1.0 EXECUTIVE SUMMARY

1.1 Introduction

M/s. Vedanta Limited (formerly known as Sesa Sterlite Limited/Sesa Goa Limited) proposes for enhancement of hot metal production capacity from 2,92,000 TPA to 3,50,000 TPA by optimizing the existing BF-1 & BF-2 within the existing plant premises.

Out of the total hot metal of 3,50,000 TPA to be produced after the proposed enhancement, Vedanta proposes to convert 1,75,000 TPA of hot metal (50% of the production) into pig iron, 50,000 TPA of hot metal into iron & alloy powder and 1,25,000 TPA of hot metal into high purity pig iron at Amona village, Bicholim taluka, North Goa district, Goa.

As per Environmental Impact Assessment Notification dated 14th September, 2006 and 01.12.2009, the project falls under category 'A', Schedule-3(a) and requires Environmental Clearance (EC) to be obtained from Ministry of Environment, Forest and Climate Change (MoEF&CC) before the commencement of ground activity.

The EIA report has been prepared based on the Terms of Reference (TOR) conditions prescribed by MoEF&CC vide letter No. F.No. J-11011/211/2016-IA.II(I) dated 11.08.2016 and baseline environmental studies were conducted during 1st March 2016 to 31st May 2016 representing pre-monsoon season, 2016 and additional one month i.e June 2016 as per the ToR.

1.1.1 Existing Facilities Of Overall Pig Iron Plant Complex at Amona & Navelim

- Two blast furnaces BF#1, BF#2 having production capacity of 2,92,000 TPA operational since more than 20 years;
- BF#3 and sinter plant having capacity of 540000 TPA and 1 MTPA, respectively, operational since 2012 non recovery coke oven plant i.e. battery-I having production capacity of 3,22,000 TPA, operational since more than 20 years;
- Non recovery coke oven plant i.e. battery-II having production capacity of 3,00,000 TPA, operational since 2011;
- 33 MW of waste heat recovery power plant aligned to BF# 1 & BF# 2 and battery-I, operational since 2006;and
- 30 MW waste heat recovery power plant aligned to BF#3 and battery-II, operational since 2012.The existing production capacity of the project is given in **Table-1**.

TABLE-1
EXISTING PRODUCTION CAPACITY

Sr. No	Facility	Production Capacity	Remarks
1	Pig iron plant with 2 mini blast furnaces (Operational since last 20+years)	2,92,000 TPA	TOR obtained and EIA has been prepared for expansion to 3,50,000 TPA hot metal production

Sr. No	Facility	Production Capacity	Remarks
2	Non recovery coke oven plant (Operational since last 20+years)	3,22,000 TPA	-
3	Waste heat recovery power plant (Operational since 2006)	33 MW	-
4	Pig iron plant with mini blast furnace (Operational since 2012)	5,40,000 TPA	Recommendation from EAC obtained for extension of validity of EC F.No. J-11011/ 946 / 2007IA.II (I) for Phase II: 3,60,000 TPA hot metal, 10,00,000 TPA sinter, 3,00,000 TPA coke plant and 30 MW WHR power plant till June 2019
5	Sinter plant (Operational since 2012)	10,00,000 TPA	
6	Non recovery coke oven plant (Operational since 2011-12)	3,00,000 TPA	
7	Waste heat recovery power plant (Operational since 2012)	30 MW	

Source: Vedanta Ltd

1.1.2 Present Proposal

Vedanta Limited – Sesa Goa Iron Ore Division operates two mini blast furnaces (MBF's), BF#1, BF#2 having Consent to Operate capacity 2,92,000 TPA which are under operation at Amona village, Bicholim taluka, North Goa district, Goa. The production capacity enhancement from 2,92,000 TPA to 3,50,000 TPA will be done through process optimization and efficiency improvement. This production increase can be achieved through increased injection of wind volume, oxygen enriched blast, charging sinter feed up to 50%, better process control in operations etc. without any changes in blast furnace (BF) proper.

Along with above production enhancement, Vedanta proposes for product diversification of hot metal as detailed in **Table-2**.

