CHAPTER 1
INTRODUCTION

1.1 Introduction

Mining industry is the backbone of industrial development, as it provides raw material to core sector industries, hence in a way it boosts the industrial growth. The entire process of natural mineral wealth exploitation cannot be done without disturbing the fragile equilibrium among interacting and interdependent natural spheres; broadly understood as lithosphere, pedosphere, hydrosphere, biosphere and anthroposphere. The perturbations may be of local to regional nature in the spatial context and of varying orders temporally. In the early history of mining; man just bothered to exploit the mineral resources, altogether neglecting the impacts of his actions. Mining has directly and alarmingly influenced environmental, social, cultural and socio-economic interests globally, of-late man has begun to learn and take measures to minimize the adversities created by mining activities. Present work is an attempt to understand the geo-environmental aspects of Rajpardi lignite mine project, run by Gujarat Mineral Development Corporation, Ltd, Ahmedabad. The project was initiated in the year 1983 (Bhatt, 2002) and is likely to last till 2020 for a planned annual production rate of 10, 00,000 tons. The mining at Rajpardi spanning approximately over a period of 40 years would have certainly induced changes in the landscape, soils, hydrogeology and socio-economic fabric of the region. To evaluate, the impacts of mining around this small mining town, different aspects leading to the understanding of environmental impacts, management and conservation have been undertaken in the study.

1.2 Geoenvironmental characteristics

The study area comprises of Trappean rocks, bordering the Tertiary sedimentary sequences in the eastern and south-eastern periphery. Quaternary sediments in the area occur as a narrow strip along river Narmada. These Tertiary sequences have been deposited in the tectonically controlled basins formed due to late Eocene tectonics, upper

Trappean flow surface acted as the basement and same Trappean rocks surrounding these basins served as source for the Tertiary sediments. The mining project is located within these Tertiary rocks to the east of Jhagadia town (Merh, 1995).

For any region, the geo-environmental aspects and interrelations of various parameters involved therein (Figure 1.1), are helpful in understanding the impacts of different processes – natural and anthropogenic, in order to propose management solutions to deal with the negative impacts.

