CHAPTER 2
METHODOLOGY

The study deals with three major aspects; first one comprising of geological, geo-morphological and hydro-geological studies, second one looks into the land use and socio-economic details while the third one is devoted to the environmental impact assessment as well as the management aspect. The scheme of study adopted is elaborated in the following sections.

2.1 Geological studies

Geological studies include various aspects of geology such as, stratigraphy, structural and tectonics, etc., for the understanding of the local geology as well as the applied aspects related to mining.

The studies were planned at different scales in order to link broad geological attributes from regional scale and subsequently narrowing to appropriate scales for the study area. Preliminary investigations were made at the scales 1:250,000 to 1:50,000 and detailed geological studies for Rajpardi mining area were done using large scale base maps, available from different sources. Regional studies primarily involved compilation of already available published literature, as enormous time is needed and does not form the scope of the present study.

The petrological studies of the samples collected during different field investigation were carried out in order to understand petrographic, sedimentological and geotechnical aspects. The surface soils and mine waste dump were studied for geotechnical and leachate analysis for the heavy metal dispersion and stability of the dumps. The published geological maps of the project and nearby areas served as the base maps and were subsequently improved by incorporating the field observations. The applied aspects of these details have been dealt for the purpose of EIA.

2.2 Geomorphological studies

The surface of any terrain results due to combination of external and internal natural processes (Wolman and Gerson, 1978). The final outcome is a surface which can be categorized into different landforms superimposed by drainage. Geomorphological studies are very important in the environmental impact assessments, as the immediate impact of any anthropogenic activity is on the landscape and other dynamic systems operating on or below the surface. Conventional geomorphic and drainage studies have been undertaken which is one of the important aspects in the present work.

2.3 Hydrogeological investigation

The hydrogeological dynamics is sensitive to the changes induced in the landscape or any other activity that influences the surface and ground water regime. In the present study, the hydro-geological condition of the area under mining and the surroundings is extensively studied. The influence of mining on the water resource in the area is evaluated and measures to minimize the quality deterioration are proposed. The added problem of acid mine water due to oxidation of sulfur species occurring in the lignite seams is also taken up from the point of view of environmental degradation in the region. Response of surface drainage to the mining activity is given special attention.

2.4 Land use and socio-economic aspects

Land use data collected from different agencies; suggests that agriculture and forestry are the main patterns of land use in the area. The mining lease is falling in the agricultural area of the region. There is a good availability of quartz rich sand as well as clay bands associated with lignite occurrences, the additional value generated by these by products of mining are to be ascertained.

In terms of socio-economic aspects of study, majority of population is schedule caste and tribes, their livelihood is mainly agriculture. The area has good water availability hence three crops is a norm rather than exception. Mining has generated some employment of unskilled nature for the local people. However, majority of the skilled manpower has

come from other parts of the state and country, resulting into the confluence of cultural identities.

2.5 Environmental impact assessment

The emphasis on the EIA gained momentum during the early seventies, looking to the fact that eventually all the anthropogenic activities do cause adverse impacts on the environment of a region, even in some cases global impacts are visualized as for example rise in global warming due to emission of green house gases from burning of fossil fuels. The EIA would help in the identification and quantification of the levels of harm done to the environment. The type of impact, viz., reversible or irreversible, long or short term, and primary or secondary and their understanding is useful in the decision making for the mining project execution, by incorporating appropriate measures to minimize the adverse impacts (Abbasi, 2003). EIA helps in visualizing the possible scenarios of impacts, which in turn helps in formulating the mitigation strategy to lessen the impact level. EIA on a long term helps in industrial growth on a sustainable basis. The EIA flow chart (Figure – 2.1) illustrates different styles of EIA studies.

Based on the impact study, distinction is made between primary and secondary impacts (Abbasi, 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.

2.6 Environmental management plan

The mining activity exerts pressure on environment and various natural resources at different stages of operation and needs to be managed for mitigation of pollution and other environmental problems. The adverse impacts of mining activities include deforestation, pollution of air, water, noise, land and soil, degradation in the land resources and landscape, etc. Based on the environmental impact assessment the feasible management plan is developed, which must be competent enough for the prevention and

control of pollution and restrict the degradation of landscape. Thus environment management plan includes mitigation measures. Various mitigation measures which can be incorporated include compensation for loss of land and forest, control of soil erosion and sedimentation, control of pollution of air, noise and water, solid waste management, disaster management, etc.

