

**Rapid Environmental Impact Assessment for  
600 MW (2 x 300) Coal Based Thermal Power Plant at  
Village-Bade Bhandar, District-Raigarh, Chhattisgarh**

**for**  
**M/s Korba West Power Company Limited;**  
**New Delhi**

**Prepared by**

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**Recognised by MoEF (GOI) Notifn. No. D.L.33004/99 Dt.24.10.2007**

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June,2008

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## **1.0 Preamble**

### **Power Scenario in the State of Chhattisgarh**

The installed power generation capacity of CSEB as on 31<sup>st</sup> March 2007 was 1673 MW comprising of 1430 MW from thermal power plant and balance from hydroelectric power generation. The estimated power demand of the Chhattisgarh state as per informal estimates is likely to reach a peak level of 3000 MW over the next 3-5 years. During the 11<sup>th</sup> plan period the State Government is targeting the following capacity addition; In addition to above the first unit of Korba East thermal power plant of CSEB with an installed capacity of 2X250 MW has been commissioned in March 2007. The second unit is expected to be commissioned during the current year.

- Korba West phase three 2 x 250-300 MW targeted to be commissioned during 2009-10.
- 3 x 500 MW Bhaiyathan project targeted to be commissioned during April-October 2011.
- 2 x 500 MW Madwa power project in Janjgir Champa targeted to be made operational during 2010-11.
- 2 x 500 MW thermal power project in joint venture with IFFCO at Premnagar in Surguja district in which CSEB has rights over 90% of the power project and which is expected to be commissioned during 2010-11.
- Korba South 1000 MW thermal power project originally to be undertaken by Daewoo of South Korea targeted for commissioning during 2011.

This aggregates to a total targeted capacity addition of around 4500 MW in next five years. Apart from this the state has a right of 5-7.5% share of power from the private sector projects coming up in the state. The state is seeing itself as the power hub of the country with most of the private producers having to sell their surplus power outside the state. The state, alongwith CEA and the PGCIL is also planning major evacuation network for taking this power mostly within the Western and the Northern grid where power shortages

are likely to continue over next 8 – 10 years making them the most potential market regions for sale of power.

Considering the above power scenario in the State of Chhattisgarh & Western Region, the need for setting up of the 600 MW (2 x 300 MW) power plant in Chhattisgarh by M/s Korba West Power Company Limited (KWPCCL) is justified.

KWPCCL has retained Anacon Laboratories, Nagpur to undertake an Environmental Impact Assessment study for the proposed 600 MW Thermal Power Plant and suggest an effective environmental management plan for minimizing the adverse environmental impacts of the project.

## 2.0 Project Description

### Site Details

The proposed power plant will come up at village Bade Bhandar, Chote Bhandar, Sarvani, Amali Bhona Teh. & Dist: Raigarh, Chhattisgarh. The site admeasuring 240 ha. is located at 21<sup>o</sup> 44' to 21<sup>o</sup> 45' N Latitude & 83<sup>o</sup> 17' to 83<sup>o</sup> 17' Longitude. The plant site has been selected based on the availability of fuel, water and facilities for power evacuation system. **Figure 1** indicates the study area map of the proposed power plant.

The entire land required for the power plant is 240 Hectares. The project area is plain and does not need extensive leveling. The major portion of land is barren government land and comprise very small portion of low yielding non irrigated agriculture private land. The break up of the land use is as follows:

Sr. No.	Details	Area (Ha)
1	Land for power plant including auxiliaries	30
2	Land for ash disposal area	75
3	Land for green belt development at plant site	80
4	Land for coal storage yard and wagon tippler system.	20
5	Land for raw water reservoir (15 days storage)	17
6	Land for colony and township	10
7	Misc. (offices, stores and other infrastructures etc.)	8
	<b>Total</b>	<b>240</b>

### Thermal Power Generation Process

In combustion process, energy of fuel is converted into thermal energy, which is then converted into mechanical energy through a turbine and finally into electrical energy through generator. The boiler walls are lined with tubes containing high quality demineralised water (known as boiler feed water). The combustion heat released from the fuel is absorbed by the boiler tubes and the heat converts the boiler feed water into steam at high pressure and temperature. The steam discharged through nozzles on the turbine blades rotates the

turbine, which in turn is coupled to a generator. Electricity produced will be passed through a step-up transformer and power then be evacuated via switch yard through a transmission system.