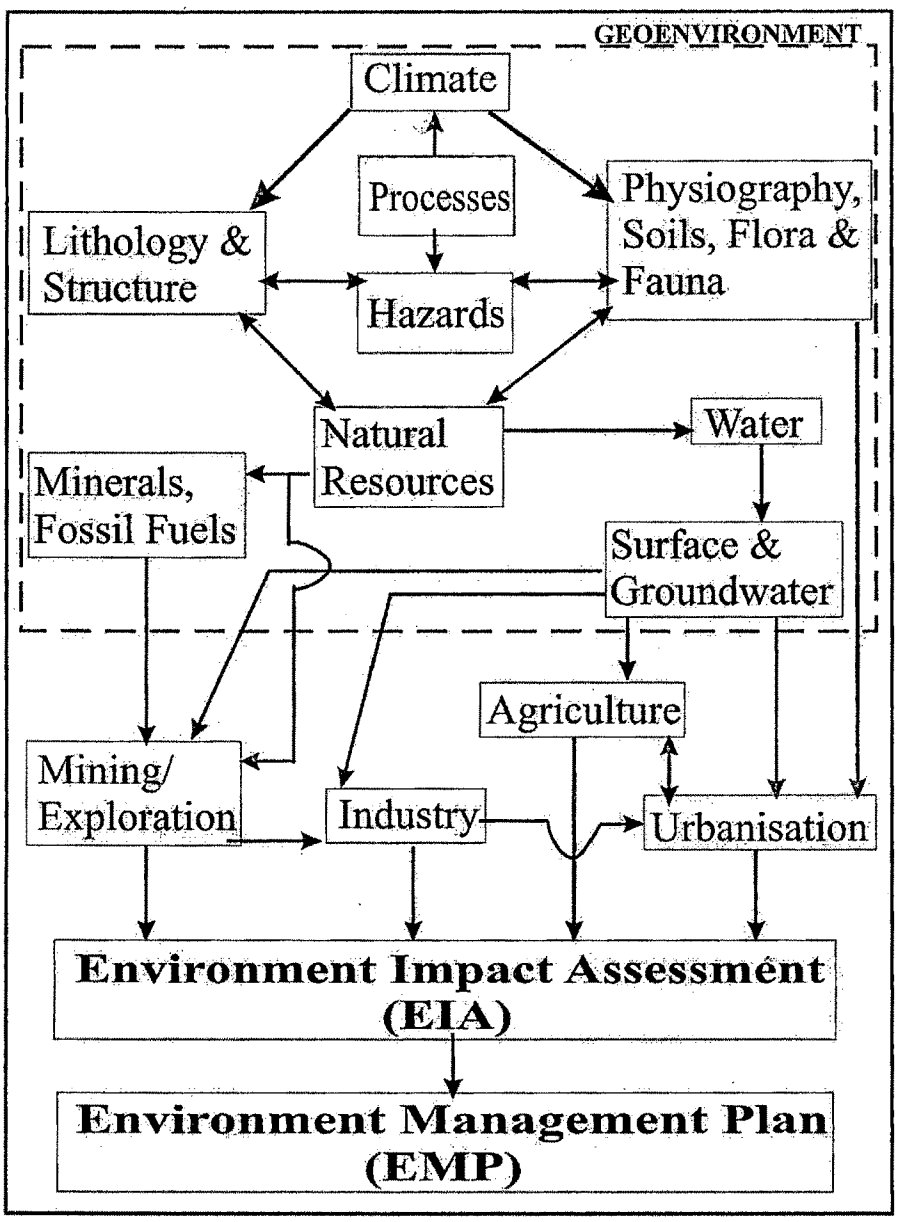

Figure 1.1: Geo-environment algorithm

The geo-environmental sub-domains, e.g., lithology, structure and physiography, etc. are influenced by the natural and anthropogenic activities which result into desirable and undesirable changes. Mining being an anthropogenic activity also contributes to the perturbations in these sub-domains, e.g., social, water, air and soils, etc. For the understanding of the environmental issues involved in mining industry one needs to divide entire mining activity into different thematic attributes as proposed by the Ministry of Forests and Environment (Table – 1.1).

Table 1.1: Attributes of mining

Sr. No.	Physical Environment	Biological Environment	Socio-economic Environment	Cultural Environment
1	Air	Flora	Population	Caste System & distinction
2	Water	Fauna	Literacy & education	Pattern of religion
3	Hydrology	Land Use	Employment & Engagement	History & tradition of area
4	Hydrogeology	Rare & Endangered species	Migration	Archeological sites
5	Meteorology	Extinct species	Income structure & Expenditure pattern	Cultural functions/ customs, festival & traditions, etc.
6	Noise & ground vibration	Ecologically fragile areas	Services	
7	Generated waste		Transport & communication	
8	Land		Rehabilitation	
9	Topography & Physiography		Health & nutrition	
10	Soil characteristics & profile		Recreation	
11	Climate		Social problem like addiction	

Study area is under subtropical climate regime and has good water resources. Existing land use is predominantly forestry and agriculture; owing to the occurrences of lignite, mining has emerged as the main industry in the area, serving variety of industries along the industrial belt between Bharuch and Vapi. Soils are fertile, topography is gently undulating, good rainfall, moderate winters and hot summers are the climatic attributes of this region.

Biological environment is characterized by the occurrences of varied flora and fauna under the protected forest areas. The forest land is likely to get affected as mining lease extends into the protected forest area, though as of now the mining is in the agricultural land areas.

Population in the region is showing steady growth due to migratory skilled and labor force. Local population has got modest employment in the project, which has in turn contributed to their economic growth. Due to the extension of mining block through the village Amod, the entire village has been relocated with mutually agreed compensations for the resettled population. The population is dominated by scheduled castes and tribes.

1.3 Need for EIA

Mining activity would inevitably influence many of the parameters listed in Table 1.1, as a result it is imperative to first understand and quantify the impact levels in the physical, biological, socio-economic and cultural attributes of a mining area (Anon., 2006). This in turn would help the planner to evolve techniques to mitigate and minimize the adverse impacts both on short as well as long term basis.

1.3.1 Classification of the study area for the purpose of EIA

One could choose the mining area as a point in the region and based on various parameters related to EIA; the area is divided into core and buffer zones. There are no definite dimensions prescribed for such a distinction, perhaps best guide is the size of mining site itself. The core zone is essentially the active mining area and buffer zone is defined by a radial distance from 5 to 10 km beyond the demarcated boundary of the core zone. Generally not much impact is expected to be visible in the buffer zone, however, on long term, one cannot rule out the impact of mining in the buffer zone. Taking into account the nature of industry, mining would result into aerial expansion in course of time, so the core and buffer zones are never predetermined features instead they expand with the growth of the project and time.

1.4 Geoenvironmental features of the study area

The study area is situated in the Narmada – Tapi rift zone; river Narmada flows from east to west, north of Rajpardi similar east to west flow direction is maintained by Tapi river. The western part of the area is characterized by the WCF and Cambay rift basin, whereas, the eastern margin has a conspicuous hilly Trappean terrain. There is a high probability of seismicity in the region owing to the NSGF; however, the frequency of such events has been rather low. There are two seismic events of magnitudes 5.0 and above recorded from the region (Anon., 2000).