TABLE-2
PROPOSED PRODUCTION DETAILS

Sr. No	Products	Existing Production in TPA	Proposed Production in TPA
A	Total pig iron/hot metal	2,92,000	3,50,000
a	High purity pig iron	-	1,25,000
b	Iron & alloy powder	-	50,000
c	Pig iron	2,92,000	Balance of 3,50,000 i.e. 1,75,000

Source: Vedanta Ltd

1.2 Environmental Setting

The environmental setting of the project are given in **Table-3**. The study area of the project is shown in **Figure-1**.

TABLE-3
DETAILS OF ENVIRONMENTAL SETTING

<table>
<tr><th>Sr. No</th><th>Particulars</th><th>Details</th></tr>
<tr><td>1</td><td>Location</td><td>Amona village, Bicholim taluka, North Goa district, Goa</td></tr>
<tr><td>2</td><td>Coordinates</td><td>Existing blast furnace unit:
<table><tr><th>Sr. No</th><th>Latitude</th><th>Longitude</th></tr><tr><td>A</td><td>15°31’37.4”N</td><td>73°59'11.7 ” E</td></tr></table>
Proposed high purity pig iron, iron & alloy powder unit:
<table><tr><th>Sr. No</th><th>Latitude</th><th>Longitude</th></tr><tr><td>A</td><td>15° 31’ 41.32” N</td><td>73° 59’ 08.89” E</td></tr><tr><td>B</td><td>15° 31’ 45.36” N</td><td>73° 59’ 08.37” E</td></tr><tr><td>C</td><td>15° 31’ 46.32” N</td><td>73° 59’ 20.39” E</td></tr><tr><td>D</td><td>15° 31’ 42.55” N</td><td>73° 59’ 19.50” E</td></tr></table></td></tr>
<tr><td>3</td><td>Toposheet no</td><td>48 E/14,E/15,& I/2, I/3</td></tr>
<tr><td>4</td><td>Elevation</td><td>44 m above MSL</td></tr>
<tr><td>5</td><td>Nearest village</td><td>Amona (0.5 km, NW)</td></tr>
<tr><td>6</td><td>Nearest town & district</td><td>Sankhali town (4.0 km, NNE)
North Mapusa district (19.1 km, WNW)</td></tr>
<tr><td>7</td><td>Nearest highway</td><td>NH-4A (4.7 km, WSW)</td></tr>
<tr><td>8</td><td>Nearest railway line</td><td>Carambolim (Karmali) Railway station (7.5 km, WSW)</td></tr>
<tr><td>9</td><td>Nearest airport</td><td>Dabolim Airport (20.3 km, SW)</td></tr>
<tr><td>10</td><td>Nearest seaport</td><td>Mormugao Port (21.7 km-SW)</td></tr>
<tr><td>11</td><td>Interstate boundary</td><td>Goa-Maharashtra (8.8 km, NNE)</td></tr>
<tr><td>12</td><td>Sensitive areas</td><td>Old Goa Church- Approx. (4.7 km, W)
Mhadei WLS boundary : 11.1 km (ESZ 9.9 km, ENE)
Bondla WLS : 13.4 km (ESZ 12.5 km, SE)
Dr.Salim Ali Bird Sanctuary : 12.8 km, (ESZ 12.7 km, W)</td></tr>
<tr><td>13</td><td>Reserve forest</td><td>Reserve Forest (5.9 km, ESE)
Reserve Forest(6.6 km, E)
Reserve Forest (R.F) near Salili (9.5 km, NE)</td></tr>
<tr><td>14</td><td>Water bodies</td><td>Mandovi river (0.5 km, SSW)
Kudne river (0.9 km, NNE)
Kumbharjua nadi(3.4 km,SW)
Karmali lake (6.6 km, SW)
Arabian sea (16.0 km, SW)</td></tr>
<tr><td>15</td><td>List of other industries</td><td>Desai cement plant (2.1 km, SE)
Amiantit fiber glass factory (2.7 km, SE)
Hegemon Ispat (3.0 km, SSE)
Sanquelim iron Ore Mine (3.9 km, NE)
Syngenta pesticide plant (Deccan Fine Chemicals) (5.4 km, SW)
Corlaim industrial area (5.8, SW)
Alcon cement plant (6.0 km, ESE)
Surla-Sonshi iron ore mine (6.0 km, E)
Kundaim Industrial estate (6.3 km, SSW)
Mareta Sodo iron ore mine (6.3 km, ENE)
Gaval Sonshi iron ore mine (6.7 km, E)
Nestle India Ltd (13.0 km, SE)</td></tr>
<tr><td>16</td><td>Seismicity</td><td>Seismic zone-III</td></tr>
</table>

