CHAPTER 2
PROJECT DESCRIPTION

2.1 Need for the Project

The Orissa government's policy seeks to promote power generation both by Independent Power Producers (IPPs) and captive power plants (CPPs). The newly formed GRIDCO has been empowered to negotiate fair and equitable power purchase agreements with IPPs and with industries owning captive power plants supplying surplus power to the State Power Grid. It also provides for sales to industries on payment of wheeling charges.

Tata Steel has proposed to establish 6 MTPA capacity steel plant in five phases at Kalinganagar Industrial Complex near Duburi village about 100 km from Talcher in Orissa State. Tata Steel has formed a Joint Venture company with TPC to take care of the power needs of the Tata Steel's plants in Eastern Region. In line with this, TPC is contemplating setting up a power plant in Orissa to meet the external power demand of Tata Steel's proposed Steel Plant at Kalinganagar. In addition, TPC has also signed MoU with GRIDCO to sell power to the extent of 250 MW from the same plant. **Table 2.1** presents the power demand scenario.

Considering the above, Tata Power Company proposes to set up a coal based thermal power plant of 1000 MW capacity near Naraj Marthapur, Cuttack Sadar Tehsil, Cuttack District in Orissa State.

Table 2.1

Allocation of Capacity in MW

Year	Tata Steel	GRIDCO	TPC	Total	Remarks
2009-10	250	250	250	750	TPC's requirement is primarily intended for achieve reliable power
2011-12	500	250	250	1000	Cumulative demand

2.2 Location

The proposed location for power plant is situated near Naraj Marthapur, Cuttack Sadar Tehsil, in Cuttack District of Orissa State. The site is bounded by latitude 20 deg 26 min 02 sec North to 20 deg 27 min 43 sec North and longitude 85 deg 45 min 28 sec East to 85 deg 47 min 07 sec East. The area is about 990 acres. The power plant capacity has been proposed to be 1000 MW (2x125 + 2x125 + 2x250 MW). The power plant site is located adjacent to an existing road connecting Khurda, Chandaka, Barang, Gobindapur, proposed site and Naraj villages. The site can be approached by road from Cuttack. Naraj Marthapur is a nearest railway station located at a distance of about 750 m from the project site boundary on Talcher- Khurda Road railway line of Eastern Railway Road railway line of Eastern railway.

2.3 Selection of site

The site selection was done on the basis a Report by Central Mine Planning and Development Institute (CMPDI), Ranchi, submitted to Central Electricity Authority (CEA) in March 2004 for locating the thermal power plants in the state of Orissa considering six (6) sites and further consideration of two (2) sites by TCE Consulting Engineers. Details have been provided in Chapter 5.

2.4 Unit Size Selection

Considering the power requirement for the steel plant at Kalinganagar and the commitment for power distribution to GRIDCO, the unit sizes for the proposed power plant have been selected as a combination of a number of 125 MW units and 250 MW units as given below:

2 X 125 MW + 2 X 125 MW + 2X250 MW = 1000 MW

2.5 Land Requirement & Plant Layout

The site is located on the northern and southern side of Puri Canal. Total land is about 990 acres. The availability of land and minimum displacement have been the factors for selecting the site in this fashion. River Mahanadi flows from west to east on the northern side of the site. The site is more than a kilometre away from the HFL of the river.

The main plant and coal storage area will be on the northern half to facilitate coal receipt by railway wagons and fuel oil by rail tankers.

While the different auxiliary system with ash pond will be in the southern half.

Figure 2.1 shows the plant layout.

All facilities of the plant are laid out in close proximity to each other to the extent practicable so as to minimise the extent of land required. The layout also facilitates communication of men and movement of materials between the various facilities both during initial construction and also during subsequent operation and maintenance.

Out of the total 990 acres of land, the Govt. land is about 21%. 4% of land is forest land which is dispersed in very small patches. The agricultural land mainly consists of single crop category.

Ash pond area is 30 acres only. About 200 acres of land contiguous to the plant area under the possession of the project consists of a hillock and that area will be kept as green area with further plantation.

2.6 Power Generation Process

Power generation in thermal power plant is achieved by steam generation at high temperature and pressure which is then used to run a turbine to generate electricity. Coal is used as fuel for steam generation.

