



## 1.0 Project Description

**Bharat Aluminum Company Ltd. (BALCO)** is an associate of Vedanta Resources Plc, a global player in non-ferrous metals with a turnover of US\$ 4 billion (Rs. 18000 Crores). BALCO was the first major Public Sector Organization which went through the economic reforms and disinvested to Sterlite Group in 2001. BALCO is intending to develop an Independent Power Plant near Korba to generate power to cater the needs of nation with special reference to Chhattisgarh state.

In general, the proposed project is designed to meet the following requirements:

- Low specific consumption of fuel and water;
- Low annual maintenance;
- Adequate instrumentation and automatic controls to ensure consistent quality and ease of operations;
- Adequate environmental protection measures to minimize the pollution;
- Cope up with the requirements of the CREP guidelines; and
- Adequate facilities to ensure safe operations of the plant.

The 1200 MW power plant would be constructed as a multiple unit configuration of two 600 MW units each, with one steam turbine and one boiler for each unit. The proposed project involves installation of two Pulverized Fuel Boilers, generating steam at 16.7 MPa at 538°C with two Condensing Turbo Generator Sets each having generating capacity of 600 MW of power. Installation of associated mechanical and electrical equipment, auxiliary units like coal, ash handling plant, water treatment plant, cooling water system, electrostatic precipitators (ESPs), NOx control equipment etc. will form a part of the total installation. Space for Flue Gas Desulphurization unit will be provided in the future. The salient features of the power plant are given in **Table-1**.

**TABLE-1  
SALIENT FEATURES OF PROPOSED POWER PLANT**

Sr. No.	Features	Details
1	Capacity	1200 MW
2	Configuration	2 x 600 MW
3	Type of boilers	Pulverized coal fired boilers
	Power evacuation	Power will be evacuated at 400-kv switchyard and would be fed to National grid.
4	Type of Fuel and source	Coal from South Eastern Coal fields
5	Coal Requirement	7.5 MTPA i.e. 21865 TPD (calculated based on 93% PLF and GCV of 3300 kcal/kg) 19600 TPD Consumption 2265 TPD Transportation and handling losses
6	Sulphur content	0.3 to 0.5 % (Max)
7	Ash Content in Coal	41.6 % (Max)
8	Ash generation	8160 TPD
A	Bottom Ash	1620 TPD
B	Fly Ash	6540 TPD
9	ESP efficiency	99.9%
10	Stack	One twin Flue stack of 275-m height
11	Water Requirement	3400 m <sup>3</sup> /hr

## 2.0 Description of the Environment

### 2.1 Location and Description of the Site

The terrain of the land in the plant site is plain with gentle slopes and no water streams present in the site area. The plant area is under possession of Vedanta Group and displacement of population is not envisaged.

The environmental setting of the proposed plant site is given in **Table-2**. Study area of 10-km radius around the proposed site is shown in **Figure-1**.

**TABLE-2**  
**ENVIRONMENTAL SETTING OF THE SITE**

Sr. No.	Particulars	Details
1	Latitude	22°22' N
2	Longitude	84°42' E
3	Elevation above MSL	300 m
4	Max temperature as per nearest IMD-Champa	43.1 °c
5	Min temperature as per nearest IMD-Champa	13.9 °c
6	Rainfall	1388.2mm
7	Present land use at the site	Industrial
8	Nearest highway	Korba – Bilaspur State Highway (4.5-km, W)
9	Nearest habitation	Lalghat(0.5 km)
10	Nearest railway station	Korba (SSW, 6.0-km)
11	Nearest airport	Raipur 220-km
12	Nearest town/City	Korba (10-km SSWW)
13	Hills/valleys	Nil
14	Topography	Plain
15	Archaeologically important places	Nil in 15-km
16	National Parks /Wildlife Sanctuaries	Nil in 15-km
17	Reserved / Protected Forest	Protected Forest near Kandaikhar (FCI) (5.0-km, W) Protected Forest near Dadar (5.1-km, SSE) Protected Forest near Rampakharra (7.5-km, SSE) Protected Forest near Rampakharra (8.3-km, SSE) Protected Forest near Bhalumara (7.2-km, SE) Protected Forest near Naktikhar (8.1-km, SSE) Protected Forest near plant area (6.5-km, NE)
18	Seismicity	Seismic Zone-II as per IS 1893 (Part I): 2002
19	Water source	Hasdeo river
20	Streams/Rivers	Hasdeo river (2.4-KM, NW) Belgari nalla (3.5-km, N)
21	Defence Installations	Nil in 5-km radius area

