CHAPTER 2

METHODOLOGY
The study involves understanding of geological, geo-environmental, geomorphological, geochemical and hydrological components, in relation to the impact due to mining activity, as well as involves study of land use and socio-economic and related issues along with most important aspect -environmental impact assessment (EIA) and preparing an environment management plan, based on the data and observation on the EIA notification 1994 **Appendix 1**.

2.1 **GEOLOGICAL STUDIES**

Geological studies were carried out to collect the background information, which will form foundation of the EIA. It involves regional geological mapping, with an emphasis on stratigraphic sections, delineation of regional and local structures and relating them with tectonics of the region. All the aspects studied are prepared thematically and compiled to form base map. Regional maps were prepared at the scale of 1:250,000, while local mine maps were prepared at the scale of 1:50,000. These maps were also compared with already published regional (Biswas & Deshpande, 1970) and lease area maps prepared by GMDC.

Systematic Lithostratigraphic sections were prepared, and samples were plotted against them. These samples were later studied for Petrological and Sedimentological analysis. Samples collected were categorized in three major types, (1) Rock samples, (2) in situ soil samples (3) overburden samples. The unconsolidated sediments samples were later sedimentologically analyzed.

The soil, chemical analysis for leaching from overburden dumps samples involving major and minor elements were carried out using appropriate analytical techniques and instruments.

2.2 **GEOMORPHOLOGICAL STUDIES**

Geomorphologic were carried to understand the evolution of the recent terrain features. Conventional and remote sensing data products were used for extracting the details on the geomorphology of the region. The hydro-geological condition of mining area and its periphery were also investigated. The drainage was also studied from the
Point of view contamination of acid mine drainage from the mine area. (Pencholi, et Communicated).

2.3 LAND USE AND SOCIO-ECONOMIC STUDIES

Land use change in the last ten years were studied. This is also specifically useful because as mining progresses, new lease area would be assigned and this will again change the land use of the surrounding area. Land use pattern was also studied to understand the evolution, critical effect and changing pattern of socio-economic status of the mine affected areas. The process of mined out area reclamation and restoration was also evaluated. Primary & secondary data related to these aspects were collected and analyzed for stated objectives.

2.4 BASELINE ENVIRONMENTAL STUDIES

Any open cast mining activity affects the quality of surrounding environment at and around the mine site during its operation. The nature and magnitude of impact on different components of the environment, viz., air, water, land, noise, biological and socio-economy, would vary depending on the nature and size of the mining project. The baseline studies on air quality include identification of specific air pollution parameters expected to have significant impacts and assessing their existing levels in ambient air within the impact zone. The impact zone covers an area of 10 km radius (buffer zone) from all exterior boundaries of mining lease area (core zone) which itself is big in magnitude. The study area surrounding the lignite mining project at Panandhro is shown in (Fig. 2.1.)

As the mining project commenced in the mid seventies at that the environmental impact and mining related assessment were not a mandatory practice, so the base line data, which normally is a pre project commencement studies is not possible in the present study.
In order to understand impact of progressive mining in the data needed for the EIA, EMP etc. is collected for the year 1995 onwards up to 2005; which in the study is referred as interim base line data.

The baseline studies as well as predictions were carried out for winter season (from November 2004 to January 2005). The EIA was carried out at the mine site and its surroundings covering 10 km aerial radius from external boundaries of the mine. All the significant environmental components particularly air and water was studied.

2.5 Environmental impact assessment

Based on the impact study, distinction is made between primary and secondary impacts (Abbasi et al. 2003). In terms of temporal categorization, short and long term impacts can be visualized and in terms of nature of adversities, one could classify the impact as reversible and irreversible type. For example, reclamation of land by filling back dump material is reversible type whereas damage to subsurface strata and soils is irreversible type.

The EIA studies can be broadly divided into three distinct phases for each of the environmental components as given below:

- Identification of significant environmental impacts and assessment of baseline status within the impact zone prior to the commencement of the project or at some designated shape during the project.
- Prediction of impact on various identified significant environmental parameters due to due to the mining operations and Kachchh Lignite Thermal Power Plant (KLTP) the data for analytical techniques. Data on the nature of the activity, quantity and quality of overburden generated, number of vehicles operating within the mine, details of area and line sources, characteristics of the lignite mined out and existing site conditions of the impact zone form the inputs for prediction models, and finally,
- Evaluation of final impact after superimposing the observed impact over the baseline status.
2.5.1 Data generation & collection

The study has been done for the core zone and buffer zone. The monitoring and testing has been done as per the guidelines of MoEF and the IS standards. Appendix 4 Monitoring has been conducted for the following parameters.