Steam generation requires heating demineralised water in the boiler at high temperature and pressure. Steam at high temperature 537^0C($\pm5^0$C) and high pressure (170 Kg/cm^2) is fed to rotate the turbine to generate power. Spent steam is converted into condensate by cooling in heat exchanger. Cooling water used in heat exchanger is cooled in the cooling tower.

Exhaust gas after exchanging the heat is released at a temperature of 140^{o}C through a chimney.

Figure 2.2 shows the Process Flow Scheme.

Major issues and units in the process are described below.

2.7 Fuel Requirement & Transportation

At maximum continuous rating (MCR) condition based on Talcher coal having a gross calorific value of 3700 k Cal / kg for 250 MW unit is 169 tonnes / hr and for 125 MW unit is 86 tonnes / hr. The maximum daily requirement of coal for all six units would be about 16,368 tonnes per day.

LDO and HFO will be used as fuel for start up and flame support.

Coal from the Talcher Coal Fields which is at a distance of about 90 km from power plant site is proposed to be transported by bottom-open rail wagons on the rail route. A main broad gauge railway line of South eastern Railways is existing at Naraj Marthapur Railway station which is located adjacent to the proposed plant boundary. A take off point is to be constructed before the station for coal rakes to enter into the power station area. A Merry Go-Round (MGR) system is proposed within the proposed plant site.

HFO and LDO required for the power plant operation be transported from the nearest terminal by rail wagons (tankers). The peak requirement of LDO will be during light up and commissioning where as the peak requirement of HFO will be during the trial operation. Ten (10) days of oil storage is envisaged.

2.8 Water Requirement

The source of water is Mahanadi river. The daily raw water requirement for the proposed power plant, including cooling tower, SG make up plus other services is estimated to be 96684 m^3/ day. The above quantity of raw water will be drawn by pumping and conveying water through large diameter piping from Mahanadi located at about 3 km from the proposed plant site. The total water requirement is given in **Table 2.2**.

Water balance diagram is given in **Figure 2.3**.

Table 2.2

Water Requirement

Item	**Quantity**
	m^3/ day
CW make up for condenser and other auxiliaries	74112
Main Clarifier blowdown	2400
DM clarifier blowdown	120
Service Water	16800
Plant & Colony potable water	480
DM water for SG makeup, ACW makeup	2448
DM plant regeneration	244
Filter backwash	80
Total raw water requirement	**96684**

Cooling water make up constitutes 76% of all water requirements. So optimisation of cycle of concentration (COC) in Cooling Tower decides the water requirement. As mentioned in TOR Point No. 21, optimisation of COC has been carried out to reduce water requirement. A high COC of 4.5 has been considered. **Table 2.3** shows then cooling water requirement break-up.

Table 2.3

CW System Make-up Requirements

Sl No	**Item**	**Quantity (M^3/day)**
1.	Cooling Tower (Evaporation + Drift Losses)	14400 x 4 towers = 57600
2.*	Condenser CW System Blow down*	4128 x 4 towers = 16512
3.	CW Make-up requirement (item 1 + item 2)	57600 + 16512 = 74112
4.	Concentration Ratio ‘C’ (item 3 / item 2)	4.5

2.9 Main Power Plant Units

Steam Generator and Accessories

The steam generator (SG) would be designed for firing 100% coal and would be natural circulation drum type. The SG would be of two pass design, radiant, single reheat, balanced draft, semi-outdoor type, rated to deliver 820 t / hr of superheated steam at 155 atm, 540°C.

The SG would be designed to handle and burn HFO as secondary fuel up to 22.5 % MCR capacity for start-up and for flame stabilisation during low-load operation. For unit light up and warm up purposes LDO shall be fired.

The steam generator would consist of water cooled furnace, radiant and convection super-heaters, re-heaters, attemperators, economiser, regenerative air heaters, steam coil air pre-heaters, etc. Soot blowers would be provided at strategic locations and would be designed for sequential fully automatic operation from the unit control room.

The draft plant would comprise of primary air fans , forced draft fans, and induced draft fans. Electrostatic precipitator (ESP) and fly ash hoppers would be provided for the collection of fly ash. The ESP shall be designed to achieve an outlet dust concentration of 100 mg / Nm^3 as per CREP norms. This will be achieved with one field out of operation.