## 2.2 BASELINE STUDY

Baseline environmental studies for the various environmental attributes were carried out during the months March 1<sup>st</sup> to May 31<sup>st</sup> covering the pre-monsoon season. The details of the base line study are presented as follows:

### 2.2.1 Soil Characteristics

#### 2.2.1 Soil Characteristics

Agriculture is the main occupation of people in the study area. Hence it is essential to identify the impacts in the study area on the soil characteristics, which would affect the agricultural, and afforestation potential. Accordingly, an assessment of the baseline soil quality has been carried out to evaluate the base line status of the soil environment.

##### 2.2.1.1 Data Generation

- **Six** locations within 10-km radius of the proposed project site were selected for soil sampling. The present study on the soil quality establishes the baseline characteristics and identifies the incremental concentrations if any, due to the proposed project. The details of the sampling locations are given in **Table-4**.





**FIGURE-1  
STUDY AREA MAP OF THE PROJECT SITE – 10 KM RADIUS**

**TABLE-4  
DETAILS OF SOIL SAMPLING LOCATIONS**

Location Code	Location	Distance w.r.t Proposed Project (km)	Direction w.r.t Proposed Project
S1	Kohariya	2.0	W
S2	Rumgarha	2.2	SW
S3	Parsabhanta	2.6	S
S4	Risda	5.6	NE
S5	Risdi	7.0	SE
S6	Laighat	3.0	NNW

**2.2.1.2 Baseline Soil Status**

The soil analysis results reveals that the pH of the soil ranged from 7.1 - 7.3 indicating that the soils are neutral in nature. The soil in the study area is predominantly of silt clay type. The bulk density of the soil ranges between 1.24 and 1.39 gm/cc. The Electrical Conductivity was observed to be in the range of 152-521  $\mu$ S/cm.

The Nitrogen and phosphorous values are in the range of 121.5–143.2 kg/ha and 30.1-41.5 kg/ha respectively. The nitrogen and phosphorous levels of the soils in the region indicate that soils are good to moderate in Nitrogen and Phosphorous levels. The Potassium values range between 205.6-244.3 kg/ha, which indicate that the soils have medium quantity of Potassium. The soil from the study area shows moderate fertility due to their NPK content.

Metals can be categorized into two groups i.e. (1) metals, which are required by the living system (Ca, Mg, Fe and Zn etc), and (2) metals, which are not required by living system (Pb, Cr, Cd & Ni etc). Metal analysis indicates that the soils are rich in first category of soils.

**2.3 Ambient air quality**

The prime objective of the baseline air quality study was to assess the existing air quality of the area. Ambient Air Quality Monitoring (AAQM) stations were set up at **Six** locations with due consideration to the above mentioned points. **Table-2.3** gives the details of environmental setting around each monitoring station and their distances with reference to the proposed power plant.

**TABLE-5  
DETAILS OF AMBIENT AIR QUALITY MONITORING LOCATIONS**

Location Code	Location	Direction (km)	Direction	Environmental setting
AAQ1	Bhadrapara[core zone]	-	-	Industrial area
AAQ2	Rumgarha	3.1	NW	Residential area
AAQ3	Dondro	5.6	NE	Residential area
AAQ4	Risdi	4.0	SE	Residential area
AAQ5	Shivjinagar	6.5	SW	Residential area
AAQ6	Manikpur	6.7	S	Residential area

**2.3.1 Observations on Primary Data**

The observations based on a perusal of the survey results are summarized below:



- TSPM: The maximum value for TSPM is observed at the core zone (AAQ-1) station, as 251.3  $\mu\text{g}/\text{m}^3$ . The 24 hours applicable limit is 500  $\mu\text{g}/\text{m}^3$  for Industrial areas. The next highest SPM value of 206.9  $\mu\text{g}/\text{m}^3$  is observed at Manikpur (AAQ-6), which is slightly exceeding the applicable limit of 200  $\mu\text{g}/\text{m}^3$  for Residential areas.
- RPM: The maximum value for RPM is observed at the Plant Area (AAQ-1) station, at 66.8  $\mu\text{g}/\text{m}^3$ . The 24 hours applicable limit is 120  $\mu\text{g}/\text{m}^3$  for industrial areas. The next highest RPM value of 52.1  $\mu\text{g}/\text{m}^3$  is observed at Manikpur (AAQ-6), which is below applicable limit of 100  $\mu\text{g}/\text{m}^3$  for Residential areas.
- SO<sub>2</sub>: The higher values of SO<sub>2</sub> are observed to be 21.6  $\mu\text{g}/\text{m}^3$  at the Plant Area (AAQ-1) and at Manikpur (AAQ-6). The 24 hours applicable limit is 120  $\mu\text{g}/\text{m}^3$  for Industrial areas. The next highest SO<sub>2</sub> value of 19.8  $\mu\text{g}/\text{m}^3$  is observed at Rumgarha (AAQ-2).
- NO<sub>x</sub>: The higher values of NO<sub>x</sub> are observed to be 24.6  $\mu\text{g}/\text{m}^3$  at Plant site (AAQ-1). The 24 hours applicable limit is 120  $\mu\text{g}/\text{m}^3$  for residential areas. The next highest NO<sub>x</sub> value of 23.9  $\mu\text{g}/\text{m}^3$  is observed at Rumgarha (AAQ-2).

## 2.4 Water Quality

Selected water quality parameters of ground water and surface water resources within 10-km radius of the study area has been studied for assessing the water environment and evaluate anticipated impact of the proposed Power Plant. Understanding the water quality is essential in preparation of Environmental Impact Assessment and to identify critical issues with a view to suggest appropriate mitigation measures for implementation.

### 2.4.1 Water Sampling Locations

- Four Surface water and Four Ground water samples were collected as grab samples and were analyzed for various parameters to compare with the standards for drinking water as per IS: 2296 and 10500. The details of the sampling locations are given in **Table-6**

**TABLE-6  
DETAILS OF WATER SAMPLING LOCATIONS**

Location Code	Location	Distance (km)	Direction
<b>Surface waters</b>			
SW1	Dhengu Nala	0.9	SE
SW2	Hasdeo river [water intake point]	3.5	WNW
SW3	Belgari Nala	2	WNW
SW4	Hasdeo river at Rahtakhar	6	SW
<b>Ground waters</b>			
GW1	Andrikachar	2.2	S
GW2	Risdi	4.0	SE
GW3	Parsabhanta	1.6	NNE
GW4	Rumgarha	3.1	NW

### 2.4.2 Presentation of Results

#### 2.4.2.1 Surface water quality

The analysis results indicate that the pH ranges from 6.3 to 7.3 and TDS fall in the range of 163-175 mg/L which are in accordance with the standards specified under IS:2296. The DO values ranging from 5.5-6.3 mg/L were observed to well within the permissible limits. Other parameters like Chlorides, Sulphates and Nitrates are within the prescribed standards. The over all physico-chemical and biological analysis reveals that the quality of these waters confirm to the prescribed limits of IS: 2296 class "C".

#### 2.4.2.2 Ground water quality

The analysis results indicate that the pH and conductivity of the ground waters was found to be in the range of 7.0-7.1 and 586-698 mg/L. The TDS were found to be well with in the

limits ranging from 429-468 mg/L. other parameters like Chlorides and Sulphates were observed to be well with in the prescribed limits. By and large the physico chemical analysis divulges that all the parameters are well with in the standards as per IS: 10500.

## 2.5 Noise Level Survey

The foremost objective of noise monitoring in the study area is to evaluate the baseline noise and assess the impact of the total noise expected to be generated by proposed project. Eight locations were monitored for assessing the existing noise levels in and around the project location. The noise monitoring locations are given in **Table-7**.