The climate of the region is moderately humid and average rainfall is 838 mm. Good monsoons, abundance of surface and groundwater has helped agricultural growth in the region. The forest cover is also significantly high and covers more than 70% of the area. The area comprises of Tertiary rocks and the depositional environment, based on various studies is considered as shallow marine and deltaic type, tectonically controlled sedimentation has preserved vegetal matter giving rise to the lignite deposits (Gadekar, 1976, 1980a, b). The Tertiary sequence representing the transgressive and regressive phases on account of the basement tectonics as well as climate induced sea level changes, has got lignite, silica sand and fire clays associated with the Tarkeshwar Formation (Narayan Rao, 1939).

It appears that the lignite mining in the region has affected the region as far as landscape changes are concerned, owing to the geological setup of the area significant impacts on the other natural domains like water and soils, etc., are not observed. The ecosystem of the area appears to be less fragile character. The Ministry of Environment, Forest & Wild Life, GoI, 1989, has proposed classification for different Eco-systems based on the degree of fragility, Rajpardi area falls in the category no. VII, i.e., area with active geological faults and vulnerable to seismic hazard.

1.5 Geographic limits

The leased mining block covers Bhuri, Amod and Maljipur villages. The area lies within latitudes 21^{O} 40'to 21^{O} 45' and longitudes 73^{O} 10'to 73^{O} 15'; in the Survey of India

topographic map numbers; 46 G/1, 46 G/2, 46 G/5 and 46 G/6 on 1:50,000 scale (Figure 1.2).

1.5.1 Physiography and drainage

The area forms a gently rising ground on eastern margin of the Gulf of Cambay, the ground elevation varies between 20 to 60 meters above mean sea level. The higher elevations are observed in the north – eastern part of the project. The hills of the Jhagadia – Rajpardi area rise up to a height of 117 m, Sarasia hill is the highest landmark (161 m) of the area. The important rivers of the area are Hakran, Madhumati, Ratanpur and Kaveri flowing from southeast to northwest ultimately discharging into river Narmada (Figure 6.1).

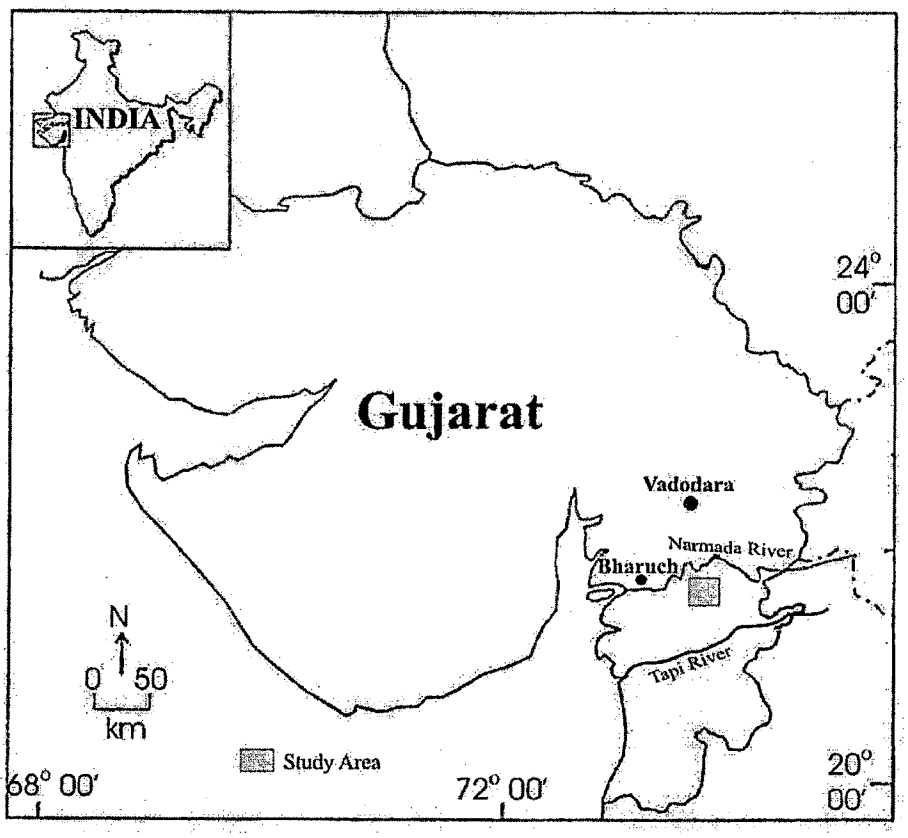

Figure 1.2: Location Map of the study area

The drainage is controlled by the ground slope, which in turn is controlled by the attitudes of the underlying Tertiary rocks. There is a strong structural control on the

drainage system of the region. River Narmada has drifted northward (Agarwal, 1984), suggesting strong tectonic and structural control on the drainage of the region.