Steam Turbine Generator and Accessories

The selected steam turbine generators (STG) would be rated for 250 MW and 125 MW maximum continuous output at the generator terminals, with throttle steam conditions of 150 ata and 538 ^oC steam temperature and 0.1bar (a) back pressure. The steam turbine would be a reheat extraction condensing turbine. The regenerative cycle would consist of three low-pressure heaters, a variable pressure de-aerator, two high pressure heaters, one drain cooler and one gland steam condenser.

2 x 100% capacity condensate extraction pumps, one working and one standby, would be provided for each unit. The pumps would be vertical, canister type, multistage centrifugal pumps driven by AC motors.

3 x 50% capacity boiler feed pumps would be provided to pump the feed water from the de-aerator to the steam generator through the high pressure heaters. The

boiler feed pumps would be horizontal, multistage, AC motor driven centrifugal pumps of barrel type with variable speed hydraulic coupling.

A complete lubricating oil system will be provided for the steam turbine generator unit. The control fluid system may be fully separated from the lubricating oil system or integrated with the lube oil system as per the turbine manufacturer's standard. The lube oil system will be comprising of lube oil pumps, main oil tank, lube oil coolers, lube oil filters, piping, valves fittings etc. The control fluid system will have its own pumps, motors, coolers, strainers, piping, valves and fittings.

A microprocessor based diagnostic and data management system complete with vibration and other sensors will be provided for the steam turbine and all HT (6.6 kV) drives/ motors of boiler and turbine islands and CW pumps.

Fuel oil system

The fuel oil system will be designed for the use of heavy fuel oil (HFO) for start up and flame stabilisation purposes. LDO will be used as fuel for light up and warm up purposes.

Electrostatic Precipitators

Each steam generating unit would be provided with two (2) electrostatic precipitators. Each precipitator will have two parallel gas paths, any of which can be isolated for maintenance as and when required, keeping the other path in operation. The overall efficiency of ESP should not be less than 99.89% with one field remaining as operational standby. The design of ESP will be such that the outlet dust-burden does not exceed 100 mg/Nm^3 at 100% MCR with worst coal.

Chimney / stack

Three (3) reinforced concrete chimneys each of 275 m height will be provided for six units (ie. one common chimney with separate flues for two units). Each chimney will be provided with two steel flues. This would meet the requirement of Indian Emission Regulation.

Raw Water Treatment

Since the river water is expected to have turbidity / suspended solids during monsoon and the quality of influent water required for the various systems in the plant is clarified water (with turbidity and suspended solids less than 20 ppm), it is proposed to provide clariflocculator type clarifier for CW make up and plant service. Another solids contact type clarifier is proposed to exclusively cater to the DM plant. This clarifier will take care of any colloidal silica presence, which cannot be removed by ion exchange units in the water treatment (WT) plant.

The clarified water from the main plant clarifier will be stored in a main plant clarified water storage tank. The storage tank caters to the requirement of CW make up and plant service. The clarified water from the DM plant clarifier will be stored in DM plant clarified water storage tank of ten (10) hours storage.

DM Plant

This broadly consists of DM pre-treatment plant, filtration and DM plant. The DM pre-treatment consists of i) Chlorination system in the form of sodium hypochlorite to destroy organic matter and algae and ii) Alum dosing system for the purpose of coagulation. The filtration plant consists of Four (4) vertical dual media filters. Activated carbon filters will be used for dechlorination. These filters will also remove any organic grease, oil etc. present in the water.

The DM plant will meet the requirements of steam generator (SG) feed water make up, and ACW system make-up. It is proposed to provide Two (2) working streams DM plant with one standby stream. Each stream of the DM plant will consist of Cation Units, Degasser System, Anion Units and Mixed Bed (MB) unit for final polishing of DM water. There will be also regeneration System for the purpose of regeneration of cation and anion resins respectively. The acidic and alkaline effluents from DM plant and the filter backwash will be led to a neutralising pit. Acid or alkali will be added to the neutralising pit depending on nature of effluents from DM plant.

Cooling Water (CW) System

Recirculation type cooling system with cooling tower is proposed for CW system using Induced draught cooling tower (IDCT). It is proposed to install One (1) no. counter flow induced draft-cooling tower for each unit. In order to conserve water, the blow down would be utilised to meet the water requirement of the fire protection systems, ash handling system and coal handling system. In order to prevent / minimise the growth of algae in the cooling water system, chlorine dosing is proposed. Provision will be made for shock dosing and continuous dosing. However, the continuous dosing rate would be adjusted during operation phase to meet the chlorine demand.

