Executive Summary

Environmental Impact Assessment for 350 (2x135 + 1x30 + 1x50) MW Coal & Middling Based Thermal Power Plant at Village-Kolam Dist. Raigarh, Chhattisgarh

1.0 Introduction

The Government of India's 5th National Power Plan has envisaged a total installed capacity of 2.12,000 MW as per the 16th Electric Power Survey, based on power demand. This capacity is to be achieved by the end of the 11th Plan, March 2012. The government of India has projected a GDP growth rate of about 7.4% based on the 11th plan power capacity to be achieved. To achieve a target of higher than 10,000 MW per annum, huge investment in power sector is required and also the manufactures, contractors, vendors and supporting will need to increase their capacities to meet this target of power sector.

In view of the above backdrop M/s Sarda Energy & Minerals Ltd. (SEML) has decided to setup a coal & middling based Thermal Power Plant with a total capacity of 350 (2x135 + 1x30 + 1x50) MW in District Raigarh, Chhattisgarh. SEML has retained Anacon Laboratories Nagpur to under take on Environmental Impact Assessment study and preparation of Environment Management Plan for the proposed 350 MW Thermal Power Plant for Environment Clearance from State Level Environment Impact Assessment Authority.

1.1 Profile of Project Proponent

Sarda Energy & Minerals Ltd (Formely Chhattisgarh Electricity Company Limited) incorporated on 23rd January 1998 is a Public Limited Company. Power has been the prime mover of growth in the Company. The Company had installed 20 MW coal based thermal power plant, which commenced operations in the year 2001. The Company also installed four ferro alloys furnaces of 9 MVA each for captive consumption and maximum realisation for the power generated. Gradually the capacity of power plant has been increased to 61.5 MW and one more Ferro Alloys furnaces of same capacity have been added thereby increasing the capacity to 45 MVA, making us the second largest producer of manganese based Ferr Alloys in the country. The facilities are installed at Industrial

Growth Centre, Siltara, Raipur over an area of about 70 acres.

Chhattisgarh Electricity Company Ltd. has got merged with Raipur Alloys & Steel Limited as per the orders of Hon'ble High Court of Chhattisgarh, Bilaspur dated 11th May, 2007 & the name of Raipur Alloys& Steel Limited has also been Changed to "Sarda Energy & Minerals Limited"(SEML) as per Fresh Certification of Incorporation dated 2nd August 2007.

Liberalization of economy by the Government, throwing open for manufacturing of Iron and Steel including mining of iron ore, coal and other related minerals to private entrepreneurs, provided an avenue for further growth in this segment, to SEML. Company is a industrial house to set up a modern integrated steel plant at Siltara Industrial Estate, Raipur. The steel plant uses non-coking coal for sponge iron production of 79,200 TPA, further it has expanded to 4,60,000 TPA sponge iron production.

Initially for meeting its requirement for 79,200 TPA sponge iron, SEML obtained a mining lease for iron ore situated at Dongarbor in the Rajnandgaon District, to produce 2.0 lakhs TPA. After expansion of sponge iron plant and meeting it's requirement of iron ore, the company has increased production capacity of Dongarbore Iron Ore Mine from 2.0 lakhs TPA to 15.0 lakhs TPA for extraction of iron ore in the year 2007.

Company has been alloted a captive coal block at Karwahi near Tamnar,Dist:Raigarh, Chhattisgarh State , to produce 1.2 Million TPA Coal . Company is also in process for installation of 1.1 Million TPA Integrated Steel Plant along with 60 MW WHRB Power Plant at Phase-1, Siltara Industrial Growth ,Centre,Mandhar,Raipur

1.2 Description of the Project

The major plant facilities include Power House, Steam Generator, Cooling Tower, D.M. Plant and Coal Storage facility. Support infrastructure such as Administrative Buildings, Water Reservoir and Water Treatment Plant will be constructed.

Location

The site, admeasuring 81.0 ha of land, for the proposed power plant has been identified at village Kolam, District Raigarh, Chhattisgarh, which is located within 22° 10' N latitude & 83° 25' 30" E longitude. Vicinity map of project site is presented in **Figure 1. Figure 2** indicates the project site and other features within the radius of 10 km.

