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Impact of Coal Based Power Porject on Air Environment – A Case Study From Nellore District, Andhra Pradesh, India

KEYWORDS: Environmental impact assessment; decision-making process; sustainable development

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ABSTRACT *Environmental impact assessment is an important legislative and scientific tool that may assist and improve the quality assistance for the decision-making process in sustainable development. The flexible EIA techniques suitable for the infrastructure and resources of a specific country, taking into account institutional, technical and financial constraints. Improvements are required in public participation, awareness, as well as in environmental control and data system sectors, besides simply enacting legislation to achieve the goals of the EIA system. Thermal Power Plants found to affect Environmental segments of the surrounding region very badly. Environmental deterioration is attributed to emission of large amount of SOx, NOx, SPM & RSPM which disperses over 25 Kms radius and cause respiratory and related ailments to human beings and animal kingdom. It also affects photosynthesis process, balance of minerals & micro and major nutrients in the plants, soil strata, structures & buildings get affected due to corrosive reactions.*

1. INTRODUCTION

A massive expansion of the thermal power generation capacity of the country is on the anvil. The total installed electricity generation capacity in India as on 30 April 2015 was 174,361 Megawatts (MW). Of this, coal-based capacity was 94,653 MW, while gas-based capacity was 17,706 MW, taking 1 the total thermal capacity to 113,559 MW . Information collected from the central Ministry of Environment and Forests (MoEF) shows that huge additions of thermal power capacity are in the pipeline. With the Electricity Act 2003 delicensing thermal power generation, this sector is no longer within the scope of any systematic planning process. It is proposed to study the onging projects in the state of Andhra Pradesh to suggest various methods of EIA process and revision of existing methods of preparing the EIA process and revision of existing methods of preparing the EIA reports which is a mandatory document for any industry in this country as per EP Act. The projects located in Nellore District, Andhra Pradesh, India.

2. STUDY AREA

The study area includes 10 km radius around the project site near Thamminapatnam and Mommidi village,Chillakur Mandal, Nellore District, Andhrapradesh.The study area of 10 km radius is covered in survey of India toposheet no 66 b/3 and 66 B/4[1:50000 scale],The national highway [NH-5] connecting Nellore –Chennai is passing at aerial distance of 21 km from the project site in NW direction. The nearest airport is at Renigunta at a distance of 108 km from the project site. The baseline environment quality represents the background environmental scenario of various environmental components such as air, water, noise, land, and socio economic status of the study area. The sources of emission in the study area are the vehicular traffic, agriculture fields and unpaved roads.

Fig: 1 Location Map of the Study Area

3. OBJECTIVE

The overall objective of the study has been to incorporate environmental considerations into planning and prepare an Environmental Management Plan (EMP) for improving of the air environmental Quality. The specific objectives of the study are:

- To map the characteristics and environmental profile of study area and to identify the air environmental pollution in and around surrounding areas.
- Prepare an environmental management plan that includes rehabilitation and mitigation measures.
- To prepare an environmental monitoring schedule with respect to the proposed project.
- To recommend guidelines for environmentally compatible land use planning and to prepare the EIA report

4. MATERIALS AND METHODOLOGY

Methodology used in this paper refers to a simple set of methods to rationale this particular study for the analysis of the principles and procedures of inquiry in EIA. By defining research questions, the problem space was subdivided into sub spaces to make it simple. Personal communications at Nellore district played an important role to understand the system and problems lying within it. Data collection encompasses several phases, including: oral questionnaires, interviewers, stakeholder analysis and in the end processing the data. Unofficial interviews and discussion with different consultants and stakeholders like Environmental Protection Agency, Common Public and Consultants lead to achieve the pre-defined objectives. Review of different laws and documents produced and comparison in international context by review of international papers on EIA, Environmental Management Plan, SEA and Sustainable development was included in the study.

a) Requirement of Coal

The coal requirement of the plant operated of on 100% imported coal estimated to be about 2.07milion tonnes (@ 100%PLF) (TED, 1997). The blend coal requirement is estimated to be about 2.70 million tonnes (@100% PLF) with blending ratio of 70% imported coal & 30% Indian coal. Based on the established norm/guidelines of central Electricity Authority, the station Heat rate is considered as 2550 Kcal/Kwh and Imported coal having Gross calorific value of 5800 Kcal/kg, Indian coal having Grass Calorific Values of 2900 kcal/kg has been considered for working out the annual coal requirement for the power plan (Venkatasubramaniyam et. al., 2012).

b) Transportation Of Coal/ Belt Conveyor From North Port To South Port

SEPL has the following modes of coal transportation to the plant site

SEPL Wharf: coal will be unloaded at the designated wharf of SEPL and transported by means of conveyor or by road through the dedicated corridor up to the plant.