Auxiliary Cooling Water (ACW) System

The ACW system meets the cooling water requirements of all the auxiliary equipment of the TG and SG units such as turbine lube oil coolers, generator air cooler, exciter air coolers, ID/SA/PA fan bearing oil coolers, BFP auxiliaries such as lube oil coolers, working oil coolers, drive motors, etc., condensate pump bearings, sample coolers and air compressors. A closed loop system using passivated DM water is proposed for the ACW system.

Chemical Dosing System

Phosphate dosing system would be provided to ensure chemical conditioning of the steam generator drum water so as to prevent scale formation. In addition, hydrazine / ammonia dosing system would be provided to ensure chemical conditioning of the feed water by removing the dissolved oxygen and carbon dioxide present in the feed water.

Coal Handling System

The maximum daily requirement of coal for four units would be about 16,368 tonnes. Coal would be received at plant site by bottom discharge broad gauge rail wagons with track hopper for unloading of coal. Coal received in BOBR wagons would be unloaded into the track hopper while the wagons are in motion by opening the wagon doors pneumatically with line side equipment. There will be a coal stockyard for stacking of coal. Belt Conveyors will carry coal from Track hopper to Coal Stockyard / SG Bunkers.

Coal would be fed to the bunkers from conveyors through motorised travelling trippers. The coal bunkers are of circular type and the openings on the top would be covered with bunker sealing belt to avoid dust nuisance. The bunkers would be adequately ventilated so as to keep the bunkers free from accumulation of volatile gases, thereby eliminating fire hazard and also avoiding dust nuisance in the tripper floor. The ventilation air would be passed through bag filters before being let out into atmosphere

Two travelling and slewing type stacker-cum-reclaimers will be provided for stacking and reclaiming of coal in the stock yard. Two sets of screens and crushers will be provided (one operating and one standby) for each stream of conveyors.

Ash Handling System

Total 1310 TPD bottom ash and 5238 TPD fly ash will be generate from 1000 MW power plant. Bottom ash produced by each steam generator would be collected in the water impounded, refractory lined furnace hopper as bottom ash.

The system adopted for bottom ash removal will be jet pump system with water impounded bottom ash hopper. A heavy-duty clinker grinder and a jet pump would be mounted at each of the hopper outlets to crush the ash clinkers to (-) 25mm size and convey the same to the slurry sump. The water required for slurry formation and dust suppression in the ash disposal area will be drawn from condenser cooling water blow down.

The fly ash (FA) system will be designed to evacuate fly ash in dry form from fly ash hoppers using pressure type pneumatic conveying system. The fly ash removal system will be designed on a continuous basis with 20 cycles per hour and during emergency with 30 cycles per hour. Dry fly ash from the air pre-heater, economiser, stack and ESP hoppers will be collected in the FA storage silos. The fly ash conveying air will be vented to the atmosphere through vent bag filter to mitigate the environmental pollution.

The fly ash collected in the storage silo will be either disposed in wet slurry form (in high concentrated slurry form) or in dry form using trucks. There will be four outlets provided for each silo, two for wet slurry disposal, one for unloading of ash in conditioned form in open trucks and one for unloading of ash in closed container trucks. Operation of complete ash evacuation and conveying up to storage silos (bottom ash as well as fly ash) will be controlled from the control panel (PLC) located in the unit control room for control / sequential operation and monitoring.

The evacuation of both wet and dry ash will be done through closed pipelines and will cross the Puri canal passing through the site over a supporting bridge. There will be no possibility of ash coming in contact with canal water. (Refer Point No 25 of TOR).

Ash Pond

30 hectares of land has been marked for disposal of bottom ash and part fly ash . This considers into account utilisation of fly ash generated out of all the four units completely in a period of 9 years as per the present regulations. Ash stock height of 5 m and bund height of 7 m (1 m free board + 1 m water over ash fill) is considered. The ash disposal area will be lined with impervious lining.

Instrumentation and Control System

Microprocessor based distributed control system with state of art Man – Machine Interface (MMI) is proposed to provide a comprehensive integrated instrumentation and control system including the functions of Data Acquisition System (DAS) to operate, control and monitor the steam generator, turbine and auxiliaries and the balance of plant systems with a hierarchically distributed structure.