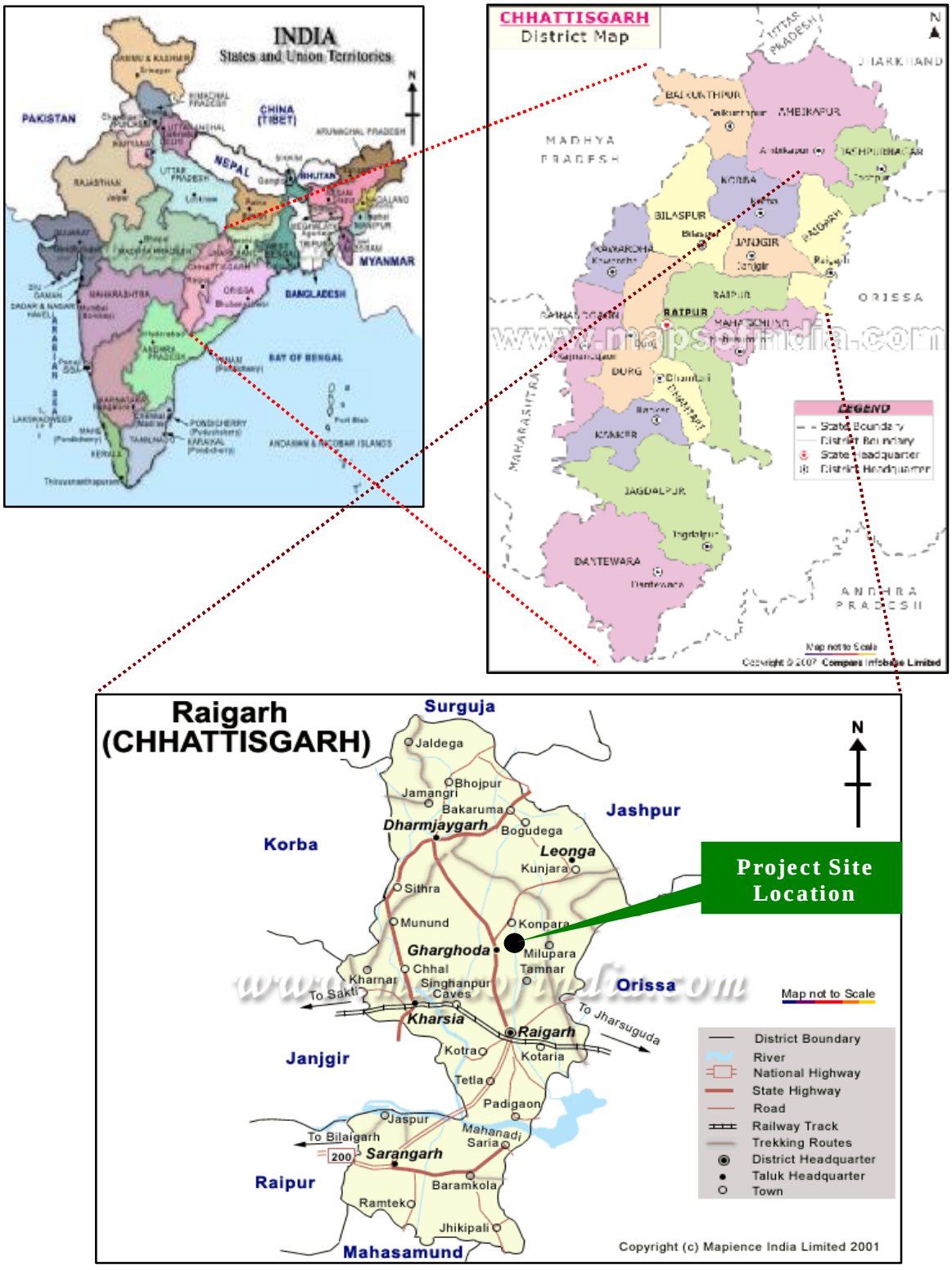


Figure 1
Vicinity Map

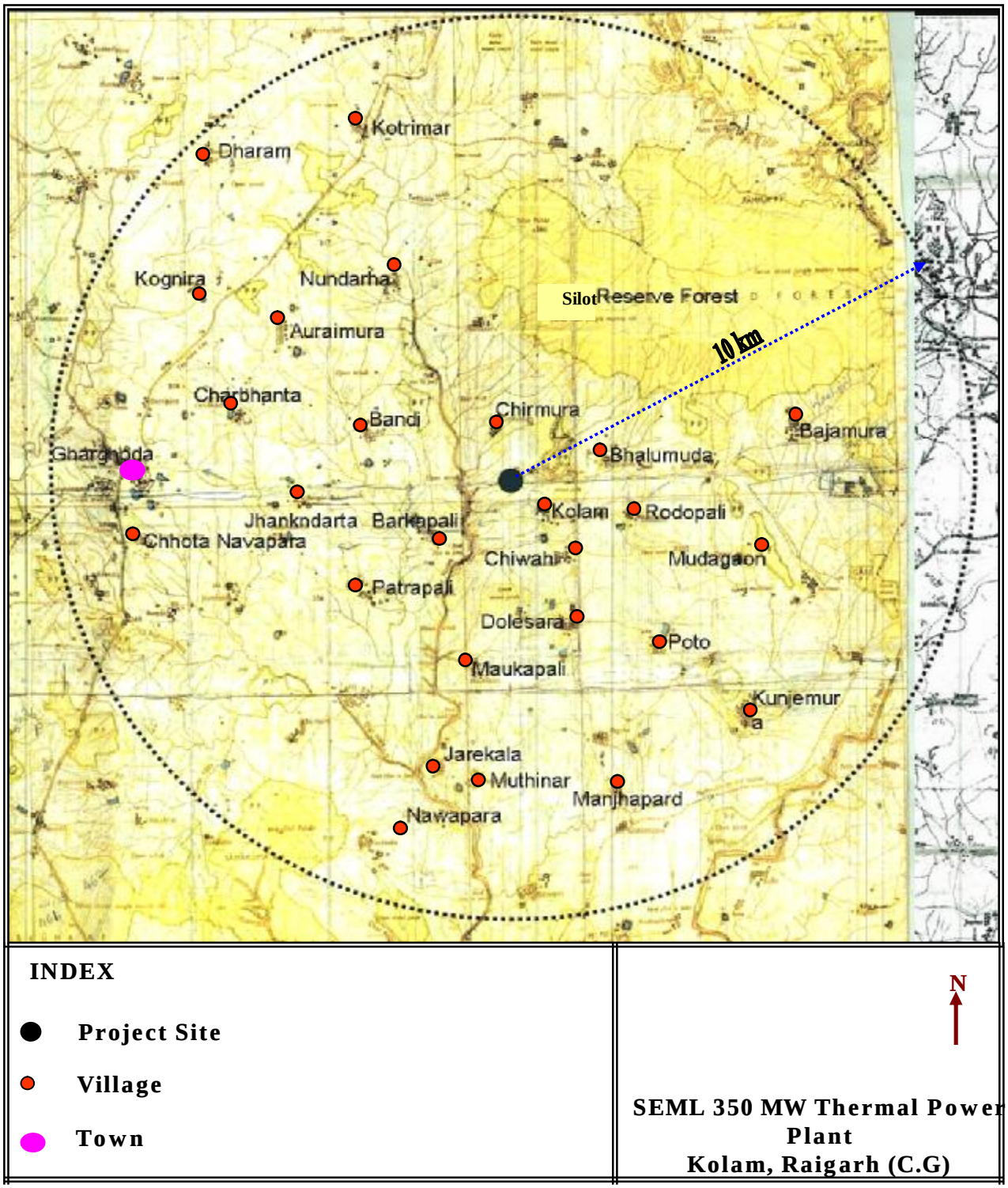


Figure 2
10 km Radius Map around the Project Site

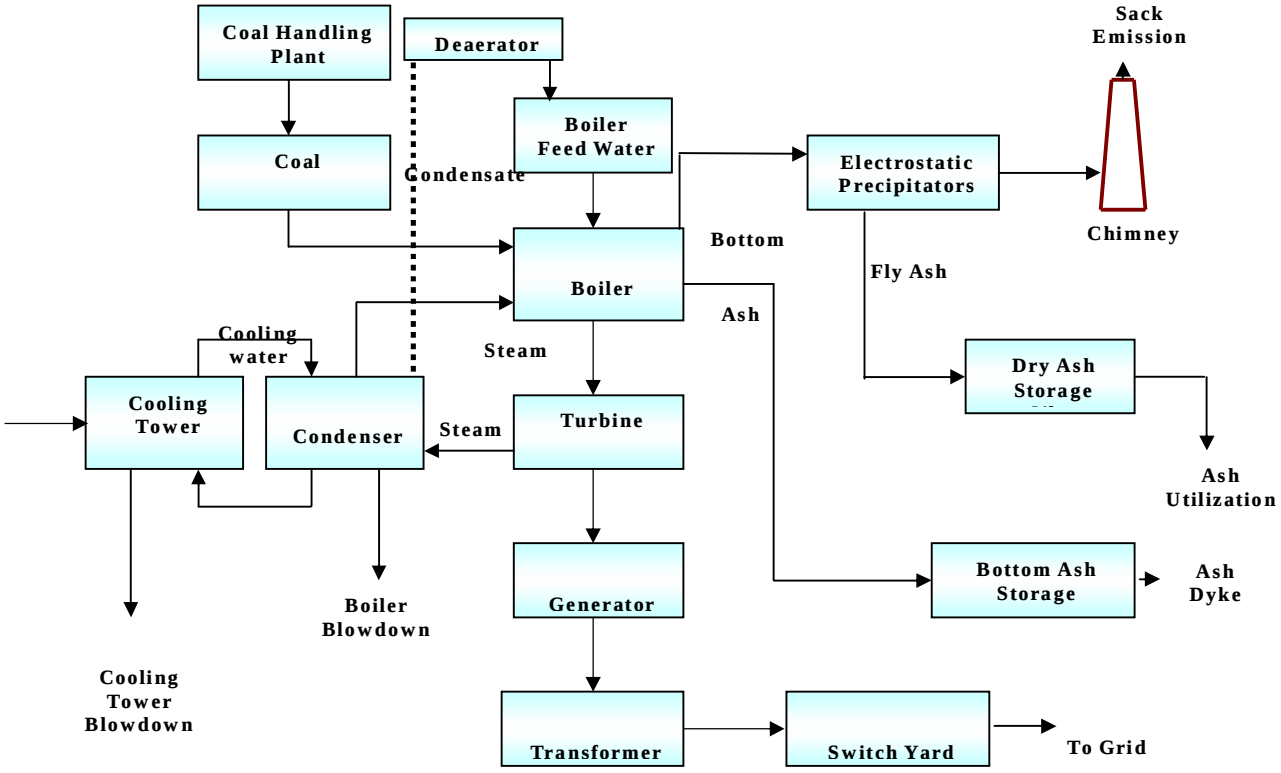
1.3 Basic Requirement for Proposed Project

Details are presented below:

Sr. No.	Particular	Details	Source
1	Land	81.0 ha	Un irrigated, single cropped private land
2	Water	1240 m^3/hr	Kelo River
3	Fuel	Coal: 21.552 lakhs TPA Middling: 3.648 lakhs TPA LDO: 4500 LPA	Coal: Captive Coal mine and E-auction Middling: Captive Coal Washery LDO: Local Oil Depot
4	Manpower	700 nos.	-
5	Project Cost	Rs.1400 Crores	-

1.4 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 which helps to rotates the turbine, which in turn is coupled to a generator. Electricity produced will be passed through a step-up transformer and power then it is evacuated via switch yard through a transmission system. Process flow diagram is presented below:



2.0 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 December 2008 to February 2009 in the study area covering 10 km around the proposed power plant 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. Departments.

2.1 Air Environment

Ambient air quality was monitored at 9 locations. Results indicate that concentrations of SPM, RPM, SO_2, NOx and CO are well within the prescribed standards.

SPM - 98 to 156 µg/m^3.

RPM - 31 to 50 µg/m^3.

SO_2 - 6 to 10 µg/m^3

NOx - 6 - 12 µg/m^3.

An automatic weather monitoring station was installed at the project site to record micro-meteorological data. Pre-dominant wind directions were observed NW, N and W.