**Note : All distances mentioned above are in ‘( )’ aerial distance from the plant boundary*

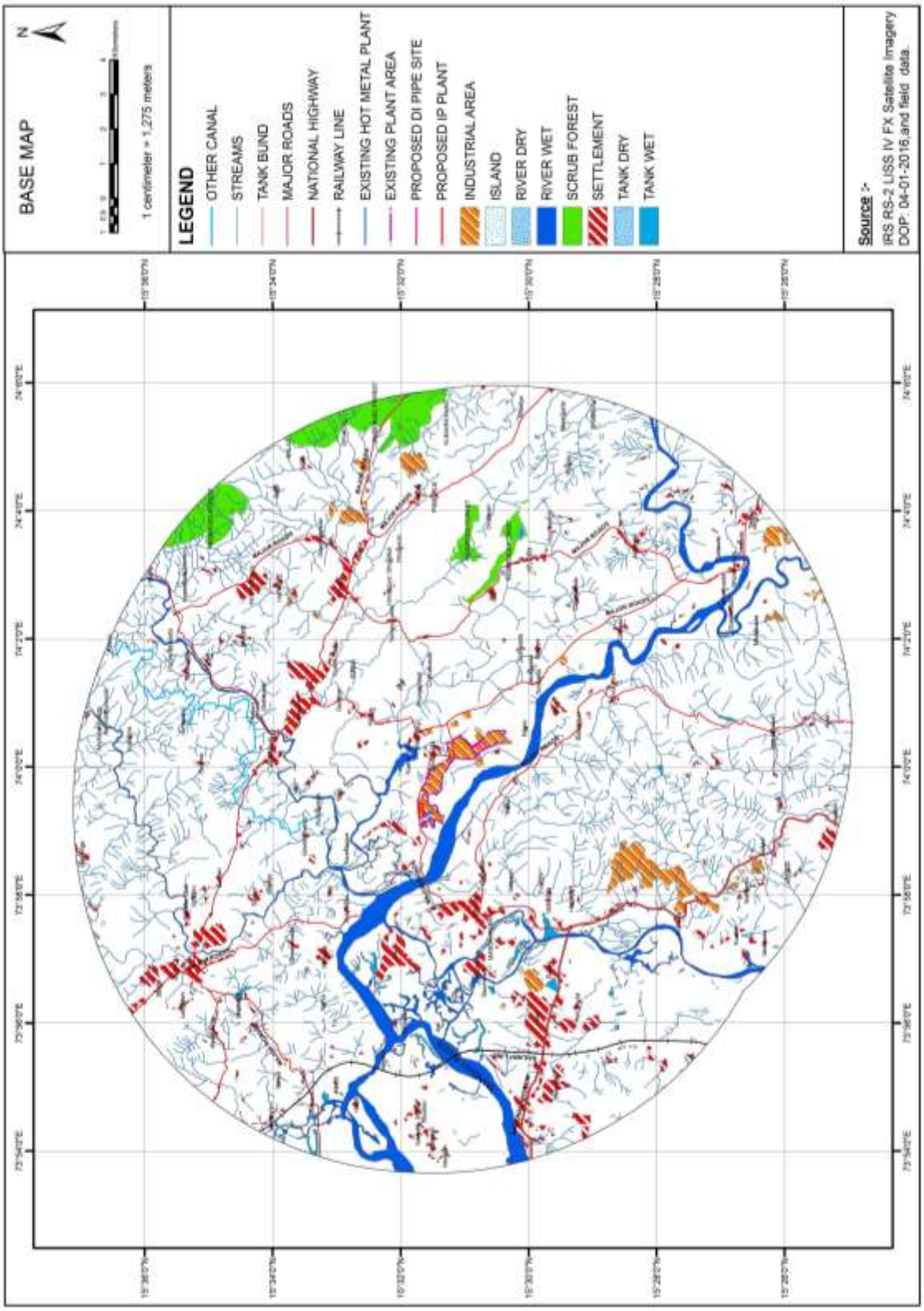

FIGURE-1
STUDY AREA MAP OF 10 KM RADIUS

1.3 Project Details

The salient features and raw materials required for the project are given below in **Table-4 and Table-5**.

