CHAPTER 1

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1.1 Introduction

The waste disposal from the use of fossil fuel energy resources are amongst the major sources of environment pollution in industrialised part of our country. Nearly 60% of electricity produced in India is through coal based thermal power plant (Mishra, 1988, Pathsarathi, 1980). The solid waste produced by coal fired power plants, comprise sludge, bottom ash and fly ash. The solid waste produced after combustion of country coal is above 32 to 40 % of which 5 to 10 % in the form of fly ash, is released to the atmosphere. Because of small particles size and therefore large surface area, the fly ash has a greater tendency to adsorbed trace elements which are transported from coal waste products during combustion (Klein et al., 1975, Campbell et al., 1978, Fisher et al., 1978). If fly ash is not disposed off properly, it may become a potential hazard to the environment.

1.1.1 Chandrapur Super Thermal Power Station

The Chandrapur Super Thermal Power Station (CSTPS) is situated near village Durgapur about 6 Km north of Chandrapur city (Plate 1.1). The power plant has four units of 210 MW and three units of 500 MW which have helped power station to achieve highest power generating capacity in India, of 2340 MW. The power plant inclosures area of about 11266 hectares of which 103 hectare has been used for erecting power plant and residential colony, 2668 hectare to develop ash pond and 7041 hectare has...
been used for storage dam of 226.05 million cubic meter capacity. The dam has been built across the river Erai and it is known as Erai dam.

1.1.2 Western Coalfields Limited (WCL) Collieries

CSTPS is a mine pit head power plant. It is located at the centre of coal fields of Chandrapur region. The coal required by the plant is supplied by near by mines namely Durgapur, Rayatwari, Padmapur, Babupeth, Sasti, Majari, Ghughus, Ballarpur, Wani, Pandharpawani, Dhoptala, Bellor etc. (Plate 1.2). These mines which work under Western Coalfields Limited, supply coal to the power station yearly. The requirement of coal by power station is 40 M.T. The water requirement of the plant is fulfilled from Erai dam, which has storage capacity of 226 million cubic meters.

1.1.3 Efforts towards Pollution Control

MSEB which runs CSTPS has taken extra precaution to reduce ash content of flue gases emitted by the plant. Each boiler unit is equipped with electrostatic precipitator (ESP), which help setting the fire particles of ash, which generally escape along with flue gases into the atmosphere. Similarly, the height of chimney have been raised to 275 m height in order to check the fly ash that scatter in the outer atmosphere.

The fly ash and bottom ash produced of boiler are carried 10 Km away from the plant and dumped in the Ash Pond (Plate 1.3). The Ash Pond is a depression created for ash slurry to be disposed for settling of ash particles at the bottom. The disposed off ash in the form of ash slurry is done by ash handling pump and ash disposed pipes.
Plate 1.1 Field Photograph showing Chandrapur Super Thermal Power Station, Chandrapur

Plate 1.2 Field Photograph Showing Open Cast Mine of Chandrapur Region.
In order to maintain ecological balance, MSEB has planted trees in the surrounding area of the factory area. The tree plantation work is continuously going on since 1984 and more than 18 lakhs trees have been planted so far.

3. Aims and Objectives

Coal mining and utilisation of coal for power generation are responsible to deteriorate the earth's atmosphere, soil resources, and water resources. All these factors are at risk of degradation. Therefore, the aims of the study are to:

- Assess the impact of coal mining on the environment.
- Evaluate the effectiveness of tree planting in mitigating these impacts.
- Propose strategies to sustainably manage coal mining activities.

Plate 1.3 Field Photograph showing View of Ash Pond.

The study area, which encompasses a 6 km radius area around CSTPS, falls in the Madras Toposheet Nos. 56M1/1, 56M1/5, 55P/4, and 55P/8. It is bounded by latitudes 79° 21' 21" E (Fig. 1.1).
In order to maintain ecological balance, MSEB has planted trees in the surroundings of factory area. The tree plantation work is continuously going on since 1984 and about 10 lakhs trees have been planted so far.

1.2 Aims and Objectives

Coal mining and utilisation of coal for power generation are responsible to a great extent, for causing environmental pollution earths atmosphere, soil resources, surface water and even subsurface water resources, all are under the high risk of pollution today. The Durgapur area is the best site to demonstrate quality deterioration of natural resources such as soil and water. The present investigation, therefore, aimed at evaluation of water quality of Durgapur area for drinking and irrigation.

1.3 Location, Extent and Approach to the Study area

The Durgapur area which includes, Chandrapur Super Thermal Power Station (CSTPS) and collieries, is located 6 Km north of Chandrapur town, the headquarters of Chandrapur district, Maharashtra State. The area is easily approachable by rail route and road. The State Highway SH-84 and Madras-Delhi rail route cross the area and connect Chandrapur to major cities.

The study area which encompass 6 Km radius area around CSTPS, falls in Survey of India Toposheet Nos. 56M/1, 56M/5, 55P/4 and 55P/8. It is bounded by latitude $19^\circ 56' 45"$ - $20^\circ 3' 45"$ N and longitude $79^\circ 13' 30''$ - $79^\circ 21' 45''$ E (Fig. 1.1).
FIGURE: 1.1 MAP OF INDIA SHOWING LOCATION OF
STUDY AREA, DURGAPUR,
DIST. CHANDRAPUR, M.S.
1.4 Scheme of Presentation

The present work has been divided into six chapters viz Chapter-1 Introduction, Chapter-2 Physiography Climate and Geology, Chapter-3 Hydrogeology, Chapter-4 Water Chemistry and Quality Evaluation, Chapter-5 Suitability Assessment of Water for Drinking and Irrigation and Chapter-6 Discussion and Conclusions.