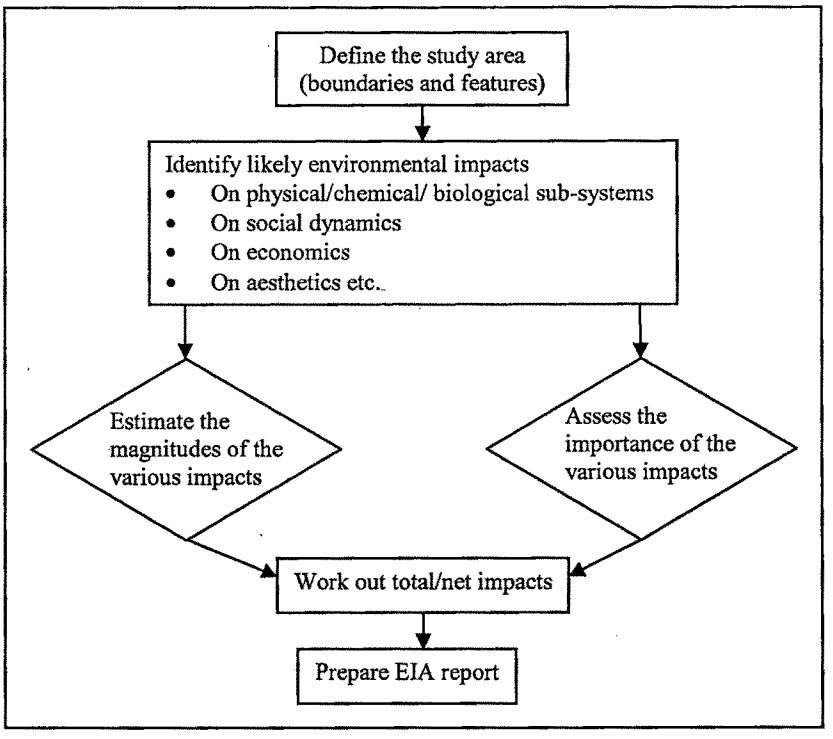

Figure 2.1: Generalized EIA and EMP flow chart

Ministry of Environment and Forest under Government of India has laid down several norms, notification and guidelines for the mining authorities to follow before, during and after the mining to ensure mining as less hazardous and more feasible.

The enforcement of environmental regulations, legislation, policy guidelines and control that may affect this project, are the responsibility of the central and the state government agencies. The principal Environmental Regulatory Agency in India is the Ministry of Environment and Forest (MoEF), New Delhi. MoEF formulates environmental policies and is engaged in the environmental clearances for different projects. The important environmental legislations in India are listed in Table 2.1.

Table 2.1: Key environmental legislations in India

NAME	SCOPE AND OBJECTIVE	KEY AREAS	OPERATIONAL AGENCY/KEY PLAYERS
Water Prevention and Control of Pollution Act, 1974, 1988	To provide for the prevention and control of water pollution and enhancing the quality of water	Controls sewage and industrial effluent discharges	Central and State Pollution Control Boards
Air Prevention and Control of Pollution Act 1981, 1987	To provide for the prevention and control of air pollution	Controls emissions of air pollutants	Central and State Pollution Control Boards
Forest Conservation Act, 1980, 1988	To consolidate acquisition of common property such as forests; halt India's rapid deforestation and resulting Environmental degradation	Regulates access to natural resources, state has a monopoly right over land; categorize forests Restriction on dereservation and using forest for non-forest purpose	State government And Central government
Wildlife Protection Act, 1980	To protect wildlife	Creates protected areas (national parks/sanctuaries) categorize wildlife which are protected	Wildlife advisory boards; Central Zoo Authorities
Environment Protection Act, 1986	To provide for the protection and improvement of Environment	An umbrella legislation; supplements pollution laws	Central government nodal agency MoEF; can delegate powers to state department of Environment
Environmental Clearance Notification, 1994	Environmental Impact Assessment of Projects; Environment Management Plans	Environmental Protection	Project Developer, State and Central Governments.
National Policy on R&R	Resettlement and Rehabilitation of project affected people	Social Issues	State Government