ENVIRONMENTAL IMPACT ASSESSMENT

FOR THE PROPOSED EXPANSION OF ALUMINIUM SMELTER PRODUCTION CAPACITY FROM 5.75 LTPA TO 10.85 LTPA AT RISDA VILLAGE, KORBA TEHSIL, KORBA DISTRICT, CHHATTISGARH STATE

EXECUTIVE SUMMARY

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Korba, Chhattisgarh

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1.0 INTRODUCTION

M/s. Bharat Aluminum Company Ltd (BALCO) was established at Korba, Madhya Pradesh (presently Chhattisgarh) as a Government of India undertaking with integrated smelter capacity of 1 LTPA (1,00,000 tonnes per annum) with Soderberg technology employing 100 kA cells and alumina refinery capacity of 2 LTPA. The plant started its operation in 1973. BALCO was taken over in 2001 by Sterlite Industries, an associate of Vedanta Resources, PLC.

Since 2001, BALCO modernized & expanded the plant in the following stages:

(i) Setting up a 2,50,000 TPA pre-baked technology smelter and 540 MW coal based power plant employing GAMI – China 320 KA technology;

(ii) Expanding further by installation of 3.25 LTPA aluminium and 1,200 MW (4X300 MW) coal based Thermal Power Plant (TPP) employing GAMI China 340 KA pre-baked anode technology. While installing 3.25 LTPA smelter, original 1 LTPA Soderberg smelter was dismantled favoring environmental friendly pre-baked technology. 3.25 LTPA smelter included 336 no 340 KA pots and ingot casting capacity of 1.50 LTPA & wire rod of 2.00 LTPA capacity; and

(iii) The previous expansion was undertaken based on the EC which was granted by MOEF for the expansion of aluminium smelter plant from 3.5 LTPA to 9.0 LTPA. Under the said EC smelter plant of 3.25 LTPA was only constructed and 1 LTPA Soderberg smelter was dismantled. However, the remaining capacity of 3.25 LTPA was not constructed due to prevailing economic scenario at that point of time. The said EC expired in September, 2015. Now BALCO is expanding its existing aluminium production capacity by 5.1 LTPA in the area earmarked for balance 3.25 LTPA smelter capacity by incorporating advanced state of the art environment friendly technology.

BALCO is presently contemplating to undertake brown field expansion of the smelter by installing 5.10 LTPA by employing 500/600 KA cell technology. It is proposed that the said smelter shall be constructed at the designated area, earlier proposed for 3.25 LTPA aluminium smelter.

1.1 Purpose of the Report

As per Environmental Impact Assessment EIA Notification dated 14th September, 2006, the proposed expansion project falls under category 'A' of project activity 3(a) and requires prior Environmental Clearance (EC) to be obtained from MoEF&CC before the commencement of project construction activity.

The application for prior EC (Form-1 and pre-feasibility report) for the proposed project was submitted to MoEF&CC on 20th August, 2017 and same was reviewed by 22nd reconstituted Expert Appraisal Committee (Industry-I) meeting held during 11th – 13th September 2017 in New Delhi to prescribe Terms of Reference (TORs) for the preparation of EIA/EMP report. TOR has been issued by MoEF&CC vide letter F.No. J-11011/123/2007-IA II(I) dated 19th September, 2017.

2.0 BRIEF DESCRIPTION OF THE PROJECT

2.1 Type of the Project

The existing BALCO integrated aluminium complex comprising 2 smelter units totalling 5.75 LTPA capacity (2.50 LTPA + 3.25 LTPA) along with all auxiliary facilities, thermal power plants totalling 1740 MW; 540 MW (4 x 135 MW) and 1200 MW (4 x 300 MW) is located at Risda village, which falls in Korba tehsil, Korba district in Chhattisgarh state.

