected by upcoming marine facilities. The intertidal region should also be periodically sampled to know the beach fauna and beach profile.

Frequency of Monitoring

15. Monitoring program should begin with proper baseline establishment and subsequent periodic observations after the project are commissioned.

1st monitoring	Before operation stage
2nd monitoring	1 month after operation
3rd monitoring	6 months after operation
4th monitoring	12 months after operation
Periodic monitoring	Once or twice every year.

Parameters to be Monitored

Shoreline changes

16. Shoreline configuration and nearshore profiles may be carried out 2 km on either side of the jetty at three seasons continuously.

Seafloor changes along the pipeline route

17. Once in a year, the change in seafloor along the pipeline routes may be monitored by a small echo sounder or by engaging divers.

Water Quality

18. Surface and bottom water samples are to be analysed for temperature, salinity, pH, dissolved oxygen, biochemical oxygen demand, suspended solids, phosphate-phosphorus, nitrite-nitrogen, nitrate-nitrogen, ammonia-nitrogen, phenolic compounds, petroleum hydrocarbons, trace metals, primary productivity, phytoplankton and zooplankton biomass and population and group diversity.

Sediment Quality

19. Sediment samples are to be analysed for trace metals and benthic biomass and population.

Mangrove And Seaweeds

20. Population density *of* mangrove and seaweeds, as well as growth and species diversity should be studied.

Fishery Resources And Bioassay

21. Fishery resources are to be assessed and static bioassay *of* the waste water should be undertaken periodically.

LABORATORY

22. An environmental laboratory for routine analysis of air and water monitoring should be equipped with the following:

a) Respirable dust Sampler (RDS) with RPM assemblies
b) Continuous stack emission monitoring instrument
c) Photo opacity monitor, Wind anemometer, Sound level meter
d) Temperature recorder, Thermo-hydrograph
e) Spectro photometer
f) CO analyser with detector tubes
g) Semi micro balance
h) Incubator, Hot air oven and Flame photometer
i) Chemicals & glass wares

OCCUPATIONAL SAFETY

23. In a power plant, the main safety hazards involve burns, slips and falls. Fire and explosions may occur from flame out. Electrical hazards and electrocution constitute another serious safety problem in power plants due to the high voltage in the electrical lines. Excessive noise from generators can also be a serious problem. Heat and humidity can contribute to heat stress among boiler works. The following safety measures are proposed to prevent and reduce accidents among employees.

a) All elevated platforms, walkways, stairways and ramps will be equipped with handrails, toe-boards and non-slip surfaces.
b) Steam pipes will be provided with thermal insulation.
c) Shield guards and guard railings will be provided where belts, pulleys, shafting, gears or other moving parts are located.
d) Electrical equipment will be grounded and checked for defective insulation.
e) Workers responsible for cleaning boilers will be provided with special footwear, masks and dust-proof clothing. The cleaning of boilers may require the use of corrosive acids such as sulphuric acid and hydrochloric acid as well as caustic chemicals. The workers using these chemicals will wear protective clothing and goggles. Emergency eyewash and showers will be available in the working area.
f) Maintenance workers and cleaners, who enter enclosed areas for cleaning fuel, oil residues or coal ash dust will wear self-contained air respirators.
g) A programme for fire safety will be regularly carried out. This is important to establish a safety programme and in case of fires due to flame out.
h) 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.
i) Rigid procedures for de-energizing and checking the electrical equipment will be followed before any maintenance and repair work can begin. Some work may have to be done on energized equipment. A supervisor will be present during the entire period of work and will make sure that all safety measures are taken to prevent any accidents. Revival techniques after electrocution will be part of any first aid course taught to the employees.
j) The temperatures can go as high as 130ºF in boiler rooms and this can result in heat stress. General ventilation and frequent work breaks to the employees will be provided to reduce these problems.
k) The noise level around the generators or other equipment would be kept lower than 90 decibels (dBA). If impossible, those working near the equipment will have an insulated room where the noise level is below 75

dBA. Personnel will be supplied with ear protection to be worn when working around the equipment. Good maintenance of equipment will also help to reduce noise.

TRAINING

24. The education and training of employees in good safety practices will be the responsibility of management. Employees will be instructed in proper use of all equipment operated, safe lifting practices, location and handling of fire extinguishers, and the use of personal protective equipment.

HEALTH

25. The main health hazards due to working in coal handling areas, ash handling areas, acid and alkali using areas, oil storage areas etc. are skin diseases and chemical burns. The workers will be encouraged to wash frequently and good sanitary and washing facilities shall be provided. A separate lunch room will be provided outside the work area. This will help to reduce dermatitis among the employees due to contact with acids, caustic chemicals, solvents, oils, as well as coal ash and fuel oil residues. The work atmosphere will be monitored for SPM, SO_2, NO_x etc. to avoid excessive exposure.