**TABLE-7**  
**DETAILS OF NOISE MONITORING LOCATIONS**

Location Code	Location	Distance (km)	Direction	Remark
N1	Proposed Chimney area	-	-	Industrial
N2	Proposed Power Plant area	-	-	Industrial
N3	Proposed Switch Yard area	-	-	Industrial
N4	Proposed Coal yard	-	-	Industrial
N5	Parsabhata	1.6	NNE	Residential
N6	Belgari	2.0	W	Residential
N7	Rampur	2.2	S	Residential
N8	Kohariya	2.0	W	Residential

### 2.5.1 Observations

It was observed that the prevailing noise levels in and around the proposed project location were found to be well with in the statutory limits prescribed by the regulatory authorities.

## 2.6 Flora and Fauna Studies

Ecological studies were conducted which includes both terrestrial and aquatic environs in and around existing industrial complex and assess to discern the biological resources. 363 plant species were identified which are mainly composed of phanerophytes and therophytes, hemicryptophytes. Phytosociological studies were conducted during summer at various locations such as forest areas and nearby village areas to assess phytosociological structure in the study. 87 animal species were recorded/ observed during study period. It can be concluded that there are quite good 4 animals species belongs to Sch-I, 8 species belongs to Sch-II and rest of species belongs Sch-III, Sch-IV and Sch-V of Wildlife protection act, 1972.

## 3.0 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

### 3.1 Operation Phase

#### 3.1.1 Air Environment

- Air pollution modeling, carried out for proposed power plant shows that resultant concentrations of SO<sub>2</sub> (48.9 µg/m<sup>3</sup>), NO<sub>x</sub> (32.0 µg/m<sup>3</sup>) and SPM (252.9 µg/m<sup>3</sup>) for pre-monsoon season will remain well within the National Ambient Air Quality Standards.
- Limiting of pollutant discharge and minimizing its effect on air quality, within prescribed standards, will be achieved, consequent to selection eco-friendly Pulverized Fuel Boilers technology and plant design for boilers and installation of tall stack of 275 meters that provides better dispersion of pollutants.
- Consequently the proposal is unlikely to have any major impacts on local or regional air quality or to adversely affect human health or status of pollution-sensitive vegetation, either locally or on nearby terrain.

### 3.1.2 Air Dispersion Modeling

In the present case, **Industrial Source Complex [ISC3]** 1993 dispersion model based on steady state Gaussian plume dispersion, designed for multiple point sources for short term and developed by United States Environmental Protection Agency [USEPA] has been used for simulations from point sources. The modeling results are presented in **Table-8**.

**TABLE-8**  
**RESULTANT CONCENTRATIONS DUE TO INCREMENTAL GLC's**

Pollutant	Concentration ( $\mu\text{g}/\text{m}^3$ )		
	Baseline	Incremental	Resultant
<b>Pre-Monsoon Season</b>			
SPM	251.3	1.6	252.9
SO <sub>2</sub>	19.8	29.1	48.9
NOX	24.6	7.4	32.0

### 3.1.3 Water Environment

- The project will source its entire water requirement from Hasdeo Reservoir. The total annual water requirement of the proposed power plant is about 81235 m<sup>3</sup> at the rate of 3400 m<sup>3</sup>/hr.
- The project will not extract groundwater and hence there will be no impact on ground water.

A quantum of 361 m<sup>3</sup>/hr will be generated as waste and will be routed to the treatment plant. After subsequent treatment it will be utilized for horticultural needs as well as in suppression of fugitive dust emissions. The plant would operate on zero discharge basis and no wastewater will be emancipated out side plant premises.

The storm water in the project area will be collected through storm water drains and stored in the storm water tank, which will be lined to prevent any contamination of ground water. The stored storm water will be utilized in the plant operation resulting in conservation of fresh water. The guard pond will be provided with proper lining to prevent seepage and avoid contamination of groundwater. Hence, the impact on the groundwater bodies is not envisaged. The garland drains around the ash pond site will be provided for the collection of run-off water during monsoon season. Hence, impact on the water quality is not envisaged.

### 3.1.4 Solid Waste Management and Land Use

A long-term ash management agenda has been drawn to ensure compliance with the Ash Management Rules and meet CREP requirements. All efforts will be put to promote ash utilization in construction business. 100% fly ash utilization will be achieved with in 9 yrs from the date of commencement of the project operations.