### 3.0 Description of the Environment

The baseline environmental quality data for various components of environment, viz. Air, Noise, Water, Land and Socio-economic were generated during March 2008 to May 2008 in the study area covering 10 km around the project site. Other environmental data on flora and fauna, land-use pattern, forest etc were also generated through field surveys and also collected from different state Govt. Department.

#### 3.1 Land Environment

About 57% of the total study area is agricultural land, 26% is water bodies, 5% is waste land, 11% is uncultivable land and only 1% forest land. Land use pattern within the study area is given below:

S. No.	Land use Pattern	Area (ha.)	PGA *** (%)
1	Forest land	438	1.39
2	Irrigated Land	3960	12.61
3	Unirrigated Land	13736	43.75
4	Culturable land	1565	5.03
5	Area not available for cultivation	3452	11.27
	Water Bodies	8249	26.27
	Total	31400	

(\*\*\* Percentage to total geographical area)

The soil quality assessment was carried out at seven locations. The texture of the soil in this area is sandy loam. The bulk density of the soil in the study area ranges between 1.28 to 1.4 g/cc. Chlorides are in the range of 2.44 to 11 mg/100gm. Organic carbon and nitrogen are in the range of 0.519 – 1.32% and 422 – 860 kg/ha.

This shows that soil is moderately good in organic and nutrient content.

#### 3.1.1 Flora & Fauna

##### Core Zone

Most of the area of the proposed power plant site is covered by low yield, rainfed (Unirrigated) agriculture. About 1/3<sup>rd</sup> portion of the area is covered by waste Land unfit for cultivation and without tree cover, indicating degraded soil conditions.

In the cultivated area the raised bunds separating the small plots, are covered with thick tree growth of various plants. Babul, Neem, Jamun, Mango, Ber, Imali, Palas, Pipal, Siras, subabool, Sisoo, Hiwar, Siwan, Ain, Semul, Khair, Lasuda, Arjun, Mahua and Bamboo are commonly found.

### **Buffer Zone**

Damka Protected Forest is situated about 8 km south- west from the project site; beyond river Mahanadi. The area is covered by sheet rock, Rock knobs and Bolders without any tree growth. Recently declared Protected forest of Purena, comprising compartment Nos. 2483,2484 and 2485 is situated on the North-west of the project site beyond Mand River flowing North-South. Out of these four hillocks, forming the protected Forest area, three are planted by Teak, Bomboo, Eucalyptus and Acacia auriculoformis. The plantation have almost failed for lack of protect pom grazing by domestic cattel. Natural groth of Tendoo and Palas was notified on various patches.

### **Fauna**

No national park or sanctuary is present in the study area. Common mammals, birds and reptiles are observed. Domestic animals were only noted during the study period. Wild animals are not found in the study area.

### **3.2 Air Environment**

Ambient air quality was monitored at 12 locations. Results indicate that concentrations of SPM, RPM, SO<sub>2</sub>, NO<sub>x</sub> and CO are well within the prescribed standards.

SPM - 82 to 224 µg/m<sup>3</sup>.

RPM - 27 to 71 µg/m<sup>3</sup>.

SO<sub>2</sub> - 6 to 7 µg/m<sup>3</sup>

NO<sub>x</sub> - 6 - 10 µg/m<sup>3</sup>.

CO - < 100 µg/m<sup>3</sup>

An automatic weather monitoring station was installed at the project site to record micro-meteorological data. Dominant wind directions recorded are from N, NW and W.

### **3.3 Noise Environment**

The noise levels in the study area are within the prescribed standards. Noise levels ranges from 43.0 dB(A) to 52.2 dB(A) during day time and 41.4 dB(A) to 44.7 dB(A) in the night time.

### **3.4 Water Environment**

The existing water resources, both surface and groundwater with respective significance are identified through reconnaissance within the study area (10 km radial distance) around project site. These locations are selected to assess the existing status of water quantity in impact zone.

The water quality in the impact zone was assessed through physico-chemical analysis of ground water samples collected during March 2008. The existing status of groundwater and surface water quality assessed by identifying 8 ground water (Bore wells) samples in different villages and 2 surface water samples from surface water sources. The physico-chemical characteristics of surface and groundwater were found to be below stipulated standards of drinking water (IS:105000). However the bacteriological quality of surface water is found to be polluted which may be due to the human activities observed during the study period.