Now BALCO intends to install 5.10 LTPA aluminium smelter based on 500/600 KA cell technology and associated facilities in the factory premises at BALCO integrated complex. Power requirement for smelter expansion shall be met from the existing thermal power plants and power import. The salient features of the proposed expansion project are given in **Table-1**. The study area map of 10 km radius around the project site is shown in **Figure-1** respectively.

TABLE-1
SALIENT FEATURES OF THE PROPOSED EXPANSION PROJECT

Sr. No.	Description	Details
1	Aluminium production capacity	5.10 LTPA Aluminium Ingots
2	Land requirement	39.66 ha (98 acres)
3	Water consumption and source	2,400 m^3/day Water is drawn from Hasdeo river.
4	Power consumption and source	About 800 MW (including auxiliary power) based on average 12,500 Kwh/tonne (DC Power) for pot line from the thermal power plant (TPP) of BALCO
5	Raw material requirement	• Alumina: About 1.94 T of alumina/ tonne of metal (or about 9,89,400 TPA) • Calcined petroleum coke: 1,82,000 TPA • Cryolite: 1,020 TPA • Aluminium fluoride: 7650 TPA • CT pitch: 39,500 TPA
6	Fuel requirement ➢ Heavy Furnace Oil (HFO)	 15,000 KLPA
7	Manpower requirement	1,050 persons
8	Project cost	Rs. 6,387 Crores