TABLE-4
SALIENT FEATURES

Sr. No.	Particulars	Details
1	Products and its capacity	Hot metal production: Enhancement from 2,92,000 TPA to 3,50,000 TPA (Net increase by 58,000 TPA) High purity pig iron : 1,25,0000 TPA Iron & alloy powder: 50,000 TPA Pig iron : 1,75,000 TPA
2	Land requirement	The proposed hot metal enhancement will be achieved through process optimization and efficiency improvement in existing blast furnace proper. Manufacture of "Iron & alloy powder" and "High purity pig iron" is planned in an area of 4 ha (10 acres), within the existing plant premises at Amona.
3	Water requirement & its source	Make up water requirement :1200 m^3/day Source: Bandhara dam which is about 10 km away from the Plant/ rainwater harvested in the company's mine site.
4	Power requirement & its source	16 MW which will be met from captive waste heat recovery boiler based power plant of 63 MW
5	Waste generation	Incremental BF slag of 9920 TPA will be 100% granulated and sold to cement makers. Slag generated during refining will be either sold to cement manufacturers or used to make pavement. Hazardous waste will be disposed to authorized recyclers.
6	Manpower	Direct : 118 persons Indirect: 300 persons
7	Project Cost	Capital cost of hot metal production enhancement, high purity pig iron, iron & alloy powder plant is estimated at Rs. 265 Crores.

TABLE-5
RAW MATERIALS REQUIREMENT & SOURCE

Sr.No	Particulars	Quantity for 350 KTPA	Source
1	Sintered ore	2,87,000	In house
2	Iron ore	2,80,000	Captive mines
3	Coke	1,89,000	In house
4	PCI (Pulverised coal)	24,500	Imported
5	Limestone, dolomite & quartzite	30,100	Domestic as well as imported

1.3.1 Process Description

Vedanta has operational blast furnaces for producing hot metal. Production enhancement will be achieved in these existing blast furnaces through process optimization and efficiency improvement. High purity pig iron will be manufactured either by refining hot metal in BOF-LRF or through ladle metallurgy route.

For iron & alloy powder, after refining hot metal in BOF-LRF, refined metal will be atomised with water and further processed in dryer, grinder, classifier, annealing furnace and then packaged by adding additives.

1.4 Baseline Environmental Status

The baseline monitoring studies have been carried out for four months representing Pre-monsoon season (March to May 2016) and during June 2016. The details are as follows:

1.4.1 Land Use

As per satellite imagery for the study area of 10km radius, the built-up land is 9.8%, forest land occupies 2.7%, agricultural land is about 5.6 %, water body is 8.1 % and remaining land is either area available for cultivation or cultivable waste land.

1.4.2 Soil Characteristics

Pre-Monsoon Season (March-May 2016)

The pH of the soil in the study area ranged from 5.3 to 7.8. The electrical conductivity was observed to be in the range of 28.7 µmhos/cm to 183.3 µmhos/cm. The nitrogen values range between 109.9 to 548.1 kg/ha. The phosphorus values range between 40 to 59 kg/ha. The potassium values range between 65.8 – 317.5 kg/ha.

June 2016

The pH of the soil in the study area ranged from 6.3 to 7.5. The electrical conductivity was observed to be in the range of 32.3 µmhos/cm to 163.3 µmhos/cm. The nitrogen values range between 89.4 to 476.4 kg/ha. The phosphorus values range between 41.2 to 64.3 kg/ha. The potassium values range between 52.3 – 316.4 kg/ha.

1.4.3 Meteorology

Pre-monsoon Season

Temperature ranged from 24^0C to 39^0C and the relative humidity recorded in the range of 42% to 79%. Total rainfall observed was 61.5 mm during the study

period. Predominant winds are mostly from NW (29.1%) followed by W (25.2%) and WNW (10.7%) direction.