2.2 Noise Environment

The noise levels in the study area are within the prescribed standards. Noise levels ranges from 47.7 dB (A) to 53.0 dB (A) during day time and 39.0 dB (A) to 43.9 dB (A) in the night time.

2.3 Water Environment

The total water requirement for the plant is about 1240 m^3/hr.

It has been 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 Hardness of the surface water were found in range of 6.8-7.8 , 95.29-162 mg/land 43.93 -82.0 mg/lit respectively, whereas the ground water showed pH 6.1-7.6, TDS 45.0 – 102 mg/lit.

2.4 Land Environment

The present project requires 81.0 ha for the proposed project. The break-up of the existing land use for the project is given below:

Breakup of Land Use

Sr. No.	Description	Area (ha)
1	Power House Building	15.0
2	Ash Dyke	22.0
3	Coal Storage Yards and truck Tripling System Yard	5.5
4	Raw Water Reservoir (10 days Storage)	6.5
5	Office, Parking, Canteen and Service Building	1.0
6	Internal Roads	4.0
7	Greenbelt	27.0
Total		**81.0**

Source: Detailed Project Report

2.5 Soil

The soil quality assessment was carried out at nine locations. The bulk density of the soil in the study area ranges between 1.31 to 1.49 g/cm^3, which indicate favourable physical condition for plant growth. The porosity and water holding capacity of the soils are in the range of 33.65 % to 39.54 % and 34.21 % to 37.64 % respectively. Variations in the pH of the soil is found to be neutral (6.35 to 7.45), thus conducive for growth of plant. Organic matter and Nitrogen are found in the range of 1.52 – 2.32 % and 270 – 486 kg/ha. This shows that soil is moderately good in organic and nutrient content.

3.0 Anticipated Environmental Impact & Mitigation Measures

The construction and operation of the proposed power plant comprises various activities each of which may have an impact on some or other environmental parameters. Various impacts during the construction and operation phase on the environment parameters have been studied to estimate the impact on the environment.

3.1 Construction Phase

- Ø Clearing of shrubs at some locations is required during construction phase. This will slightly change the present land use pattern.
- Ø The development of green belt in and around the project site is expected to mitigate the impact due to ground cover clearing during construction phase will have positive impact on the topography

Impact on Landuse

The total project area is of 81.0 hectare. It is proposed to develop adequate greenbelt to cover 27.0 ha of the plant area. Clearing of shrubs at some locations is

required during construction phase. The plantation will be in about 33% of the total project area, which will not only improve aesthetic aspects but will also compensate the vegetation loss, which may take place during the construction period.

- Ø After completion of the construction phase, the surplus earth shall be utilized to fill up the low lying areas.
- Ø The top soil from the excavated areas shall be preserved in separate stacks for re-use during the plantation;
- Ø Green belt development and related activities shall be taken up so that plantation will grow to adequate height by the time of commissioning of the plant
- Ø The dust generated will be fugitive in nature, which can be controlled by sprinkling of water. Sprinkling of water shall be done at frequent intervals by using truck-mounted sprinklers, along the roads and work zone areas to reduce the fugitive dust;
- Ø Construction equipment shall be maintained and serviced regularly such that the gaseous emissions from these equipment are maintained within the design specifications
- Ø The waste generated from the sanitary units of workers camps will be treated in packaged STP and treated wastewater will be used for plantation, hence, no impact on water bodies
- Ø Plantation will be done under green belt development plan to compensate the vegetation loss during construction. Greenbelt development will be as per CPCB guidelines.
- Ø The contractor shall be advised to provide fire wood/kerosene/LPG to the workers to prevent damage to trees
- Ø Local people will be offered employment during construction.

3.2 Operation Phase

Impact on Land Environment

- Ø The development of green belt in and around the project site is expected to mitigate the impact due to ground cover clearing for proposed project.
- Ø Adequate rainwater harvesting measures will be implemented to capture and

utilize the storm water inside plant premises.

Impact on Air Environment

The sources of air pollution in the process due to the proposed facilities have been identified and quantified. The contribution from the existing activities has been captured in the ambient air quality during baseline monitoring studies. Particulate matter, Sulphur dioxide (SO_2) and Oxides of Nitrogen (NOx) emissions will be the main pollutants in the proposed plant. The incremental ground level concentrations from the proposed facilities have been estimated by dispersion model.

The Industrial Source Complex (ISC) model was applied with the flat terrain option. The ground level impacts of individual pollutants i.e. SO_2, NOx and SPM from the proposed thermal power plant were predicted in terms of 24 hourly average concentrations. The prediction results in this study, corresponding to winter season. During the normal operating conditions, the pollutant incremental concentration will be much less than the worst case scenario projected.

The predicted resultant concentrations indicate that SPM, SO_2 and NO_x will be below prescribed standard for residential and rural areas.

Resultant GLC'S Of Pollutants

All values in **µg/m³**

Sr. No.	Parameters	Distance/ Direction	Baseline Conc.	Incremental Conc.	Resultant Conc.
1	SPM	2.0 km/SE	156	0.73	156.73
2	SO_2	2.0 km/SE	10	21.4	31.4
3	NOx	2.0 km/SE	12	12.0	24.0

Maximum Permissible Value SPM: 200µg/m³ (CBCB Standards)

SO_2: 80µg/m³ (CBCB Standards)

NO_x: 80µg/m³ (CBCB Standards)

Storm water from Plant drains during Monsoon

Storm water recharge pits will be provided in the plant. These pits retain the storm water during monsoon season. In addition, these ponds also serve as buffer storage for any spillages, overflows and washings from different sections of the plant. This volume will be adequate for the proposed facilities which will be connected through additional plant drains. The run-off collected in these ponds will be recycled to the extent possible. Discharge, if any during monsoon period will be after complying with the permissible standard.