AFFORESTATION PROGRAMME

26. Afforestation is a key element in environment conservation and protection. The establishment of a vegetation covering land in and around the proposed thermal power plant ,ash disposal area and colony will result in many direct and indirect benefits as :

(a) Vegetation can absorb a wide variety of atmospheric pollutants emitted from thermal power plant and attenuates the noise levels.

(b) Vegetation will be able to control the build-up of atmospheric green house gases (e.g. CO_2) that are emitted during power generation and thereby will postpone global warming.

(c) Afforestation will help restore the ecodynamics around the plant. It checks soil erosion and increases soil fertility.

(d) A green belt acts as a buffer zone and increases the aesthetic value of the surrounding area by adding to the greenery and providing a visual filter.

(e) A green belt will also compensate the vegetation loss during the construction phase and will help in reclamation of land used for ash disposal.

(f) Provision of one third land of the project area will help in complying with the statutory requirements.

27. An appropriate afforestation programme is envisaged which will help in establishing the harmony with the environment of the proposed mega power plant and surrounding environment. The green belt covering 33% of the acquired area will be planted inside the plant premises.

28. The above tree plantation program would consider the following:

- Selected plant species would be native of the area. Introduction of monocultures and alien plant species would be avoided to the maximum possible extent.
- Heterogeneous tree species will be selected and planted considering soil and climate adaptability, flowering, growth characteristics, canopy structure and resistance to pollution load.

29. A nursery will be maintained at site or sapling may be taken from local forest nursery to develop good planting stock to meet the plantation requirements. A horticulturist of EMD will supervise this and the entire plantation/afforestation programme.

FLY ASH UTILISATION PLAN

30. The imported coal to be used in power plant which will contain maximum of 1.0 % of sulphur and maximum 15% of ash content. This large volume of fly-ash occupies large area of land and possesses threat to environment. In order to mitigate and minimise the environmental impact of fly ash disposal, power plant developer will plan to utilise 100% ash in Cement and construction industries, back filling, construction of road, agriculture and brick making. Graphical presentation of tentative ash utilisation plan is shown as Figure – A, which is included in Appendix – 29. Total of 241Ha land has been earmarked for ash disposal area, where ash will be stored till 100% ash utilisation is achieved. Fly ash generated from the proposed power plant would be commercially utilised in one or more of the following industries, to the extent possible:

a) Cement Industry
b) Brick Industry
c) Fly ash aggregate making Industry
d) Road making / paving
e) Agriculture, back filling and filling of abandoned mines
f) Any other technical feasible use.

31. Apart from the above fly ash can also be used for construction of ash-pond dyke, reclamation of low lying areas, mine fills and for agricultural applications such as soil conditioner and fertilizer.

32. Department of Science and Technology (TIFAC) has initiated fly ash mission for possible usage of fly ash generated from thermal power plants [Kumar V and Singh G, 2006]. Various uses of fly ash in agriculture and wasteland management as mentioned in the paper are shown in Appendix – 30. For e.g it improves the permeability status of the soil, improves fertility of soil, improves soil texture, reduce bulk density of soil, improves water holding capacity, optimises pH value, improves soil aeration, provides micro-nutrients like Fe, Zn, Cu, Mo, B, Mn, etc, reduces pest incidence. Thus, use of fly ash can save the money for pesticides and fertilisers. Pond ash at a dose of 30-50 tonne/hectare on one time basis along with recommended dose of fertilisers and manure is recommended for its use in agriculture, forestry sector, wasteland management for cultivation of different cereals, pulses, oil seeds and vegetables, etc, the repeat application of which can be made after 4-5 years as it would have significant residual effect on the yield of succeeding crops over a period of 4-5 years. The abandoned ash pond could also be safely reclaimed via suitable amendments for forestry/ floriculture purposes.

33. A survey questionnaire was prepared and circulated among the various cement manufacturing and construction industries (Sanghi Cement, Adani Industries, M/s Adani SEZ) near the vicinity of the project area for the possible utilisation of the fly-ash being generated from the proposed 4000MW (Nominal) power plant (Appendix -31). The questionnaire covered various options of fly-ash utilisation in the existing cement/construction industries. The outcome of the survey result would be implemented. The hunt for further prospective potential users would be continuous programme for maximum utilisation of generated fly ash (The filled in questionnaire received from Adani SEZ is attached for the reference).