1.4.4 Ambient Air Quality

Pre-Monsoon season (March-May 2016)

Ten ambient air quality locations were monitored in and around project site. The minimum and maximum concentrations for PM_{10} were recorded as 50.0 $\mu g/m^3$ and 71.3 $\mu g/m^3$.The minimum and maximum concentrations for $PM_{2.5}$ were recorded as 21.1 $\mu g/m^3$ and 33.8 $\mu g/m^3$ respectively.

June 2016

The minimum and maximum values of PM_{10} and $PM_{2.5}$ were observed in the range of 48.1 $\mu g/m^3$ and 68.4 $\mu g/m^3$.The minimum and maximum concentrations for $PM_{2.5}$ were recorded as 20.0 $\mu g/m^3$ and 29.6 $\mu g/m^3$ respectively.

1.4.5 Water Quality

The baseline water quality status in the region is established by analysing samples collected from 16 locations consisting of eight ground water samples and eight surface water samples. The ground and surface water samples were analysed and found that ground water quality is well within the drinking water quality limits and surface water has been found to be suitable for drinking after the conventional treatment followed by disinfection.

1.4.6 Noise Levels

The noise monitoring has been conducted for determination of noise levels at ten locations in the study area. Noise monitoring results reveal ambient noise levels in all the locations are well within the limits as per CPCB ambient noise standards.

1.4.7 Flora and Fauna

There is no presence of Schedule-I mammals in the study area. However there are Schedule-II, III, IV and V species listed in the Indian Wildlife (Protection) Act, 1972.

Incidentally, there is no presence of endangered botanical flora reported in the study area, which is listed in the Schedule VI of the Indian Wildlife (Protection) Act, 1972.

Mangrove species are found in the creeks, along with halophyte species such as *Pandanus tectorius* –Kewda species.

1.4.8 Social Environment

The study area (10 km radius) area has a total population of 147353 persons according to 2011 census. The configuration of male and female indicates that the

males constitute to about 50.97% and females to 49.03% of the total population. The total literacy rate is 88.66 % in the region.

1.5 Anticipated Environmental Impacts and Mitigation Measures

The identification of impacts, appraisal of various impacts and its mitigation measures to control pollution are given below:

1.5.1 Topography

The existing hot metal plant and proposed iron powder plant site is located on a flat area. This will not cause any significant topographical changes in the area as the proposed hot metal production enhancement will be carried out in the existing unit.

Minimum leveling is required to be carried out during the construction of the proposed iron & alloy powder plant site. This will not cause any significant topographical changes in the area.

1.5.2 Air Environment

Particulate matter, NO_2 and SO_2 are the major pollutants emitted from the existing blast furnaces, proposed iron & alloy powder plant and refining of hot metal through BOF-LRF. Adequate measures will be taken to observe the prescribed standards by CPCB/GSPCB.

Air Pollution Control Measures

- *Existing Pig Iron Plant*

- The raw material handling section is provided with dry fog dust suppression system, water sprinklers and dust extraction system completely with bag filters;

- Blast furnace consists of gas cleaning plant (GCP) containing dust catcher, venturi-scrubber, moisture separator at MBFs to clean the blast furnace gas by removing dust in waste process; and

- The top gas coming out from the blast furnace is cleaned by taking the gas through BF gas cleaning device for separation of particulate before the clean gas is recovered for in-plant energy demand.

- *Reducing Air Pollution in Blast Furnace*

- Tough sinter and coke is being used which reduces the quantity of dust emitted; and

- Proper ventilation system is provided in the cast house and other raw material handling areas.

- *Proposed Basic Oxygen Furnace-Hot Metal Pre-Treatment*

- Particulate emissions abatement from hot metal pretreatment by means of effective air pollution control devices such as bag house.

- *Proposed Ladle Refining Furnace*

- Fumes and particulates generated during heating operations at the LF will exit the water-cooled ladle roof through the opening in the roof. These emissions will be captured (i.e. entrained) into a lateral draft type fume collection hood mounted on supporting structures above the ladle roof.

- *Proposed Annealing Furnace & Grinding*

  Use of de-dusting system at annealing furnace & grinding.