Mitigation/Management Measures

- Ø The wastewater will be treated and reused for greenbelt development;
- Ø The plant shall be operated on the zero discharge concept and no wastewater will be discharged out side the plant

3.3 Impact of Solid Wastes

The main solid waste from the proposed Power Plant will be ash (Fly ash and Bottom ash). The bottom ash will be about 20% of the total ash generated i.e. 679 TPD and the fly ash will be about 2715 TPD. It is proposed to utilize 100% of the fly ash generated. During emergency the ash will be disposed off safely in ash pond area to avoid environmental hazards. All efforts, however, will be made to utilize fly ash for various purposes. e.g. brick preparation, soil stabilization, as a filler layer under road pavements. Unused fly ash will be disposed off in the ash pond. To control fugitive dust emission from the ash pond area water sprinkling would be done. After the ash pond is abandoned, its area will be reclaimed through tree plantation.

3.4 Impact on Noise levels

The main noise generating sources will be Compressors and Turbine. The noise levels at the source for these units will be in the range of 75 dB (A). The noise dispersion from the plant units has been computed based on the mathematical model. The predicted incremental noise levels at the boundary of the plant are in the range 34 to 41 dB (A).

- Ø Noise level can be reduced by stopping leakages from various steam lines, compressed air lines and other high pressure equipment
- Ø Providing noise proof cabins to operators where remote control for operating noise generating equipment is feasible.
- Ø The air compressor, process air blower, pneumatic valves should be provided with acoustic enclosure;
- Ø In all the design/installation precautions are taken as specified by the manufacturers with respect to noise control shall be strictly adhered to;
- Ø The noise control system will be designed to form an integral part of the plant;
- Ø Other than the regular maintenance of the various equipment, ear plugs/muffs are recommended for the personnel working close to the noise generating units;
- Ø Inlet and outlet mufflers shall be provided which are easy to design and construct.

3.5 Impact on Soil

The adverse impact due to the proposed 350 MW thermal power plant on land environment would be due to ash disposal. Since the ash is to be used for brick preparation, Soil stabilization and as a filler layer under road pavements.

Deposition of fly ash and coal dust on the vegetation and subsequent fall out on the soil during rainy days will be supportive to the plants as the trace metals present in ash will help for the growth of the plant. There will be some sort of control recycling of trace metal present in fly ash for the benefit of human and cattle population.

Impact on Ecology

The impact on terrestrial ecology may be felt due to emission of gaseous pollutants like SO_2 SPM and NOx. These pollutants at a very low dose act as fertilizer for the vegetation. However at higher doses, they can be injurious to both vegetation as well as animals.

3.6 Prediction of Impacts on Socio-Economics

The requirement of skilled/unskilled manpower will be met from nearby villages during construction phase in addition to some regular employment during operation. The project will also help in generation of significant indirect employment. This will be a positive socio-economic development for the region. There will be a general upliftment of standard of living in the region. Infrastructure like roads will developed by the proponent.

Impact on Socio-Economics

Impacts on Employment Generation

The requirement of skilled / unskilled persons will be met from nearby villages during construction phase in addition to some regular employment during the operational phase. 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.

Indirect Impacts

Impacts on Public Health and Safety

The discharge of waste materials (stack emission, wastewater and solid wastes), from process operations can have potential impact on public safety and health. The impact

due to the emission from the proposed power plant will be insignificant as the mitigation measures delineated in EMP are strictly followed. The public health and safety is dependent on the effective implementation of control measures suggested for pollution control.

Management of Public Interests

Based on the analysis of the socio-economic profile of the study area along with the prediction and evaluation of likely impacts arising out of the proposed activity, it has been possible to prepare a feasible environmental management plan. It is felt that this would help in minimizing the adverse impacts on the socio-economic environment to a considerable extent, while at the same time addressing to large extent the aspirations of the community. For the recruitment of semi-skilled and un-skilled workers particularly during construction, preference shall be given to the local people.

SEML is equally conscious for socio-economic development and are committed to raise quality of life and social well being of communities where it operates. Its CSR initiatives have been prioritized on local needs, which focus on Health, Education, Sustainable Livelihood, Social Mobilization, Infrastructure Development, Water Harvesting, Agriculture, and Environment Conservation.

Environmental Monitoring Programme

- The environmental monitoring is important to assess performance of pollution control equipment installed at the project site. The sampling and analysis of environmental attributes including monitoring locations will be as per the guidelines of the Central Pollution Control Board/State Pollution Control Board
- Environmental monitoring will be conducted on regular basis by SEML to assess the pollution level in and around the project area
- Adequate budgetary provision shall be made towards implementation of Environmental Management Plan

4.0 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 a

4.0 KL storage tank for LDO. In case of fire in the LDO tank, the modeling results indicate that radiation intensity of 37.5 kW/m^2 (i.e. 100% lethality) will occur within the radius 2.2 m of pool fire.

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.

Occupational Health and Safety

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

5.0 Project Benefits

The proposed 350 MW power plant will result in improvement of infrastructure as well as upliftment of social structure in the area. The people residing in the nearby areas will be benefited directly and indirectly. It is anticipated that the proposed power plant will provide benefits to the locals in two phases i.e. during construction phase as well as during operational stage of the plant.

5.1 Construction Phase

The major benefit due to the proposed project will be in the area of generating temporary employment.