2.10 Waste Management

Liquid Effluent

The liquid effluents are generated from a number of units during operation of a power plant. Proper treatment of the streams can reduce the amount of discharge of pollutants in wastewater and also reuse of the treated streams helps in conservation of water. This needs identification of the individual waste streams and their characteristics. This determines whether the streams will be segregated and treated separately or not and which of the streams can be considered for reuse. Here emphasis has been given on maximum reuse of wastewater, proper treatment and minimum discharge.

The sources of liquid effluents are:

1) Cooling tower blow down
2) Boiler blow down
3) Oil handling area run off
4) Plant services waste water (including oil contaminated drains)
5) Coal handling plants waste water
6) Water treatment plant waste
7) DM Plant regeneration waste
8) Run off from coal pile area
9) Ash Handling system waste
10) Plant sewage

Figure 2.3 depicts the Waste Water management Scheme. Reuse and recycling of liquid effluents to the extent possible has been considered. Cooling tower blowdown will be used for ash handling. Ash water from ash pond will be recycled back to the system after proper treatment. All other service water will be treated and collected in a common mixing basin (CMB). As much of treated wastewater will be reused in the plant for cleaning, gardening and dust suppression. Excess will be discharged through a single point. The quality of the discharged effluents will conform to Indian Standards for liquid effluents for thermal power plants as per EPA Notification. The standard is furnished in **Table 2.4**. Treated effluent will be discharged in the Mahanadi River upstream of the intake point. The proposed treatment philosophy is broadly discussed below;

1) **Cooling Tower Blowdown (CTBD)**

Among the liquid effluents generated in the plant, the major quantities come from cooling tower blowdown. The blowdown from the cooling towers have been estimated to be 688 m^3/hr. Major pollutants in CTBD can be suspended solids and others like chlorine, zinc, chromium and phosphate depending on treatment to abate biological growth and corrosion. Here chlorine will be used for the purpose.

Cooling tower blowdown would be utilised for ash water for transportation of ash for disposal to ash pond, fly ash conditioning, dust suppression system in coal handling areas, horticulture, washing and cleaning etc. As dry fly ash utilization is proposed, ash water requirement will be reduced. Unused blowdown water will be disposed through CMB (Common Mixing Basin).

2) **Boiler Blowdown (BBD)**

Boiler blow down is done to control dissolved solids in boiler water. This stream mainly contains some dissolved salts, though the amount is generally low. This stream may contain phosphates or other chemicals used for prevention of scale formation and corrosion. Quality of blow down varies with boiler size, maintenance, quality of make up water etc. and ranges between 0.1 – 1 % of steam flow. Total quantity is low and about 15 m^3/ hr is considered. This stream can be directly sent to the CMB

3) **Oil Handling Area Run Off**

Oil handling area run off is the main source of oil in plant effluent. Oil spillage takes place during loading, unloading, washing of floors, leakages from pumps etc. All of these flows will be intermittent.

All drains from the oil handling areas will be segregated. As nearly all the stream flows will be intermittent, all will be collected in an equalization tank and then treated in an oil separator. Oil will be separated by gravity and can be skimmed off. The separated oil will be reused. The treated water will be finally sent to the CMB.

4) **Plant Services Waste Water**

This consists waste water from different plant uses including washings, leakages, etc. This stream mainly contain suspended solids and at times oil & grease. This effluent will be passed through an oil separator unit for removal of particulates and oil. Clean water will be sent to the CMB.

5) **Water Treatment Waste**

Major water treatment waste is generated from raw water treatment as sludge from the clariflocculators. Backwash of filters and sludge from the plate settlers contain suspended particles in high concentration. All these in slurry form is sent for first settling and then to the centrifuge for recovery of water. Centrifuge sludge is disposed in ash pond.

DM Plant Regenerant Waste is generated due to periodic regenerations of resin-beds in the water demineralisation plant. This stream have high amount of dissolved solids and also may be acidic or alkaline. The stream will be first neutralized in a tank by addling acid or alkali as required. The neutralized effluent will then be sent to CMB.

6) **Waste Water from Coal Handling**

Wastewater will be mostly generated from coal-pile area during rainy season. The yard will have guard drain so that the run-off can be collected at a point. This stream will contain mainly suspended coal particles. The effluent will be led to the coal particles settling tank to settle the coal particles. Settled coal particulates can be excavated during summer when the pond will be dry. There may be addition of chemicals, if required, to neutralize the stream. The clean supernatant from the settling tank will be taken to the CMB for final discharge.