The Chapter-1, Introduction contains mainly aims and objectives, location, extent and approach to the study area and previous work done. The Chapter-2, Physiography, Climate and Geology is devoted to geomorphological studies, climate and geological studies of the area. The Chapter-3 Hydrogeology, mainly deals with occurrence, movements of ground water and its seasonal fluctuation in the area. Chapter-4, Water Chemistry and Quality Evaluation is devoted to analytical details of water samples and their chemical classification. Chapter-5, Suitability Assessment of Water for Drinking and Irrigation contains comparatively studies between concentration of various physical chemical parameters with that of drinking water standards. This chapter also includes dispersion pattern of toxic ions of ground water. The last chapter Discussion and Conclusions has described mainly the relationship between toxic ions concentration in water with aquifer rock. Important conclusions drawn are also listed in the same chapter.
1.5 Previous Work Done

The northwesternly extension of Godavari Valley coal field across the state boundary of Maharashtra is referred to as Wardha valley coal fields. The coal occurrence of Chandrapur region is a part of Wardha valley coal fields. Many stalwarts and renowned British geologists have carried out systematic coal exploration work in this region in the past. The eminent geologist W.T. Blandford, (1868) and T. Oldham, first reported sandstones containing plant fossil of this region. The Talchir sediments have been identified of glacial origin by F. Fedden (1875). T.W.H. Hughes conducted the first systematic geological mapping of this area in 1877. E.R. Gee, mapped the area of Ghughus colliery. Amongst Indian Geologists V.R.R. Khedkar and B.N. Sinha (1946-47) mapped part of Ghughus colliery. B.C. Pande (1957) studies the geology of Chanda, Ballarshah, Majari, Ghughus and contributed important drilled core log informations on coal seams in the area. GSI officers V.D. Puri (1967) have been associated with exploratory drilling programme along with B.C. Pande. Other Government Organisations such as The Directorate of Geology and Mining (DGM.), Government of Maharashtra, and CMPDI., (Chandra T.K. et, al. 1974 A, 1974 B, Datta J. et, al. 1978, Datta J. et, al. (A) 1977, Datta J. et, al. (B) 1977) Smith, 1965, studies glacial marks on the protoreozoic basement rock of this region in detail. Bose and Ramanamurthy (1977) found divergening trends in striation on basement limestone bed conducted the drilling investigations in number of coal occurring places for regional assessment of coal in the coal field area.
Geophysical surveys have been conducted in Chandrapur region and Bouguer anomalies have been found negative which confirm trough graben structure in Pranhit-Godavari basin (Chakraborty et al. 1977), Raja Rao (1982) has done a compressive studies on coal resources of Tamilnadu, Andhrapradesh, Orissa and Maharashtra.

The exploratory drilling data of coal have shown that composite coal seam are developed in Barakar formation. The petrography and trace metal concentration studies of coal seams has been done by Singh and its co-workers (1985).

The hydrogeology of the Durgapur area has been studied earlier by officers/scientists of Central Ground Water Board (CGWB), Ground water Survey and Development Agency (GSDA), Government of Maharashtra during systematic hydrogeological studies, carried out by Deshmukh and his co-workers, the aquifer characteristics of various ground water rock formations have been evaluated. The pumping test data of the area indicate that the Kamthi and Barakar form confined only unconfined aquifer in the area. It is also found that the confined Barakar and Kamthi aquifers are interconnected. The permeability in Kamthi and Barakar is found ranging between 2.87 to 11.54 m/day. The confined aquifer of sandstones show permeability 19.27 m/day.

Hydrogeological study of Durgapur coalfields was carried out by CGWB (Dalal et al. 1977). The regional transmissibility of coal bearing formation was estimated. The regional transmissibility was found 700 m²/day. Elangovan (1980) carried out regional basin wise hydrogeological studies and found water table aquifer formed by Vindhyan
super group rocks and semiconfined aquifer formed by Gondwana super group rocks. Chemical quality of water was found suitable for domestic and irrigation purpose. Sankaran (1989) prepared development plan to tap ground water in trial area of Chandrapur region. Rao and his co-workers studied environmental degradation and pollution problem in Chandrapur district, Padmapur opencast and Durgapur opencast mines were selected for the studies. Phreatic aquifer fluctuation was found varying between 10-25 m. The ground water recharge estimated for the area is 15.75 million cubic meter. The impact of dewatering in mine has been found as wells of Sinhala village which dried during pre monsoon of 2000. Adyalkar and his workers studied the hydrogeology of the Gondwana formation utilising remote sensing data (Adyalkar, et al. 1996). Various hydrogeomorphical unit have been identified and potential ground water zones delineated.

The studies related to environmental pollution are vary many. The impact of coal mining on the environment has been studied with the help of trace elements distribution in Gondwana coals (Singh, et al. 1990). Ground water pollution by heavy metal leachate from Ash Pond has been studied by Sahu K.C. (1998), (Geochemistry of Gondwana formations of Karimnagar district, A.P. has reveal that the sediments of Gondwana were deposited in fault controled sinking continental basin). The arsenic contamination in water is found by Fulakar, et. al. (1989). Sharma, A.K. (1995) has done evaluation of environmental degradation by Super Thermal Power Plants. The extensive work on leaching of major and trace elements from coal ash has been carried out at ISM, Dhanbad. It is found that trace metals like Cu, Zn, are found in high levels in bottom ash pond and fly ash (Gurdeep Singh, 1996).