1.5.3 Water Environment

In blast furnaces, water is mainly used for non-contact cooling of various parts of the furnace and auxiliaries. Additional water is used for furnace moisture control, dust control and slag granulation.

Iron powder is manufactured from atomization process which requires water at the time of formation of tiny droplets of iron. Additional water requirement is required for annealing furnace for cooling purpose & to control dust suppression in grinding /crushing.

Entire water used for industrial purpose is recycled and reused. There is no discharge of effluents in the process. In order to conserve precious fresh water demand, the plant water system will be designed based on 100% recirculation system and thus effective discharge to outside the plant premises will be almost zero. Hence, there will be no impact on the external water regime due to the effluents from the plant.

1.5.4 Noise Environment

The areas where noise levels persists continuously for a significant period of time are blower area and tuyers which are earmarked as high noise zone areas. The following control measures are being adopted to keep the ambient noise levels well below the limits:

- Noise proof cabins to operators are provided where remote control for operating noise generating equipment is feasible;
- Equipments are designed to conform to noise levels prescribed by regulatory agencies; and
- High noise generating sources are insulated adequately by providing suitable enclosures.

1.5.5 Solid Waste/ Hazardous Waste Management

The details of waste generation and its management are given in **Table-6**.

TABLE-6
WASTE GENERATION & DISPOSAL

Sr. No.	Waste Product	Proposed (TPA)	Disposal Scheme
1	Blast furnace slag	9,920	Disposed to cement industries
2	BOF/LRF slag	10,000	Reused in process/utilised inside plant
3	Iron ore fines	10,000	Reused in sinter plant
4	Coke fines	8,000	
	Hazardous Waste		
5	Used oil	5,000	Authorization from GSPCB for selling to authorized agents

1.6 Hazard Identification and Risk Assessment

The comprehensive management plan for risk analysis and possible hazards is given in **Table-7**.

TABLE-7
COMPREHENSIVE MANAGEMENT PLAN FOR RISK ANALYSIS AND POSSIBLE HAZARDS

Sr. No.	Operation process Equipment /areas	Possible Hazards	Precautionary Measures	Measures to be taken in case of hazard
1	Blast furnace	Fire hazard caused by flames. Burns may be possible if directly coming in contact.	1. Emergency kit is kept ready nearer to the furnace. 2. Fire fighting equipments powder / foam type extinguishers on vehicles and mounted on walls are kept readily available. 3. Hydrant systems are provided at conspicuous places. 4. Water hoses are provided. 5. No smoking zone are declared. 6.Furnace operator's and workmen are trained to fight fire.	1. To switch off the system. 2. Fire extinguishers shall immediately be used. 3. Water hose will be operated to set out the fire. 4. Emergency alarm to be put on to signal the accident. 5. First aid shall be rushed to the site by the security staff. 6. Inform the safety manager / incharge present in the factory. 7. Immediate first aid should be given to the victims and sent to hospital for further treatment.
2	Charging of raw materials in furnace and moving parts other accessories	Cut/burnt /trapping and fire hazards may be possible	1. Workers have been provided with gloves & proper equipment to handle the material 2. Workers involved are trained in safe practices 3. Fire proof system has been made available and fire fighting equipments are provided like extinguisher and water hydrant with sufficient	1. If any worker is hurt /burnt in plant, immediate first aid should be given to the victim by trained person and refer to the doctor/ hospital for further treatment. 2. Inform the in-charge officer present in that shift.

Sr. No.	Operation process Equipment /areas	Possible Hazards	Precautionary Measures	Measures to be taken in case of hazard
			number of points easily available. 4. Only trained and qualified persons operate the furnace.	
3	Molten metal handling	Burn injury due to molten metal	1. Whole process is being done under supervision of qualified/trained person. 2. Only trained employees are allowed with proper heat proof dress/safety shoes/aprons/ screens. 3. Entry for other workers/ persons is strictly prohibited. 4. Restricted entry zones are declared.	First aid should be given to the victim and send to hospital for further treatment.