Liquid effluents in the coal handling plant will be generated during dust suppression at the time of railway unloading of coal, in the primary crushed coal open stock pile and during reclamation from the store yard. A sizeable amount of the water sprinkled will be retained with the coal, certain amount will be lost due to evaporation and remaining water will be coming out as effluent containing mainly suspended solids. This stream will be led to the settling tank described above where most of the coal particles will settle.

7) **Plant Sewage**

Plant sewage will be first treated in the septic tank and the overflow will be taken to an Upflow filter (USAB) and the final effluent will be treated with chlorine before disposal to CMB.

8) **Ash Pond Effluent**

Ash pond effluent will be collected at one end of the pond and most of the ash will be deposited in the pond. The overflow will be pumped back to an ETP consisting to remove the remaining particulates from the recycled ash water. This water will be sent back for ash handling again. Sludge from the system will be sent back to ash pond.

9) **Effluent Treatment Plant (ETP)**

Though there will be a central Effluent Treatment Plant (ETP) will be set up to treat plant wastewater. ETP will consist of equalisation tank, chemical mixing system and clariflocculator to separate oil and suspended solids. Ash pond recycled water will be sent to it. Besides, the other wastewater streams e.g oil handling area run off, coal handling area run-off can be sent to the equalisation tank for further treatment if required.

10) **Common Mixing Basin (CMB)**

CMB is the final reservoir for all the treated wastewater. The basin also acts as mixing zone and equalises the combined treated effluent assuring better water quality. The water required for dust suppression, ash conditioning, green belt, plant washes etc will be obtained from this reservoir. Excess water from cooling tower blowdown will be sent to this basin. The excess treated water will be released by a pipeline into the Mahanadi river upstream of the intake point of the plant.

Table 2.4

Standards for Liquid Effluent – Thermal Power Plant

Source	**Parameter**	**Concentration**
Boiler Blowdown	Suspended Solids	100 mg/l
	Oil & Grease	20 mg/l
	Copper (total)	1.0 mg/l
	Iron (total)	1.0 mg/l
Cooling Tower Blowdown	Free available Chlorine	0.5 mg/l
	Zinc	1.0 mg/l
	Chromium (total)	0.2 mg/l
	Phosphate	5.0 mg/l
Ash Pond Effluent	pH	
	Suspended Solids	100 mg/l
	Oil & Grease	20 mg/l

Source: EPA Notification (S.O. 844(E), 19 Nov 1996)

Gaseous Effluent

Emission from Stack

Combustion gases from the boiler emitted through high stack is the main source of gaseous emission. The emission quality primarily depends upon the quality of the coal burnt. Since the ash content of the fuel is expected to be in the range of 40% with occasional variation, a sizeable quantity of fly ash in the form of particulate matter would be generated. An efficient electrostatic precipitator (separation along with a properly designed boiler would keep the stack emission of particulate within acceptable limits. The design of the electrostatic precipitator would ensure particulates emission level to 100 mg/Nm3, as per CREP norms. The emission standards as per Environment (Protection) Act Notification are provided in **Table 2.5**.

Table 2.5

Emission Standards

Unit Capacity	Pollutant	Emission Limit
210 MW or more	Particulate Matter	150 mg/ Nm^3
Less than 210 MW	Particulate Matter	350 mg/ Nm^3

Source: EPA Notification (S.O. 8(E), 3 Jan 1983)

Stack Height Limits

Unit Capacity	Stack Height
500 MW and above	275 m
200/210 MW and above to less than 500 MW	220 m

Source: EPA Notification (G.S.R. 742(E), 30 Aug 1990)

Sulphur di oxide (SO_2) emission depends upon the sulfur content of the coal. With average sulphur content of about 0.5%, SO_2 emission per day will be about 163.6 TPD. The concentration will be about 1650 mg/Nm^3 There is no prescribed limit for SO_2 emission in Indian standard. However comparing with World Bank Standard of 2000 mg/Nm3, this is quite reasonable.

Nitrogen oxides (NOx) emission is dependent primarily on combustion methods. There is also no prescribed limit for NOx emission in Indian standard. However comparing with World Bank Standard of 750 mg/Nm3, The low-NOX burners for the boilers will be able to achieve this limit.