5.2 Operational Phase

SEML will employ local people to the extent possible for avoiding creation of additional infrastructure. SEML will develop medical facilities for catering to the needs of the project personnel. These facilities will also be extended to the local community in due course.

SEML will initiate action for social upliftment in the area like female education and vocational training. Financial support will be extended to strengthen educational and infrastructure in the region.

The manpower requirements for the operational phase of the Power Plant will be about 700 people. In addition, there will be an indirect employment for skilled/ semi skilled people during project life.

All attempts will be made to employee suitable locally available skilled personnel from the study area. In case of non-availability of skilled persons, people will be taken from

out side the study area.

There will also be small increase in the vehicular traffic due to passenger transport. This increase in traffic will not have any consequence to warrant special mention. One should expect that the increased passenger load in the sector would prompt the state government to start new and frequent public transport services to this area, bringing upliftment to the whole locality.

Other Benefits

SEML is equally conscious for socio-economic development and are committed to raise the quality of life and social well being of communities where it operates. Its CSR initiatives have been prioritized on local needs, which focus on Health, Education, Sustainable Livelihood, Social Mobilization, Infrastructure Development, Water Harvesting, Agriculture and Environment Conservation.

6.0 Environmental Management Plan

M/s SEML will follow guidelines specified by CPCB under the Corporate Responsibility for Environmental Protection (CREP) for thermal power plant. 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:

- Site for construction workers camp shall be clearly demarcated to prevent occupational hazards. Ensure provision for necessary basic needs and infrastructure facilities such as water supply, sanitary facilities, temporary housing, domestic fuel etc.
- At the site of construction, where petroleum powered equipment is used and temporary storage of petroleum products (highly inflammable) is done, may cause fire hazard. Necessary care shall be taken as per the safety norms.
- Diesel operated construction machinery; vehicles etc. at project site shall be properly maintained to minimize exhaust emissions as well as noise.

- Though the effect of noise on the nearby inhabitants due to construction activity will be negligible, noise prone activities shall be restricted to the day time.
- Tree plantation shall be undertaken at the time of development of the project site, so that they grow to considerable height by the time of commissioning of the proposed project.
- As soon as construction is over, surplus of excavated soil shall be utilized to fill up low lying areas, rubbish needs to be cleared and all surfaces be reinstated.
- Falling of matured trees shall be avoided.

Operational Phase

During the normal operation phase of the proposed power plant, pollution impacts were predicted and found to be marginal on air, land and socio-economic components and insignificant on noise and water. The following mitigation measures are recommended for various environmental components.

Ash Evacuation System

The ash disposal system shall be adopted where the ash and bottom ash will be collected in silo. Suitable vendors will be identified for its commercial use.

The function of the ash Handling Plant is to remove coarse ash from all boiler economizer, air heater and dust extraction plant hoppers and transport it to the storage silo(s). This shall be carried out by either a combination vacuum-pressure pneumatic system or by direct pressure pneumatic system. The equipment shall be suitable to handle the ash burden from the specific fuel under all loading conditions.

Nearly 20% of the total ash is bottom ash. The function of the furnace bottom ash handling system is to extract the ash from bottom of the boiler on a continuous or intermittent basis, in order to reduce ash in size with the help of grinder and then it is transfer to common storage area outside the boiler house for pumping to the ash pond in slurry form.

The design of the furnace bottom ash extraction system shall conform with the relevant requirements of IS 8633: 1977 “Technical Requirements for Location of Boiler Installations and Boiler Houses” as well as any recognized International Standards.

Storage Silos

The silos shall be fitted with suitable equipment to load dry ash into bulkers so that the same may be transported to ash utilization plant as and when required. Ash storage silos capacity shall be sufficient to store the maximum dust produced for the maximum period.

The silos shall be of cylindrical RCC/steel plates fitted with access doors, pressure relief vents and remote level indicators; venting arrangement etc. The silos shall be designed for mass flow and the discharge shall ensure an even flow of dust to the dry loading or conditioning equipment. The silos shall be supported such that there is headroom below for Bulkers. There shall be an intermediate floor for housing the slurry forming devices; unloaders; dry dust loading spout equipment; fluidizing blowers and heaters etc.

The silo shall be of proven flat bottom type fitted with radical air sliders; hoods and related arrangements. Each silo shall be fitted with vent filters sized to meet emission standards. The fitters shall be cleaned automatically on load by pulse-jet system.

Action Plan for Ash Disposal Site

The conditions for the disposal of the ash from proposed Thermal Power Plant and action plan for full utilization for ash within a period of 9 years which will be phase out the dumping and disposal of ash on land in accordance with the MoEF notification dt: 14th September 1999.

Design volume of the ash disposal site

Total Ash Generation = 3394 T/day

$$\text{Volume of Waste} = \frac{\text{Total Quantity of Waste (T)}}{\text{Density of Waste (Tons/m}^3\text{)}}$$

$$= \frac{3394}{1.50} = 2262.6 \text{ m}^3\text{/day}$$

$$= 2262.6 \times 365 \text{ days} = 825849 \text{ m}^3\text{/year}$$

For 5 years = 825849 x 5 years = 4129245 m^3

Area required for 5 years for the depth of 18 meters

$$= \frac{4129245}{18} = 229402.5 \text{m}^2$$

Area required (Ha.) for storage of ash for 5 years is 22.9 ha.