Krishnapatnam port company Ltd(KPCL) also has planned to transfer coal from the Northern berth to south side by means of a conveyor arrangement to their designated coal stack yard for further utilization by the proposed power plant in the south of the port including SEPL.

SEPL will implement a dedicated conveyor system from the KPCL coal stack yard to its coal handling plant located inside the power plant.

c) Industrial Source Complex Short term Dispersion model (ISCST3)

The pollutants released in to the atmosphere will disperse in the down wind direction and finally reach the ground at farther distance from the source. The concentration of ground level concentrations mainly depends upon the emission source and micrometeorology of the study area.

In order to estimate the ground level concentrations due to the emission from the proposed power plant, an EPA approved ISCST3; Industrial source complex short term dispersion model has been employed. ISCST3 provides option to model emission from a wide range of sources that are presents at a typical industrial source complex including terrain parameters (Smith and Egan, 1979). The model considers the source and receptors in undulated terrain as well as plain terrain and combination of both. The basis of the model is the straight line steady state Gaussian plume equation, with modifications to model simple point source emission from stacks, emission from stack that experience the effects of aerodynamics down wash due to nearby building, isolated vents, multiple vents, storage piles, conveyor belts etc.

5. RESULTS AND DISCUSSION

a) Impact on Environment and Control Measures

The proposed power plant will result in emission of particulate Matter, Sulphur dioxide and oxides of nitrogen due to burning of coal in the boilers.

The boiler will be based on Circulating Fluidised Bed Combustion Technology. Boilers are designed for the worst coal quality of 24 %ash and sulphur content of 3.15 %.

SEPL will initially commission 2135 MW plant under Phase-1. 2135 MW will be commissioned under phase-II making the total installed power generation capacity of the plant at 540 MW. However predictions are carried out for both phase –I and Phase-II to estimate the cumulative impact.

As the plant will use either 100% imported coal or blend coal having ratio of 70 % imported coal and 30% Indian coal, predictions are estimated for both the scenarios as shown below:

Table: 1 Showing and capacity phases

	OPERATION	CAPACITY
SCENARIO-A	100% imported coal	Phase-I and Phase-II
SCENARIO-B	100% blend coal(70% Imported coal and 30% Indian coal)	

b) Emission Details

The steam requirement of the 2135 MW of phase-I and 2135 MW of phase –II will be form four boilers each of 460 tph capacity, Fuel consumption of both phase-I and phase –II is estimated to be based on the station heat rate of 2550 kcal/kwh

Table: 2 Showing imported coal and blend coal

PHASES	100%IMPORTED COAL	BLEND COAL
Phase-I 2135 MW	2846.5	3703.2 (1993.92-imported coal, 1709.28-Indian coal)
Phase-II 2135 MW	2846.5	3703.2 (1993.92-imported coal,1709.28-Indian coal)
Phase-I & II 540MW(total)	5693	7406.4(Imported coal -3987.84 Indian coal-3418.56

Major pollutants emits from coal burning are particulate matter, SO_2 and NO_x.

Details of coal quality considered for the worst case scenario are given bellow:

Table: 3 showing imported coal and blend coal parameters

Parameter	IMPORTED COAL	BLEND COAL
Calorific values (Kcal/kg)	5800	4461
Sulphur content (%)	3.15	1.87
Ash content (%)	7.0	24

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Burning of imported coal /Blend coal in the proposed power plant will result in ash generation. Of the total ash generated, about 15% is bottom ash and 85% fly ash.

The following table shows the ash generation from the power plant for both imported coal and blend coal.

Table: 4 Showing power plant operation and ash generation

	POWER PLANT IN OPERATION	ASH GENERATION T/DAY	
Scenario-A	100%imported coal	399	Fly ash-340
			Bottom ash-59
Scenario-B	100% blend coal(70%imported and 30% Indian coal	1630	Fly ash-1386
			Bottom ash-244

Bottom ash resulting from combustion of coal in the boiler will be cooled in ash coolers and conveyed to surge hopper. From surge hopper, ash will be conveyed to bottom ash silo by pressure pneumatic system.

Fly ash resulting from the combustion gets collected several sets of hoppers located in the flue gas path viz economizer, air pre heater, electrostatic precipitator and stack hopper. Ash removal from different fly ash hopper and transportation of fly ash to storage silos will be by dense phase, pressure pneumatic system. On top of the fly ash silo, a bag filter vent unit will be mounted to filter exhaust air before leaving the same to atmosphere. ESP will be designed in such a way that the dust concentration level at outlet is maintained at 100mg/Nm^3 with all fields in operation (CES, 2009).