1.6.1 Occupational Health Measures

Occupational health of the workers is looked after by occupational health centre which is managed by factory medical officer and medical staff. Occupational health service activities being followed in the existing plant as follows:

- Pre-employment medical examination of employees. Employees recruited for employment undergoes necessary pre-employment medical examination for fitness for the job. In this way, right persons are selected for right job;
- Periodical medical examination of employees;
- Periodic medical examination of employees is being conducted regularly and necessary feedback is being provided to individuals. They undergo audiometry test, Radiograph of chest, Verna test, Pulmonary function test, E.C.G., blood & urine examination and clinical examination; and
- Eye check-up for the employees.

1.7 Post Project Monitoring plan

Monitoring schedule is very important in order to ensure that emissions and noise levels conform to the standard for which control measures have been designed. A comprehensive monitoring program is suggested in **Table-8**.

TABLE-8
MONITORING SCHEDULE FOR ENVIRONMENT PARAMETERS

Sr. No.	Particulars	Monitoring Frequency	Duration of Sampling	Important Monitoring Parameters
1	**Air Pollution and Meteorology**			
	Air Quality			
	a) Ambient Air Quality Monitoring			
	Existing six ambient air quality monitoring stations in and around plant as approved by GSPCB	Twice in a week	24 hr continuously	PM_{10}, $PM_{2.5}$,SO_2, NO_2 and other parameters as per CPCB norms

Sr. No.	Particulars		Monitoring Frequency	Duration of Sampling	Important Monitoring Parameters
	b)	Stack gas analysis in major stacks	As specified by GSPCB	One time	Specified as per State Pollution Control Board
	c)	Fugitive dust sampling at work zone as per CPCB or SPCB guidelines	Once in a year	24 hr continuously	Particulate matter
	Meteorology				
	a)	Meteorological data to be monitored	Daily	Continuous monitoring	Wind speed, direction, temperature, relative humidity and rainfall.
2	**Industrial Noise Levels**				
	a)	Major noise generating sources	Every month	24 hr continuous with 1 hr interval	Noise level in dB(A)
	Ambient Noise Levels				
	b)	6 Locations around Sesa's Iron & Coke making facilities	Monthly	24 hr continuous with one hr interval	Noise levels in dB(A)

1.8 CSR Activities

M/s Vedanta Ltd is committed to CSR activities through its group of companies. The existing CSR programs implemented has covered the following programs for the socio-economic development in surrounding villages near the project. The budget expenditure from 2011-17 spent so far towards CSR programs and activities are given in **Table-9.**

TABLE-9
CSR EXPENDITURE DETAILS

(In Lakhs)

CSR Activities	Years					
	2011-12	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**
Education	14.21	8.99	10.93	13.52	10.17	6.25
Health	14.06	19.15	32.66	29.22	16.68	20.10
Infra	55.60	14.05	28.29	61.52	43.09	39.87
Livelihood & Agriculture	39.55	24.15	16.05	24.59	25.03	18.45
Sport & Culture & others	2.27	2.05	2.07	0.62	0.55	0.80
Women Empowerment & others	2.39	0.74	0.53	0.00	0.00	0.00
Grand Total	128.09	69.12	90.54	129.48	95.53	85.47

1.9 Project Benefits

- Generation of employment and improved standard of living;
- Establishment of small and medium scale engineering ancillaries;
- Revenue to Government;
- Change in the socio-economic scenario of the area;
- Direct and in direct employment during construction and in operation phases;
- Employment for the unskilled and semiskilled workers during construction and operation phase of the proposed project will be from the nearby villages;

- Development of the basic amenities viz. roads, transportation, electricity, drinking water, proper sanitation, educational institutions, medical facilities, entertainment; and
- Overall the project will change living standards of the people and improve the socio-economic conditions of the area.

Thus, in view of considerable benefits from the project without any adverse environmental impact, the proposed project is most advantageous to the region as well as to the nation.

1.10 Conclusions

The proposed enhancement of hot metal production & converting hot metal into pig iron, iron & alloy powder and high purity pig iron project will have certain level of marginal impacts on the local environment, which will be mitigated by effective EMP. However, development of this project has certain beneficial impact/effects in terms of providing the employment opportunities that the same will create during the course of its construction as well as during operational phase of the project.

Thus, it can be concluded that with the judicious and proper implementation of the pollution control and mitigation measures, the project will be beneficial to the society and will help to reduce the demand – supply gap and will contribute to the economic development of the region in particular and country in general.