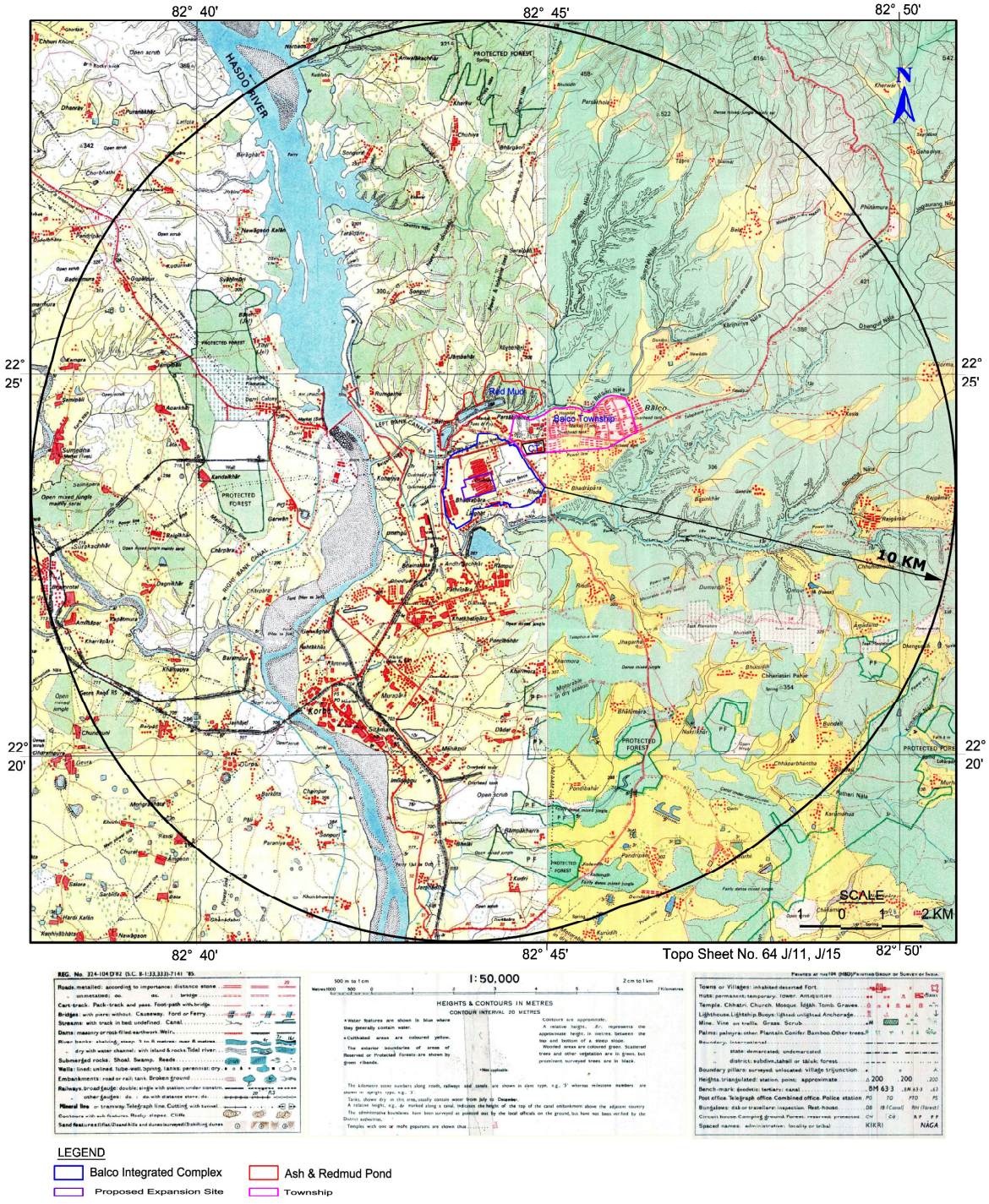

FIGURE-1
STUDY AREA MAP

2.2 Environmental Setting of the Project Site

The proposed expansion project site is located in latitude: of 22°23'24.5"N to 22°23'49.4"N longitude of 18°43'32.9"E to 18°44'09.5"E within the existing BALCO integrated complex at Risda village, Korba tehsil, Korba district, Chhattisgarh.

The proposed expansion project site is well connected by the existing NH-149B at a distance of 1.0 km in west direction and Korba railway station at a distance of 6.0 km in the direction SSW. The nearest airport at Raipur, which is about 220 km from project site and nearest town is Korba, which is about 5.2 km from the proposed expansion project site. As per study area of 10 km radius, the dense mixed jungle at Risda and 5 protected forest areas near Bhalumara, Naktikhar, Rampakharra, Bhargaon and Bundeli are located. The Balgari nala and Dhengu nala, which is about 0.1 km and Hasedo river is about 1.5 km from the project site. The region is industrially developed with many major power plants and coal mines operating in the study area besides existing aluminium smelter of BALCO.

2.3 Process Description

In the process adopted for aluminium manufacturing, electrolytic reduction of alumina is carried out to get metallic aluminium. The process of reduction is well known and commercially established Hall–Heroult process of electrolysis and will employ State of Art 500/600 KA cell and environmentally friendly technology. Electrolytic operations are carried out at a cell amperage of 500/600 KA. Generally, the higher cell amperages are conducive to more economical production & tendency over time has been to achieve high current intensities with lower resource specifics and lesser environmental impact. Other trends in technological developments are with respect to anode design, cathode design, cell design, voltage control, bus bar arrangement, pot fume exhaust system and dry scrubbing etc.

The anode system proposed to be used is prebaked centre feed type. Aluminium metal is deposited in molten form on the cathode under the electrolyte layer and is tapped under vacuum. As the operation is continuous, alumina is charged at suitable intervals after breaking the crust that is formed at the top of electrolyte layer.

Fume liberated at the anode during the electrolytic process consists primarily of oxides of carbon & fluorine compounds. The former are obtained by chemical reaction of the anode mass whereas the later result from the dissociation of fluorides in the cell bath. Additionally entrained fluorides, alumina dust are also included in liberated gases. The gases are treated through dry scrubber type gas cleaning system.