The stack height is selected as to limit ground level concentration of SO_x, NO_x, etc. within acceptable limits by proper dispersion. For the present case, Environment (Protection) Rules, 1986, prescribe a stack height of 275 m for the power plant having capacity 500 MW and above. As this will be ultimately a power plant, all 3 stacks are proposed to be 275 m high.

Details of the stack and emission are provided in **Table 2.6**.

Table 2.6

Stack Emission Data

Unit Size	2 x 125 MW	2 x 125 MW	2 x 250MW
Number of Stacks	1	1	1
No. of Flues in each stack	Two (2)	Two (2)	Two (2)
Stacks Attached to	Boilers	Boilers	Boilers
Height of Stack	275 m	275 m	275 m
Diameter	3.32 m	3.32 m	4.7 m
Exit velocity	25 m/s	25 m/s	25 m/s
Exit Temperature	140 ^oC	140 ^oC	140 ^oC
Particulates Emission / Unit	100 mg/Nm^3	100 mg/Nm^3	100 mg/Nm^3
Sulphur Dioxides Emission / Unit	859 kg/hr	859 kg/hr	1690 kg/hr
Nitrogen Oxides Emission / Unit	193 kg/hr	193 kg/hr	386.9 kg/hr

Continuous SO2 / NOx and particulate monitoring are envisaged in the stack, to meet the statutory requirements. Oxygen and CO measurements are envisaged in the flue gas duct.

Fugitive Dust

Fugitive dust is another source of air pollution mostly from coal handling operations. Loading unloading activities, coal transportation and coal sizing operations in crusher house, various transfer points can be significant sources of fugitive dust. Depending on the suitability of the location, Dust suppression (DS) or Dust Extraction (DE) will be provided. DS consists of water spraying arrangements. DE will be placed at transfer points and room ventilation so that the fugitive dusts are extracted and conveyed pneumatically through a filter system.

Chemical type dust suppression system will be provided for screen house and junction towers. Plain water type dust suppression system would be provided all around the stockpile to suppress the dust generated and to keep dust nuisance to the minimum. Plain water type dust suppression system would be provided for track hopper and for wagon. The bunker ventilation system would be provided with bag filters to trap the dust generated while loading coal into bunkers and to vent out dust free air.

Another source of dust pollution will be dry handling of fly ash. Unloading of ash from silos and transportation can cause significant dust pollution. Silos will be provided with water sprays to be operated during unloading. During transportation fly ash will be taken in covered truck and with water sprayed at the top or closed truck.

For controlling dust emission from ash pond, after disposing ash for a specific period (say 6 months or one year), when the ash dump reaches certain height, it will be covered with a layer of earth. This will be continued till the ash pond is full with ash.

Solid Waste

Ash

Disposal of ash generated in a coal fired power plant especially having high ash content coal is generally a problem. With increased awareness and need for protecting the environment, Ministry of Environment & Forest (MoEF) is permitting new power stations to be established only with fly ash handling and disposal in dry form. Keeping this in mind ash utilisation in manufacturing useful products like fly ash bricks, etc. has been made mandatory by Government of India's extraordinary Gazette Notification No.S.O.163(E) dated 14.9.99. and updated by Gazette Notification MO. S.O. 979 (E) dated 23.08.03

TPC has conceived a consolidated ash utilisation plan for the proposed plant. Dry fly ash will be totally used for cement production, brick manufacturing and some for mine backfilling. Bottom ash which will initially be dumped in the ash pond will be excavated and used for landfilling and mine backfilling. Negotiations are going on with the cement manufacturing units Ambja Cements Ltd and Ultratech Cements Ltd, for reuse of the fly ash.

A Note on Ash Disposal details the scenario at the end of this chapter

Noise

Noise will be generated in the plant due to running of different machines like the turbines-generators, pumps, compressor, fans, crushers etc. All general equipment will be procured which will not exceed noise level of 85 dB(A). However for some equipment this may not be possible. In those cases the noise generating equipment will be housed in suitable enclosed places so that the noise outside would be within acceptable level. Personal working there will be provided with suitable gears like ear plug etc. for protection.

Permissible levels for work zone and for different areas are given in **Table 2.7** and **Table 2.8**.