At local level, Rajpardi lignite mine site displays, flat topography, the average ground elevation is 55 to 60 meters. Near the reserve forest area, in the vicinity of the mine there is distinct rugged topography. The north eastern side of the mining project is characterized by abruptly standing Hingoria and Sarasia hills. The southern part has low relief and is covered with variety of soils.

1.6 Communication

The area is well connected by the network of roads. Good transportation is available to reach Rajpardi. Important highway is National highway No. 8A, Delhi-Mumbai railway line passes through Bharuch and Ankleshwar towns.

1.7 Flora and fauna

The hilly terrain, south of Jhagadia and Rajpardi fall within the Ratanpur reserved forest area, the western most part of the Satpura hills. The Narmada River forms the northern boundary of this forest area. The moisture content in the soils of the area is low, supporting only the sparsely growing shrubs and trees. The Ratanpur forest comprises of species of teak, sisum, khair, dhawada banyan, pipal, neem and tamarind trees apart from shrubs and variety of grasses (Annexure 1).

The hilly area of Ratanpur reserved forest and grasslands in the low lying areas have a variety of wild fauna. Panther, fox, black face monkey, cobra, leopard, deer, barking deer and sambar are reported from the area. The most common poisonous snakes reported from the area are cobra, krait, etc. (Annexure 1).

1.8 Crops

Agriculture is the main occupation in the area providing means of livelihood to 71% of the total population. The soils in the central and northern region comprises of the

transported sediments of the Tertiary and Trappean rocks. The Kharif season is from middle of June to middle of October and the main crops grown are paddy, bajri, jowar, kodra, maize, gram, math etc. The crop selection based on the soil types in the region are given below;

- Black soils: Highly retentive of moisture and crops grown are jowar (both rabi and kharif), wheat, paddy, fuvar, gram, peas and cotton.
- Bhatha soils: Rich alluvial silt deposited by rivers, found along the bank of the river Narmada, crops grown are jowar, tobacco and vegetable.
- Kyari soils: Richest soil growing paddy, wheat and gram.

1.9 History

Jhagadia is a small town of historical and archaeological importance. Bawaghor was an Ethiopian merchant who started the mining and trading of semi-precious agate stones in the sixteenth century from the Babaguru hills near Ratanpur village (Agarwal, 1984), the local people visit the Bawaghor tomb located on the hills named after him. The agate deposits in the area have supported the famous agate industry of Cambay for the last several centuries.

1.10 Population

The population of the study area is 21619 as per the 1991 census. About 45% of this population is schedule caste and tribes. The religions followed by the people are Hinduism, Islamic, Christianity and Jainism. The tribal people follow their own religion and social customs.

1.11 Objective and scope of work

Lignite deposits of Rajpardi area are associated with lower Tertiary sediments. Lignite is extensively used in power generation and as a fuel for small scale industries in the nearby Ankleshwar – Bharuch industrial belt.

The mining activity in general, coal and lignite mining in particular influences the environment in and around the mining sites. The impacts include land degradation, in turn affecting the agriculture and the health of the nearby population due to increased dust, noise pollution and toxicity in the soils and water resources of the area.

The estimated mineable lignite reserve at Rajpardi is about 41.50 millions tones, of which 10.5 million tones has been mined out. The quality of lignite has been rated better compared to the Neyveli (Tamil Nadu) as well as Palana (Rajasthan) lignite deposits. The mining method adopted is open cast type since the lignite bands are not very deep from the surface.

The main objectives of the study are as under:

(i) To estimate the extent of land degradation due to mining activity.
(ii) To understand the hydro geological conditions of the area.
(iii) To study the soils and water resources for physical and chemical investigations.
(iv) To propose measures to minimize the degradation of the land, water, flora and fauna resources due to mining.

Broad aspects identified as per the cited objectives are:

(i) Review of the literature related to the various aspects of the geology of the area. A detailed study of structural and geomorphic set up of the area with a view to understand the morphotectonic evolution of the area, as well as evaluation of the land degradation.
(ii) Synthesis of data on hydrogeological conditions and the water studies to understand the dynamics of water system and to assess the quality of ground water in the proximity of the mining block.
(iii) The data so collected both in the field as well as in the laboratory would be analyzed to understand the causes and suggest remedial measures for land and water resources degradation due to mining activity.