The newest primary aluminium production facilities use a variant on pre-bake technology called Centre Worked Pre-bake Technology (CWPB). This technology uses multiple "point feeders" and other computerized controls for precise alumina feeding. A key feature of CWPB plants is the enclosed nature of the process. Fugitive emissions from these cells are very low, less than 2% of the generated emissions. The balance of the emissions is collected inside the cell itself and carried away to very efficient scrubbing systems, which remove particulates and gases. Computer technology controls the process down to the finest detail, which means that occurrence of the anode effect and the condition, which causes small quantities of Per Fluorocarbons (PFCs) to be produced can be minimized.

Apart from the pre-bake cells, an anode plant is another section of the aluminium smelter. The purpose of the anode is to enable electricity to be transferred into the reduction cell in order to produce aluminium. The electricity is conducted into the cell through an aluminium rod connected to the anode. Since large numbers of anodes are consumed in the process each year, it is therefore advantageous to produce the anodes on the same site as the smelter.

3.0 DESCRIPTION OF THE ENVIRONMENT

Baseline environmental status has been established for various environmental attributes within a study area of 10 km radius from the project site. The major environmental disciplines covered in the EIA report includes ambient air quality, water quality, noise, soil, ecology (terrestrial and aquatic), land use, geology, hydrology and demographic & socio-economic conditions. water quality, soil quality, ecology, land use and socio-economic profiles of people. The baseline studies were carried out during 1st October 2017 to 31st December 2017, covering post-monsoon season, and partly winter season in the various domains of environment.

3.1 Soil Characteristics

The soil samples were collected within the study area during post-monsoon and partly winter season of 2017. It has been observed that the pH of the soil in the study area ranged from 6.1 to 7.2. The electrical conductivity was observed to be in the range of 83 to 330 µmhos/cm. The nitrogen values range between 53.2 kg/ha to 113.3 kg/ha. The phosphorus values range between 66.4 kg/ha to 120.6 kg/ha. The potassium values range between 0.17 kg/ha to 0.79 kg/ha. Soluble chlorides in the region varied from 105.3 mg/kg to 240.5 mg/kg. Organic matter concentrations ranged from 0.50% to 1.17%. Organic carbon concentrations ranged from 0.29% to 0.68%.

3.2 Climatology and Meteorology

The recorded temperature at site during study period ranges between 14.5^{o}C to 32.5^{o}C and relative humidity ranges in between 42% to 70%. Predominant winds from N and NW directions were observed during the study period.

3.3 Ambient Air Quality

To establish the baseline status of the ambient air quality in the study area, the air quality was monitored at eight locations during post-monsoon and partly winter season of 2017. The $PM_{2.5}$ and PM_{10} are observed to vary from 14.6 µg/m^3 to 49.4 µg/m^3 and 29.4 µg/m^3 to 72.3 µg/m^3 respectively. The SO_2 and NOx are observed to vary from 15.1 µg/m^3 to 38.6 µg/m^3 and 17.3 µg/m^3 to 48.6 µg/m^3 respectively. The CO is observed to vary from 244 µg/m^3 to 873 µg/m^3 respectively. The O_3 is observed to vary from 4.2 µg/m^3 to 15.8 µg/m^3 respectively. The remaining parameters as per 16th November 2009 CPCB Notification are observed to be within permissible limits.

3.4 Water Quality

The baseline water quality status in the region is established by collecting water samples in study area.

- *Surface Water Quality*

The analysis results indicate that pH is found to be 7.0 to 7.3, which is well within the specified standard 6.5 to 8.5 limit. The values for EC were observed to be between 114 µS/cm to 207 µS/cm in studied samples. The TDS was observed to be 65.0 mg/l to 133.5 mg/l. Dissolved oxygen was observed to be 4.9 mg/l to 5.9 mg/l. The chlorides and sulphates were found to be 4.8 mg/l to 22.1 mg/l and 2.3 mg/l to 14.6 mg/l respectively. Fluorides was observed to be in range of 0.3 mg/l to 0.9 mg/l. Bacteriological studies was observed that, the total coliform in range of 246 MPN/100 ml to 470 MPN/100 ml.