Table 2.7

Noise Standards - Work Zone

Permissible Level dB(A)	Time
90	8 hour
93	4 hour
96	2 hour
99	1 hour
102	30 minutes
105	15 minutes

Source: Noise Standard Schedule, XXIX, pf W.B. Factories Rules'58

Table 2.8

Ambient Air Quality Standard in Respect of Noise

Area Code	Category of Area	Limit in dB(A) L_{eq} Day Time	Limit in dB(A) L_{eq}* Night Time
A	Industrial area	75	70
B	Commercial area	65	55
C	Residential area	55	45
D	Silence zone	50	50

Note:
1. Day time shall mean from 6.00 am to 9.00 pm
2. Night time shall mean from 9.00 pm to 6.00 am
3. Silence zones is defined as an area comprising not less than 100 meters around hospitals, educational institutions and courts. The silence zones are declared by the competent authority.
4. Mixed categories of areas may be decided as one of the four above mentioned categories by the competent authority.

*dB(A) leq denotes time weighted average of the level of sound in decibels on scale A which is related to human hearing.

Ref: EPA Notification [GSR 1063 (E) 26 December, 1989]

Heat Effluent

Thermal power generation causes emission of large amount of heat as only a portion of the heat energy is converted to electricity. Heat losses occur through exhaust gases and through cooling tower.

Heat loss through the stack is only about 8-10% of the total heat input to the furnace. This is nominal when compared with the capacity of earth as the heat sink and this would be adequately dispersed with the plume from the high stack. Moreover, majority of the heat in cooling tower is rejected in the form of evaporation loss. This does not cause any appreciable thermal pollution to the surrounding area. It may further be noted that the area has moderate wind speed and high rainfall.

Hazardous Waste

Coal based power generation process does not generate any hazardous waste as defined in rules [Ref. Hazardous Waste (Management and Handling) Amendment Rules, 2000].

However besides the main process, some of the utility activities can generate some hazardous wastes such as

a) Oily sludge from separators
b) Used Oil
c) Used batteries

Oily sludge will be separated and stored in lined pits. Used oil and the batteries will be sold to the authorized dealers.

Note on Ash Disposal

Problems of disposal of ash, both bottom ash and fly ash, from the solid fossil fuel-fired boilers are attracting attention of environmentalists as well as technologists all over the globe. The concept of ash disposal generally adopted in almost all the thermal power stations up to the recent past was to dispose the mixture of fly and bottom ash in (lean) slurry form which were impounded in low lying areas called 'ash pond'. The mixtures of fly ash and bottom ash, due to different physical and chemical properties were thought to be ineffective for commercial exploitation. Considerable research and development work undertaken during the past two to three decades throughout the world has opened various avenues of commercial utilization of fly ash.

Fly ash is an amorphous ferro-alumina silicate compound of spherical crystalline shape with particle sizes ranging between 2 to 50 micron. It varies from light to dark gray in colour with specific gravity lying between 1.9 to 2.3 and the bulk density of loose dry fly ash is around 800 Kg/m^3.

Fly ash has good pozzolonic property, good flowability and low permeability, which facilitate myriad utilization of fly ash. Ash generated from the station would have sizeable quantum of inert oxides and carbonates of silica, alumina, magnesium, etc. Some of the commercially viable uses of such fly ash are as follows;

i) *As Mine fill*
ii) *As fill materials in cement*
iii) *Building blocks*
iv) *Light-weight aggregates*
v) *Partial cement replacement*
vi) *Road sub-base*
vii) *Grouting material*
viii) *Filler in asphalt mix for roads*
ix) *Partial replacement of lime aggregate in concrete work*
x) *Road embankment*
xi) *Land filling material*
xii) *Recovery of minerals namely Aluminium & Iron.*

Bottom ash, which has a relatively large grain size, finds a ready use in construction of roads and embankments in rural areas. Review of the various application areas of fly ash reveals that substantial usage of ash generated in the proposed plant would be:

i) *As mine fill of abandoned stone quarries in the nearby area.*
ii) *In cement plant in adjoining districts*
iii) *For construction of village roads.*
iv) *Manufacturing of Ash bricks*

Fly ash can also be suitably mixed with the overburden for filling abandoned mine. This mode of backfilling has proved quite effective and eco-friendly and can substitute cost intensive sand filling earlier done by mining authorities.

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