Ash Utilization/Management

The fly ash can be used for the manufacture of cement. It can also be utilized in mass concrete construction. Ash can also be used for a number of other purposes such as:

- Brick preparation
- Soil stabilization
- As a filler layer under road pavements

The fly ash utilization and Management Plan are presented below:

Particular	1st Year	2nd Year	3rd Year	4th Year	5th Year
Total Ash	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**
Use in brick plant	0.01	0.01	0.01	0.02	0.02
Fly ash use in micro nutrition as fertilizers	0.01	0.01	0.01	0.01	0.01
Use in clay brick 50% total production	0.02	0.02	0.02	0.02	0.02
Road development in surrounding area	0.03	0.03	0.03	0.04	0.04
Use of Pozzolnic Material cement	0.4	0.55	0.65	0.75	0.81
Total fly ash consumption	**0.47**	**0.62**	**0.72**	**0.84**	**0.9**
% of use of flyash	**52.2**	**68.9**	**80**	**93.3**	**100**
Surplus Ash	**0.43**	**0.28**	**0.18**	**0.06**	**0**
Total Surplus ash before 100% utilization	**0.95**				

Note: Actual fly ash utilization may vary depending on demand. However, 100% utilization is planned from 5th year onwards.

SEML is in the process of discussions with various cement manufacturers in the vicinity of the proposed power station. The MOU shall be appended along with the final EIA/EMP report. The company shall also adhere to the comprehensive Guidelines for the use and disposal of flyash as per the Notification issued by MoEF in this respect.

Air Environment

Coal based thermal power plant will emit particulate matter, sulphur dioxide, oxides of nitrogen, carbon monoxide, heat, etc.

Air Emission Control Measures

Suspended Particulate Matter (SPM)

The concentration of dust (ash) in the flue gas at the outlet of stack would be about 50 milligram/Nm^3. The boiler would be provided with an electrostatic precipitator (ESP). Electrostatic precipitator (ESP) of efficiency > 99.5% so as to restrict the GLC

within the prescribed limit will be installed of the stack emissions, the CO content will be negligible and NO_X content would be minimal.

Sulphur Di-Oxide (SO_2)

SO_2 as per Central Pollution Control Board: < 80 µg/m^3 (annual average)

It is proposed to install Two RCC stacks of 110 meters and 180 meters height each enclosing two independent flues one for 1 X 30 + 1 X 50 MW and one for 2 X 135 MW (350 MW) This will ensure SO_2 dispersion within acceptable limits.

Nitrogen Oxides (NOx)

The GLC to meet ambient air quality : < 80 µg/gm^3 (annual average)
As per the Central Pollution Control Board : < 120 µg/m^3 (24 hrs basis)

Low NO_X burners shall be installed to meet above limits.

Noise Environment

- Manufacturers and suppliers of machine/equipment like compressors, turbines, 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) shall 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 shall be provided with ear-muffs/ear-plugs.
- Acoustic laggings and silencers shall be provided in equipment wherever necessary.
- The compressed air station shall be provided with suction side silencers. Ventilation fans shall generally be installed in enclosed premises.
- Supply ducts and grills on the ventilation and air conditioning system shall be suitably sized for minimum noise level.
- The silencers and mufflers of the individual machines shall be regularly checked.

Water Environment

Wastewater Management

Demineralization (DM) Plant effluent and boiler blow down shall be collected in a neutralizing pit where the acidic and alkaline effluents will neutralize each other. If required, lime dosing for final pH adjustment shall be followed. This shall be pumped and mixed with other effluents in the guard pond. The entire treated waste water shall be recycled and reused.

The necessary design parameters, material of construction for cooling system including cooling towers shall be selected in such way that they are able to utilize water from clarifier. Provision for oil/grease separators shall be made to skim oil / grease, if any in the waste water. Zero effluent discharge shall be practiced by recycling the waste water for dust suppression, plantation etc.

The following mitigation measures are recommended to minimize the impacts on water environment:

- The treated effluents from all streams shall be stored in a guard pond having 3 days retention capacity.
- The heat cycle makeup requirement for thermal power plant shall be met from dimineralized water.
- The sanitary waste water will be treated in packaged STP and treated water will be used for plantation.

Details of Rain Water Harvesting Scheme

Groundwater Recharge with Rain Water Harvesting

There will be generation of surface run-off from the proposed plant facility during monsoon season. The run-off will be of two types i.e. run-off from the pervious area of the facility site and run-off from the built-up area of the facility.

Run-off from the Built-up Areas

The run-off from the paved surfaces of the proposed facility will be routed through a carefully designed storm water drainage network and collected in storm water collection sump and excess rainwater will be discharged to bore wells constructed on these internal drains.

The run-off from the pervious area will be routed directly to the rainwater harvesting structures constructed at suitable locations as per the contours. For augmenting the ground water resources in the proposed plant, number of rainwater harvesting pits will be constructed and the internal drains where excess rain water flowing in drain will be diverted to these pits. These structures will facilitate percolation of water into the ground and thus augmenting the groundwater sources. The roof top water will be routed to the storm drains. This will result in increase in groundwater tables and to some extent the improvement of ground water quality.

The size and the locations of rainwater harvesting pits will be decided during detailed engineering of the project. Run off from the proposed project site (254 ha) is calculated using rational formula:

- Area (A) = 810000 m^2
- Rainfall Intensity (I) = 1.4 m (average)
- Run-off coefficient = 0.6
- Total yield of water from 81 ha. = 680400 m^3

The harvested water will be recharged in ground water through recharge pits.