The characterization of the water in and around the project site has been done. It has been now observed that all the physico-chemical parameters and heavy metals of water samples from surface and ground water are below the stipulated drinking water standards. The pH, TDS, and Dissolved Oxygen of the surface water were found in range of 7.15– 8.3, 182-190 mg/lit and 6.2-6.3 mg/lit respectively, whereas the ground water showed pH 7.05 - 8.16, TDS 456-668 mg/lit.

### **3.5 Socio-Economic Environment**

To study the socio-economic aspects of people in the study area around the proposed project site, the required data has been collected from various secondary sources and supplemented by the primary data generated through the process of a limited door to door socio-economic survey.

Demographic data indicates that the:

- The total population of the study area is 70289 with 14565 households.
- The scheduled castes & scheduled tribes percentage of the total population of the study area is 10.99% and 27.20% respectively.
- The literacy rate in the study area is 63.68%.
- 33.65% of the main workers are engaged in agriculture and allied activities.

#### ***Awareness and opinion about the project***

The respondents from most of the villages are aware of the project. They have good opinion about the project as it will improve the economy, infrastructural facilities, job opportunities and business opportunities of the villagers. The cultivators are in favour of the project. The educated youths opined that the management should give preference to them / local people.

### ***Commitment of KWPCCL towards Social Welfare Activities***

The project will provide full opportunity for local people to get employment and help in the up liftment of socioeconomic status of the area. The commitments of management include up liftment of social, health, basic needs of drinking water supply and provision of education facilities. Management will develop green belt to improve aesthetic quality of the region.

#### **4.0 Anticipated Environmental Impacts and Mitigation Measures**

The environmental impacts have been assessed assuming that the pollution due to the existing activities in the area where project is planned has already been covered under the present environmental scenario established by the monitored baseline data. Various impacts during the construction and operational phase on the environment parameters have been studied to estimate the impact on the environment.

##### **4.1 Land Environment**

The project area is of 240 ha. clearing of shrubs is required during construction phase. No matured tree will be cut from the project site. It is proposed to carry out plantation in about 33% of the total project area, which will not only nullify the impact due to vegetation loss during the construction phase but will also improve aesthetic aspects.

Combustion of coal will result in fly ash and bottom ash generation. A part of ash will be stored in Silos at the project site. Ash beyond the silos capacity will be disposed of in a HDPE lined ash pond in slurry form. KWPCCL will be installed a fly ash bricks and fly ash aggregates plants to use the fly ash generated.

Temporary houses will be provided for construction labour. The area will be developed aesthetically so that there no significant adverse impact during operational phase.

##### **4.2 Air Environment**

###### ***Impact on Air Quality***

The air pollution impact from a thermal power plant depend upon factors like design, capacity, process technology, quality of fuel used for combustion, operation & maintenance of process units and air pollution control measures adopted in individual units.

Particulate Matter, Sulphur Dioxide and Oxides of Nitrogen are the main pollutants from the proposed plant. Combustion of coal in the boiler will generate 4568 TPD ash. About 20% of this will be bottom ash and the remaining 80% ash will be carried along with the flue gas in the form of particulate matter as fly ash. To limit the concentration of the fly ash to below 50 mg/Nm<sup>3</sup>, electrostatic precipitator of 99.98% efficiency will be installed. A 275 m

high stack will be provided for adequate dispersion of pollutants. The NO<sub>x</sub> emissions from the boiler will be controlled by providing low NO<sub>x</sub> burner.

The Industrial Source Complex (ISC) model was applied with the flat terrain option. The ground level impacts of individual pollutants i.e. SO<sub>2</sub>, NO<sub>x</sub> and SPM from the proposed thermal power plant were predicted in terms of 24 hourly average concentrations. The ground level concentrations (GLCs) of the individual pollutants have been computed at 250 m distance interval within the study area of 10 km radius to superimpose over baseline data. The prediction results in this study, corresponding to winter season are shown in the form of concentration isopleths which also indicate the spatial distribution of concentration levels. During the normal operating conditions, the pollutant incremental concentration will be much less than the worst case scenario projected. The values are as follows:

SPM 0.10 to 0.40 µg/m<sup>3</sup>

SO<sub>2</sub> 2.0 to 8.0 µg/m<sup>3</sup>

NO<sub>x</sub> 2.0 to 4.0 µg/m<sup>3</sup>

The predicted resultant concentrations indicate that TSPM, SO<sub>2</sub> and NO<sub>x</sub> will be below prescribed standard for residential and rural areas.