### 3.1.5 Noise Environment

The main noise generating sources are blowers from boilers and turbines. The impact of noise emission from boilers will be minimized by acoustic enclosures and the noise levels will be limited to 85dB [A].

### 3.1.6 Greenbelt Development

Greenbelt with a width of 50-m will be developed around the plant site covering an area of 30 acres in the IPP premises. In the proposed greenbelt, about 30000 number of trees will be planted with a density of 2500 trees/ha. Every year 6000 number of trees will be

planted and absolute greenbelt will be developed over a period of 5 years. Annual budget of Rs. 1 crores will be allocated for this purpose.

### 3.1.7 Socio- Economics

The major economic impacts, which will accrue to the region, during the construction phase and operation of smelter, will be an increased availability of direct and indirect employment. Local people will be benefited after commissioning of the proposed project in terms of petty to major contractual jobs and associated business establishments.

## 4.0 Environmental Monitoring Programme

Post project environmental monitoring is important in terms of evaluating the performance of pollution control equipments installed in the project. The sampling and analysis of the environmental attributes will be as per the guidelines of CPCB/CSECB. The frequency of sampling and location of sampling will be as per the directives of Chhattisgarh State Environment Conservation Board. Following attributes will be covered in the post project environmental monitoring in and around the project site:

1. Ambient air quality monitoring on weekly basis in the plant area and in the surrounding villages with respect to SPM, RPM, SO<sub>2</sub>, NO<sub>x</sub> and CO;
2. Source emissions will be monitored on monthly basis. Automatic continuous online monitoring system shall be installed in the stacks;
3. Water quality monitoring at intake point, surface water bodies and ground water in the surrounding villages. Further, the wells around the ash pond area will be identified and monitored on the regular basis;
4. Treated wastewater before routing to clarifier will be analyzed on fortnightly basis. The pH, temperature, electric conductivity, TDS and flow will be monitored regularly;
5. The noise levels will be recorded in and around plant. The noise levels at boundary of the plant will be recorded on monthly basis;
6. The soil quality around ash pond area will be monitored on six monthly basis for the fertility of the soil;
7. All the results will be compiled and thoroughly analyzed to assess the performance of the power plant; and
8. The results will be reported on regular basis to the Chhattisgarh State Environment Conservation Board and regional office of MoEF.

## 5.0 Additional Studies

Hydrogeological studies in the proposed Ash Pond area are in progress

## 6.0 Project Benefits

Total installed capacity power generation in the country is 115360 MW, whereas the peak demand is close to 154015 MW. Only the eastern and the north eastern region are surplus in power. The execution of the proposed project would help in meeting the demand. The region wise power scenario is given in **Table-1.1**.

**TABLE-1.1  
POWER SCENARIO IN INDIA**

Region	Installed Capacity	Peak Demand (2006-07)	Peak Demand (2011-2012)
Northern Region	32100	35540	46675
Western Region	32750	35220	46825
Southern Region	30370	31020	42060
Eastern Region	17710	11990	15665
North-eastern Region	2360	1875	2970
Island	70	NA	NA
<b>Total</b>	<b>115360</b>	<b>115645</b>	<b>154015</b>





It can be seen from the above that the short fall is likely to continue for the next 7 to 8 years, if not longer. Based on the demand projections of the 16<sup>th</sup> Electric power survey, the government of India's 5<sup>th</sup> national Power plan has envisaged a total installed capacity of 212000 MW. This capacity is to be added by the end of the 11<sup>th</sup> plan that is March, 2012.

## **7.0 Environment Management Plan**

### **7.1 Environment Management Plan during Construction Phase**

During construction phase, the construction activities like site levelling, grading, and transportation of the construction material cause various impacts on the surroundings.

#### 7.1.1 Air Quality Management

The activities like site development, grading and vehicular traffic contribute to increase in SPM and NO<sub>x</sub> concentration. The mitigation measures recommended to minimize the impacts are:

- Water sprinkling in construction area;
- Asphaltting the main approach road;
- Proper maintenance of vehicles and construction equipment; and
- Tree plantation in the area earmarked for greenbelt development.