- *Ground Water Quality*

The analysis results indicate that the pH ranges in between 6.7 to 7.9, which is well within the specified standard of 6.5 to 8.5. Total hardness was observed to be ranging from 18.4 mg/l to 399.0 mg/l.

Chlorides at all the locations were ranging in between 7.1 mg/l to 394.2 mg/l. Fluorides were observed to be ranging in between 0.2 mg/l to 1.2 mg/l and are found to be within the permissible limit. Nitrates are found to be in range of 0.1 mg/l to 30.2 mg/l. The heavy metal contents were observed to be in well within the limits except few parameters.

3.5 Noise Level Survey

The noise monitoring has been conducted in the study area. Day time, night time noise levels were found to be varying from 47.7 dB(A) to 55.6 dB(A) and 45.2 dB(A) to 52.2 dB(A) respectively in the study area. The noise levels in general found within the acceptable levels as per standards prescribed by Central Pollution Control Board (CPCB).

3.6 Ecological Studies

There are few Schedule-I animals which are occasionally present in the buffer zone of the 10 km radius such as *Melurus ursinus*-Asian Sloth Bear, *Panthera pardus* fusca- Leopard, apart presence of Nilgai occasionally in the study area.

The fauna are listed in the Schedule-I, II, III, IV and V of the Indian Wildlife (Protection) Act, 1972. The species of the fauna are also cross verified with record of the forest beat working plans of the Korba Tehsil and adjoining Tehsils.

As per the forest department records and primary survey, there are no sanctuaries, national parks, biosphere reserves in the study area. The study area does not consist of any important 'Bird Areas'.

The study area does not have any migratory corridors of any important bird areas. On comparison of the check list given in the Schedule-I of the Indian Wildlife Protection Act, 1972, there are 8 which are listed in the Schedule I of the Indian Wildlife (Protection) Act, 1972, and remaining of the species are confined in the schedules of II, III, IV and V of the Indian Wildlife (Protection) act, 1972.

3.7 Demography and Socio-Economic Profile

The information on socio-economic aspects of the study area has been compiled from secondary sources, which mainly include census data of 2011. The salient features of the demography and socio-economic profile are as follows:

- Total population is 3,53,464;
- The scheduled castes (SC) are 12.98% and scheduled tribes (ST) are 16.36%;
- Overall literacy rate in the study area according to 2011 census is 81.94%, out of which male literacy is 56.60% while female literacy is 43.40%; and
- The percentage of main workers and marginal workers are 85.30% and 14.70% respectively.

4.0 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The summary of anticipated environmental impacts due to the existing units and proposed expansion project during operation phase and mitigation measures are given in the following **Table-2**.

TABLE-2
SUMMARY OF ANTICIPATED IMPACTS DURING OPERATION PHASE

Discipline	Potential Impacts	Probable Source	Mitigative Measures	Remarks
Air Quality	Increase in SO_2 and PM level in ambient air	Aluminium smelter plant and captive power plant	Stacks of adequate heights of stacks has been provided to fume treatment plant, Baking furnace, green anode plant and thermal power plant respectively to ensure wider dispersion	Maximum short term ground level concentration (GLC) of PM, and SO_2 is within the permissible