2.5.2 Methodology for interim baseline background study

The following data, through field survey and compilation from different sources, has been collected by author,

i Details of fauna and flora.

ii Eco-sensitive places, sanctuaries, biosphere reserves within 10 km radius.

iii Major industries within 10 km radius.

iv Land use pattern within core zone and buffer zone (10 Km radius around the core zone) based on Census and satellite image and cropping pattern.

v Demography and Socio-economic based on last available Census data for entire study area.

vi Relevant meteorological data, for previous decades from India Meteorological Department (IMD)

vii Geo-hydrological aspects based on available data from various secondary sources.

2.5.3 Technique specific details

- Ambient Air Quality Monitoring (AAQM) has been done as per guidelines of MoEF and CPCB. Noise monitoring has been done as per CPCB standard and results were compared ambient air quality standard in respect of noise, water sampling has been done as per availability of ground/surface/sea water sources in the study area & results were evaluated on comparison as follows:

- Drinking water specification as per IS 10500 –1991

- General standards for discharge of effluents,

- General standards for discharge of Environmental Pollutants Part A: Effluents Schedule VI.

- Soil sampling has been done as per Indian standards

- Classification of flora and fauna has been done as per Schedules of Wild Life Protection Act, 1972
2.5.3.1 Respirable particulate matter

The sampling of ambient air was performed with respirable Dust Sampler (Make: Envirotech Instruments, New Delhi), which is primarily a High Volume Sampler fitted with a cyclone separator for pre-separation of particles larger than 10 microns diameter. Air exiting from the separator is drawn at a measured rate through the separator followed by a pre-weighed glass fibre sheet of 20 cm x 25 cm sizes (Whatman, EPM-2000). 0.3 LPM pressure maintained in the manometer to suck the air. The RPM concentrations are determined gravimetrically from the average airflow rate, sampling period and the mass of particulate matter collected over the GF filter surface.

2.5.3.2 Suspended particulate matter

Sampling for SPM was also performed with the sampler used for RPM sampling. The coarser particles (NRPM) collected in the cyclone separator are transferred quantitatively on a Petri dish and evaluated gravimetrically. The sum of masses of coarser (NRPM) and respirable particles (RPM) gives the mass of SPM collected during sampling. The SPM concentrations are computed from the total mass of SPM and total volume of air sampled.

2.5.3.3 Sulphur dioxide

The sampling of ambient air for evaluating SO$_2$ concentrations was performed with a Multi-gas Sampler, using the vacuum created by the respirable Dust Sampler for drawing the air samples through the impingers. Air is drawn at a measured and controlled rate of 400 to 500 ml/min through a solution of sodium Tetra-Chloro-Mercurate. After completion of the sampling, the used absorbing reagent is treated with dilute solutions of sulfuric acid, formaldehyde and para-rosaniline hydrochloride. The absorbance of the intensely coloured para-rosaniline methyl sulphonic acid is measured and the amount of SO$_2$ in the sample is computed from graphs prepared with standard solutions. The ambient SO$_2$ concentrations were computed from the amount of SO$_2$ collected and the volume of air sampled.

2.5.3.4 Oxides of nitrogen

The sampling of ambient air for evaluating NO$_x$ concentrations was performed with a Multigas Sampler, using the vacuum created by the Respirable Dust Sampler for drawing the air samples through the impingers. Air is drawn at a measured and controlled
rate of about 200 ml/minute through an orifice-tipped impinger containing solutions of sodium hydroxide and sodium arsenite. After completion of the sampling, an aliquot of the used absorbing solution was treated with solutions of $H_2O_2$, sulphanilamide and NEDA. The nitrite ion present in the impinger was calculated from the absorbance of the resulting solution and from the graphs prepared with standard solutions. The ambient NO$_x$ concentrations were computed from the total nitrite ion present in the impingers, overall efficiency of the impinger and the procedure, and the volume of air sampled. A summary of the methodology is given in Table 2.1.

Table 2.1. Summary of the methodology

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Testing Procedure</th>
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<tbody>
<tr>
<td>NO$_x$</td>
<td>Absorption in dil. NaOH &amp; NaAsO$_2$, treated with sulphanilamide and N(I-Nepthyl) Ethylene diamine Dihydrochloride and Hydrogen Peroxide and then estimated colorimetrically (CPCB recommended method).</td>
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<tr>
<td>RPM</td>
<td>Respirable particulate matter sampler</td>
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The National Ambient Air Quality Standards as per Environment (Protection) Rules, 1996 are presented in Appendix 4.

The chapter highlights the broad strategy and scheme adapted to general and synthesizes data for the stated objectives.