#### 7.1.2 Water Quality Management

The wastewater from vehicle and construction equipment maintenance centre will contribute to oil and grease concentration. The wastewater from labour colony will contribute to higher BOD levels. The mitigation measures recommended to minimize the impacts are:

- Sedimentation tank to retain the solids from run-off water;
- Oil and grease trap at equipment maintenance centre;
- Septic tanks to treat sanitary waste at labour colony; and
- Utilizing the wastewater in greenbelt development.

#### 9.1.3 Noise Level Management

Operation of construction equipment and vehicular traffic contribute to the increased noise level. Recommended mitigation measures are:

- Good maintenance of vehicles and construction equipment;
- Restriction of construction activities to day time only;
- Plantation of trees around the plant boundary to attenuate the noise; and
- Provision of earplugs and earmuffs to workers.

#### 7.1.4 Ecological Management

During construction, vegetation in the plant premises is required to be cleared. The measures required to be undertaken to minimise the impact on the ecology are:

- The felling of trees will be kept at minimum;
- Transplantation of existing matured trees will be undertaken and transplanted in the area earmarked for greenbelt development; and
- The greenbelt having tree density of 2500 trees/ha will be developed.

### **7.2 Environment Management Plan during Operation Phase**

During operation phase, the impacts on the various environmental attributes should be mitigated using appropriate pollution control equipment. The Environment Management Plan prepared for the proposed project aims at minimizing the pollution at source.

### 7.2.1 Air Pollution Management

Fugitive and stack emissions from the power plant will contribute to increase in concentrations of SPM, SO<sub>2</sub> and NO<sub>x</sub> pollutants. The mitigative measures recommended in the plant are:

- Installation of ESP's of 99.9% efficiency to limit the SPM concentrations below 75 mg/Nm<sup>3</sup>;
- Provision of 275-m high stack for wider dispersion of gaseous emissions;
- Providing low NO<sub>x</sub> burners to reduce the NO<sub>x</sub> emissions;
- Dust extraction system will be provided at transfer points of conveyor system;
- Conveyor belt will be closed to prevent dust generation;
- Provision of water sprinkling system at material handling and storage yard;
- The ash will be transported by closed bulkers;
- Asphaltting of the roads within the plant area;
- Development of Greenbelt around the plant to arrest the fugitive emissions.

### 7.2.2 Water Pollution Management

The wastewater will be generated from cooling towers in the power plant. Additionally, domestic wastewater from canteen and employees wash area will also be generated. The recommended measures to minimise the impacts and conservation of fresh water are:

- Recycling of complete wastewater generated in cooling tower into ash handling and disposal;
- Provision of sewage treatment plant to treat domestic sewage from plant and township;
- Utilization of treated domestic wastewater for greenbelt development;
- Lining of guard pond suitably to prevent any seepage into ground to avoid any groundwater contamination;
- Provision of separate storm water system to collect and store run-off water during rainy season and utilization of the same in the process to reduce the fresh water requirement;
- Suitable rainwater harvesting structures to be constructed.

### 7.2.3 Noise Pollution Management

In the process, various equipments like pumps, cooling tower, compressors etc generate the noise. The recommendations to mitigate higher noise levels are:

- Equipment will conform to noise levels prescribed by regulatory authorities;
- Provision of acoustic enclosures to noise generating equipments like pumps;
- Provision of thick greenbelt to attenuate the noise levels; and
- Provision of earplugs to the workers working in high noise level area.

### 7.2.4 Solid Waste Management

The main solid waste from the power plant will be the ash (fly ash and bottom ash). The total ash generation will be about 8160 TPD. Out of this, the bottom ash will be about 20% of the total ash generated i.e. 1620 TPD and balance 6540 TPD will be fly ash.

As per fly ash Notification, 1999, BALCO will put all efforts to utilize 100% of the ash generated within the nine years from the commissioning of the plant. The major recommended measures to mitigate the impacts due to disposal of solid waste are:

- Ash will be disposed off by using high concentrated slurry disposal system;
- The organic portion of solid waste generated in the Sewage Treatment Plant (STP) will be used as manure in greenbelt development; and
- Maintaining the data base on solid waste generation.