Land Environment

Greenbelt Development Plan

The main objective of the green belt is to provide a buffer between the sources of pollution and the surrounding areas. The green belt helps to capture the fugitive emissions and attenuate the noise apart from improving the aesthetics quality of the region. A 20 -25 m wide greenbelt shall be developed along the periphery of the plant and in all open areas. Avenue plantation shall also be developed as per the standard norms.

Approximately 1500 trees per Ha will be planted in consultation with the local Forest Department.

The general guidelines for development of greenbelt are:

- Trees growing up to 5 m or more shall be planted along the plant premises and along the road sides
- Planting of trees shall be undertaken in rows.
- Open areas inside the plant boundary shall be covered with grass lawns.

- For adsorption of dust and gaseous pollutants the following types of plants have been considered,:

i. Fast growing

ii. Thick canopy cover

iii. Longer duration of foliage.

iv. Adequate height and spread of crown

v. Big leaves (long and board laminar surfaces) supported by firm petioles.

vi. Large number of stomata apertures. (Large leaf area index)

vii. Perennial and evergreen

viii. Abundance of surfaces on bark and foliage through roughness of bark, epidermal outgrowth on petioles, abundance of auxiliary hairs, hairs or scales on laminar surfaces and protected stomata (by wax, arches, rings, hairs, etc.)

The choice of plants includes shrubs that grow 1 to 2 m high and trees of 3 to 5m heights. It shall be ensured that the foliage area density in vertical is almost uniform by intermixing the trees and shrubs. Since safety during transport is a major consideration, shrubs in traffic islands and along road dividers shall be short enough to be below the eye-level of motorists.

Socio-economic Environment

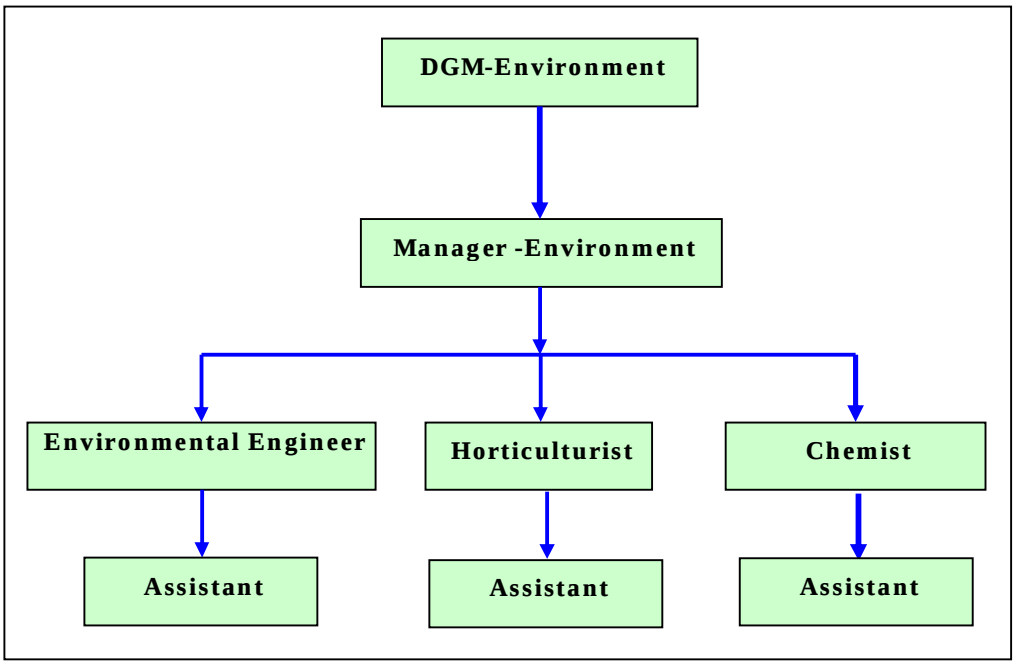
In order to take care of the likely impacts of the proposed project and to minimize the apprehensions of the local people an effective EMP has been prepared as under:

- Communication with the local community shall be institutionalized and done on a regular basis by project authority to provide an opportunity for discussion.
- Project authorities will undertake regular environmental awareness programs on environmental management measures being undertaken for improving their quality of life.
- To mitigate the strain on existing infrastructure, adequate provision of basic amenities viz. education, health, transport etc. shall be made considering the immigrating population and the work force in the area.
- Job opportunities are the most demanding factor, the local people having suitable skill shall be considered for employment.

- For social welfare activities to be undertaken by the project authorities, collaboration shall be sought with the local administration, gram panchayat, block development office etc. for better co-ordination.

Institutional Arrangements for Environment Protection & Conservation

Environmental management cell, will be established for the plants, which will be supervised and controlled by an independent plant Manager supported by a team of technically qualified personnel apart from other operating staff. Organization structure is as follows.



It will be the responsibility of this department to supervise the monitoring of environmental attributes viz. ambient air quality, water and effluent quality, noise level either departmentally or by appointing external agencies wherever necessary.

In case the monitored results of environmental pollution are found to exceed the allowable limits, the Environmental Management Cell will suggest remedial measures and get them implemented.

Budgetary Provision for Environmental Measures

An adequate budgetary provision of Rs. 112 Crores during construction and Rs. 10.0 Crores during operation has been made for implementation of Environmental Management Plan.

Corporate Social Responsibility

Being a corporate citizen the company has the responsibility of contributing to the welfare of the society in which it operates. The company will organise various awareness programmes for its employee and the general public of the area where it operates to ensure a better, sustainable way of life for the weaker sections of society.

Budgetary Provision for CSR Activity

Particular	**Capital Cost** (in Lakh)
Education	10
Health Care	5
Community Development	5
Total	**20**