#### **4.3 Water Environment**

The water requirement of about 2300 m<sup>3</sup>/hr, which will be met from the Mahanadi River. Adequate capacity water reservoir will be provided.

Waste water from cooling water system and boiler blow down will be neutralized and will be stored in guard pond. 335 m<sup>3</sup>/hr of waste water will be generated. Treated waste water will be recycled and reused for dust suppression, cooling, plantation etc. There will be no impact on the water regime due to the effluents from the proposed unit. Adequate rainwater harvesting measures will be implemented to utilize the storm water inside plant premises. It has been estimated that around 3600000 m<sup>3</sup> of rain water at the project site will be available for groundwater recharge, ash handling system, green belt development etc.

#### **4.4 Ecology**

As per the modeling results, there will be no impact on plantation falling within the study area due to gaseous emissions, if mitigative measures are taken as recommended in this report.

#### **4.5 Noise Environment**

Equivalent sound pressure level averaged over 8 hours. Leq (8 hrs) is used to describe exposure to noise in work places. In special cases, where noise levels may exceed

the acceptable limits, such as around the turbine, provision will be made of acoustic shield, if necessary.

All equipment in the proposed power plant will be selected/designed /operated to have a noise level below 85 to 90 dBA in line with the OSHA requirement. As per modeling results, the incremental noise levels due to the proposed plant will be in the range of 34 dB (A) to 41 dB (A) at a distance of 400 m from the source. Adequate noise control methods will be adopted.

#### **4.6 Socio-Economic Environment**

The proposed power plant will create mixed impact on the socio-economic environment due to:

- Change in occupation pattern.
- Migration of population from nearby areas for jobs.
- Marginal strain on existing infrastructure.

The positive impacts would consequently lead to an upliftment of the Quality of Life of the people in the area.

#### **5.0 Environmental Monitoring Program**

Environmental monitoring will be conducted on regular basis by KWPCCL to assess the pollution level in and around project area. This will help in assessing performance of pollution control equipment installed in the project and take mid term corrective measures, if any required. Portholes and sampling facilities will be provided.

The sampling and analysis of attributes including monitoring locations point sites will be as per the guidelines of the Central Pollution Control Board.

Environmental Management Cell will be established to supervise the monitoring programme. Budgetary provision for pollution control equipment and its recurring cost of Rs. 125 crores has been made for implementation of Environmental Management Plan.

#### **6.0 Additional Studies**

##### **Risk Assessment**

Hazard analysis involves the identification and quantification of the various hazards (unsafe conditions) that exist in the plant. On the other hand, risk analysis deals with the identification and quantification of risks, the plant equipment and personnel are exposed to, due to accidents resulting from the hazards present in the plant. There will be 2x360 KL HFO and 2x2000 KL LDO storage tanks. In case of fire in the LDO tank, the modeling results

indicate that radiation intensity of 37.5 kW/m<sup>2</sup> (i.e. 100% lethality) will occur within Plant premises.

Disaster Management Plan has been prepared to manage any disastrous event, if any, from the plant operation. Environmental and safety legislations will be kept in view while implementing the project.

Steam turbine & generator building	Moderate hazard potential	Fire and short circuit
Boiler	Moderate hazard potential	Fire / steam explosion
Coal Handling Plant	Moderate hazard potential	Fire or dust explosion
Coal storage	Moderate hazard potential	Spontaneous combustion
HFO / LDO storage	Major hazard potential	Fire

### **Occupational Health and Safety**

Effective implementation of measures suggested for pollution control will ensure safety and health of the workers.

### **7.0 Project Benefits**

The requirement of 300 skilled / unskilled persons will be met from nearby villages during construction phase in addition to some regular employment during operation. The project will help in generation of significant indirect employment. This will have positive socio-economic development in the region. There will be in general upliftment of standard of living of the people in the region.

### **8.0 Environmental Management Plan**

While implementing the project, the proponent will follow guidelines specified by CPCB under Corporate Responsibility for Environmental Protection (CREP) for thermal power plants. The following environmental management plan has been suggested during construction and operational phases.