Discipline	Potential Impacts	Probable Source	Mitigative Measures	Remarks
			of pollutants.	limits.
Air Quality	Increase in PM in ambient air	Vehicular traffic	All motorable roads in the plant area is paved to reduce dust emission.	-
Terrestrial Ecology	Impact on plant species	Emissions from stack	Emissions are controlled as well as dispersed through appropriate design.	As emissions are within limits, no active injury to the vegetation is expected.
Aquatic Ecology	Impact on marine life	Aluminium smelter plant, cooling tower, laboratory etc.	Wastewater generated in smelter plant is treated and reused in the process.	Zero discharge, thus no impact upon aquatic ecology.
Water Quality	Deterioration of water quality of surface water	Discharge from cooling tower plant service water waste and effluents	Adequate treatment facilities like ETP, STP neutralization pit, settling ponds, biological treatment system and drainage systems etc. are provided so that the treatment of effluents conforms to the regulatory standards utilized for greenbelt development.	Zero discharge, thus no impact upon aquatic ecology.
Noise	Increase in noise levels in the plant area	Equipment in main plant and auxiliaries	Equipment is designed to conform to noise levels prescribed by regulatory agencies. Provision of green belt and plantation is further help in attenuating noise.	-
Socio-Economics	Strain on the available infrastructure and resources in the region	Influx of people of plant employees as well as contractor's employees/ Laborers	There is no Rehabilitation and Resettlement issues for proposed expansion project. There is an existing township for accommodating employees.	-

5.0 ENVIRONMENTAL MONITORING PROGRAM

The environmental monitoring program is important in terms of evaluating the performance of pollution control equipments installed in the project As the proposed expansion project is situated within the existing BALCO complex and is surrounded by existing smelters and TPP, therefore existing monitoring locations of ambient air, water and noise will be applicable to the proposed aluminium smelter expansion and will cover all directions required. However, BALCO will discuss with CPCB/CECB regarding any additional monitoring locations if any and will comply with the suggestions.

The total project cost for the proposed project is about Rs. 6,387 Crores, which may further escalate depending upon the project execution period. Out of this, estimated capital investment of EMP budget is about Rs. 396.5 Crores will be spent on environmental protection and about Rs. 2.0 Crores will be spent for recurring cost.

6.0 RISK ASSESSMENT AND DISASTER MANAGEMENT PLAN

Risk assessment has been carried out to quantify the extent of damage and suggest recommendations for safety improvement for the proposed expansion project. Risk mitigation measures based on MCA analysis and engineering judgments are incorporated in order to improve overall system safety and mitigate the effects of major accidents.

An effective Disaster Management Plan (DMP) to mitigate the risks involved is in place for existing BALCO integrated complex. This plan defines the responsibilities and resources available to respond to the different types of emergencies envisaged. Training exercises will be held to ensure that all personnel are familiar with their responsibilities and that communication links are functioning effectively.

7.0 PROJECT BENEFITS

The beneficial impact of proposed expansion project on the civic amenities will be substantial after the commencement of project activities. The basic requirement of the community needs will be strengthened by extending healthcare, educational facilities to the community, building/strengthening of existing roads in the area. BALCO is already providing the above amenities and would further strengthen the activities either by providing or by improving the facilities in the area, which will help in uplifting the living standards of local communities.

BALCO believes that an effective growth policy must also take into account the fulfillment of basic needs of the masses, especially of those living in rural areas. BALCO participates in various CSR activities in the areas like infrastructure development, education, medical facilities, sanitation, community development and awareness programmes, vocational training in and around the project site.

CSR outreach of BALCO is spread across 117 villages in 3 districts of Chhattisgarh touching lives of more than 90,000 people. Providing free residential vocational training for more than 6320 youth skilled in 6 different trades and placed since inception, the first of its kind in Chhattisgarh. Providing sustainable livelihood to the tribal families and development rural infrastructure is also taken up as part of CSR activities.

8.0 CONCLUSIONS

BALCO believes that the proposed expansion project would add significant value to Indian economy. The project will not only help ensure our country by becoming self-sufficient in terms of aluminium, but will also drive macro-economic growth.

The proposed expansion project would have minimal impacts on the environment. However, with proper and judicious implementation of the mitigation and environment management measures, the impacts can be further minimized and can be maintained well within the permissible limits specified by the regulatory authorities.

Thus, it can be concluded that with the strict implementation of the pollution control and mitigation measures, with proper environment management system in place the proposed expansion project will be beneficial to the society and will contribute to the economic development of the state in particular and the country in general.