Overall Baseline Ambient Air Quality
Result of the ambient air quality at the above location s were found to be well within the limit of national Ambient Air Quality (NAAQ) standard specified for Residential and rural area. Concentrations of SPM, RPM, SO_2 and NOx are mainly contributed due to vehicular traffic and local activities. The 98th percentile value of SPM, RPM, SO_2 and NOx in all the locations at the study area during summer season, 2015.

Sulphur dioxide
Sulphur dioxide emission from the boilers is due to burning of coal containing sulphur content of about 3.15% in imported coal and 1.87% in blend coal.

Oxide of Nitrogen
The Oxides of Nitrogen emission from the power plant is estimated to be about 300-400 mg/Nm3. However to estimate the worst case scenario of the proposed units, emission concentrate of oxide of Nitrogen has been computed with a value of about 400mg/Nm3 in the exhaust gas (State of Environment, 2005).

Respirable Particulate Matter-RPM
RPM values monitored at all locations showed 98th percentile values in the range of 44-62 µg/m$^{3.}$ Highest value of 62 µg/m^3 was recorded at Muthukuru village. However, this value is well within the limits of NAAQ (Fulekar, 2013).

g) Sulphur dioxide- SO_2
98th percentile value of sulphur dioxide in the study are from the monitored data was in the range of 9.8- 16.2 µg/m^3. Maximum value of sulphur dioxide of 16.2 µg/m^3 obtained near the sampling station located at Ipuru village. The value of SO_2 monitored in the study area are well within the of NAAQ standards (NAAQS, 2006).

h) Oxides of Nitrogen- NO_x
Ambient air quality status monitored for nitrogen oxide in the study area was in the range with 98th percentile values between 12.1-17.1 µg/m^3. A maximum value of 17.1 µg/m^3 was prevailing at the time of sampling at Krishnapatnam village sampling station.

i) Carbon Monoxide-CO
CO concentration at all the locations was found to be less than 1 ppm.CO concentration at all the locations was found to be less than 1 ppm. Percentile values of ambient air quality in core Zone are presented. The values of SPM, RPM, SO2, NO_x and CO monitored at all locations are well within the limit of AAQ standards (EPA, 1978).

j) Maximum Cumulative Ground Level Concentration
Ground level concentrations of SPM SO2 and NOx were estimated using the mean meteorological data to project the incremental increase of concentrations above base line concentrations due to emission from the power plant. The following table shows the summary of the same.

Table: 5 Showing SPM, SO2, N-Scenario

	Suspended particulate Metter	Sulphur dioxide	Oxide of Nitrogen
SCENARIO –A	3.80	27.45	15.72
SCENARIO -B	4.51	20.65	18.06

k) Impact on Villages
Predicted maximum cumulative ground level concentration obtained for 24-hours mean meteorological data of summer season are superimposed on the baseline concentrations recorded at various villages to project the overall post scenario.

Environmental Monitoring Program
Environmental parameters viz. air, water, noise, will be monitored regularly in order to evaluate any changes from the baseline status and take appropriate mid course correction. Monitoring program will be followed till the mining operations ceases; every year as per the schedule below:

Air Quality Monitoring: One location in core zone and two locations in the buffer zone will be monitored for once per season except monsoon.

Noise Levels Monitoring: Noise levels in the working area will be monitored once in every month till the continuation of operations. Ambient noise levels will also be monitored once in a season in the buffer zone to evaluate the noise levels in surrounding community.

Water Quality Monitoring: Water environment will be assessed periodically for both surface water and ground water. Surface water quality will be monitored at identified rivers during all four seasons. Ground water level and quality on seasonal basis will be assessed in the open / dug wells to evaluate the impacts of ongoing operations. Water levels will also be monitored on seasonal basis in surrounding wells.

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5.2 Ecological monitoring:

Half yearly monitoring of afforestation program will be done for the survival rate and plant growth within the core zone. Plantation, before the onset of monsoon season, will be done progressively till the final closure of the mine.

The monitoring system will also include:

- Continued analysis of mine site drainage water at regular intervals to monitor suspended solid content in particular and other parameters in general.
- Efficacy of check dams, gully plugs, retaining walls and settling tank and to improve the silt arresting arrangement.
- Compliance management with all environmental legislations
- Implementation of various environmental management programs and reporting the performance to the top management.
- Co-ordinating the environment related activities within the project as well as with outside agencies
- Green belt development, etc.

6. CONCLUSIONS

The project development and consequent economic development should lead to improvement through better living and greater social awareness. As thermal power project cannot be stopped unless we want to revert back to medieval ages, solution lies in advanced planning and environmental management and protection as a part and parcel of the system. As the proposed operation is small scale, the adverse impacts on the environment will be very little. The above EIA and EMP is proposed to make this mining operation less damaging to the surrounding environment. The less is committed to implement the above project in a time bound manner.

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