#### **Construction Phase**

The following control measures are recommended to mitigate the probable adverse impacts:

- Clear demarcation of sites for construction workers camp to prevent occupational hazards and ensure water supply, sanitary facilities, housing, domestic, fuel etc.
- Falling of matured trees should be avoided.
- Necessary precautions to be taken for LDO storage safety norms

- Vehicles at the project site should be properly maintained to minimize exhaust emissions as well as noise generation.
- Dust emissions arising out of the excavation, leveling, transportation and stockpiling activities should be controlled by water sprinkling.
- Noise prone activities should be restricted to daytime.
- Tree plantation should be started during the construction phase so that plantation grows to a considerable height by the time of commissioning of the proposed project.
- Surplus excavated soil, rubbish needs to be cleared once the construction work is over.

## **Operational Phase**

### **8.1 Air Environment**

The following air pollution control measures have been recommended for implementation:

- Attempts to achieve/maintain the Plant Load Factor (PLF) of at least 85%.
- 99.89% efficiency ESP should be provided to contain particulate matter emissions below 50 mg/Nm<sup>3</sup>.
- 275m high stack will be for proper dispersion of gaseous emissions as per the guidelines of CPCB.
- Low NO<sub>x</sub> burner should be installed to keep NO<sub>x</sub> emissions well below the standards.
- Dust suppression / extraction system at the fuel handling area.
- Roads within the plant will be black topped.
- 33% of the entire project area will be developed as green belt using native plant species.

### **8.2 Noise Environment**

Manufacturers and suppliers of machine/equipment like compressors, turbines and generators will be selected to ensure that these machine /equipment meet the desired noise/vibration standards by providing noise absorbing material for enclosures or using appropriate design / technology for fabricating/assembling machines. The operator's cabins (control rooms) should be properly (acoustically) insulated with special doors and

observation windows. The operators working in the high-noise areas like compressor houses, blowers, generators, feed pumps, steam generation plant, turbo-generator area should use ear-muffs/ear-plugs. Plantation will further reduce noise impacts within the project premises.

The following measures are also recommended:

- Vehicles movement in the plant area will be regulated to avoid traffic congestion.
- Use of high pressure horn will be prohibited.

### **8.3 Water Environment**

#### ***Wastewater Management***

During plant operation, acidic and alkaline effluents will be generated periodically from the De-mineralization (DM) Plant and boiler blow down which will be collected in a neutralizing pit where the acidic and alkaline effluents will be neutralized with each other. This will be pumped and mixed with other effluents in the polishing pond after filtration. The treated effluent will be recycled.

The following additional measures are recommended:

- Oil / grease separator should be provided to skim oil / grease, if any, in the waste water.
- The sanitary waste should be discharged to septic tank and soak pit system.
- Induced draft cooling tower with COC of 4.
- Separate collection of storm water and development of rain water harvesting.

The project will operate on the principle of zero effluent discharge. The entire treated waste water will be recycled and reused for dust suppression, plantation, ash handling etc.

### **8.4 Land Environment**

#### ***Fly Ash Management***

Ash generated from plant should not be stored on land in open areas under any circumstances. The ash generated should be collected in dry form for storage in silos as temporary arrangement. Ash beyond the silos capacity should be disposed of in ash dike. The ash pond will be constructed as per MoEF guidelines.

Fly ash will be utilized by KWPCCL for manufacturing fly ash bricks and fly ash aggregates. Also KWPCCL will motivate other entrepreneur to setting up fly ash brick plant surrounding the project area.

### ***Guidelines for Greenbelt Development***

A buffer between the sources of pollution and the surrounding areas will be developed by developing a 30 - 50m wide greenbelt along the plant premises. The green belt helps to capture the fugitive emissions and attenuate the noise apart from improving the aesthetics. Approximately 1500 trees per ha will be planted in consultation with the local Forest Department.

The choice of plants should include shrubs that grow 1 to 2 m high and trees of 3 to 5m heights. It should be ensured that the foliage area density in vertical is almost uniform by intermixing the trees and shrubs.

### **8.5 Socio-economic Environment**

Following measures are suggested

- Locally available workforce would be employed.
- The project authorities should communicate with the local community should be done on regular basis to provide an opportunity for discussion.
- Project authorities will organize regular environmental awareness programmes.
- Social welfare activities to be undertaken by the project authorities in collaboration with local administration, gram panchayat, block development office etc. for better co-ordination.
- Project authority will provide free medical facilities to villagers within the study area.

