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Environmental pollution and impact in Singrauli coal field area, Madhya Pradesh, India

Sachin Tamrakar
Department of Geology, Govt. Science College, Jabalpur, Madhya Pradesh, India

Abstract
Environments are at present facing hazard because of different reasons. One such reason is the mining activities. It has many bad impacts on the environment like human health, air, water bodies and wildlife habitat. Singrauli Coalfield is extend transversely the districts of Singrauli (Sidhi) and Sonebhadra in the states of Madhya Pradesh and Uttar Pradesh, generally in the basin of the Son River. The Singrauli Coal field, particularly surface mining requires large areas of land to be temporarily disturbed. This raises a number of environmental challenges, including soil erosion, dust, noise and water pollution, and impacts on local biodiversity. Steps are taken in modern mining operations such as reduce water pollution through clean runoff, reduce air pollution through used of wet drilling to minimize impacts on all basic aspects of the environment. Mine reclamation activities are undertaken gradually – with the shaping and contouring of spoil piles, replacement of topsoil, seeding with grasses and planting of trees taking place on the mined-out areas. Care is taken to relocate streams, wildlife, and other valuable resources. Where the mining is underground, the surface area can be simultaneously used for other uses such as forests, cattle grazing and growing crops - with little of no disruption to the existing land use.

Keywords: environment, pollution, Singrauli coal field, son river, Madhya Pradesh

Introduction
Natural property like, air, minerals, water, forests and productive land have been the spine of human survival by providing the requirements of life such as food, medicines and fuel energy. More than the time, they have been exploited vastly for financial gains. Increasing population and the mission for power has led to mining of minerals, mainly coal, to meet the always rising demand. Mining and its connected activities in earth are responsible for a change in the environment. By the year 2009, Singrauli was declared as one of the critically polluted areas in an analysis conducted by Central Pollution Control Board and MoEF in collaboration with IIT, Delhi. It ranked ninth among the list of 14 critically polluted areas with an index of 81.79 (CPCB, 2009) [1].

Location
Singrauli Coalfield, covered area of about 2202 sq. km. is at present the biggest source of pit head coal for power generation in the country. It is located mainly in Singrauli (Sidhi) district of Madhya Pradesh, while a small part of about 80 sq. km. in the east, falls in Sonebhadra district of Uttar Pradesh. The Kachni river divides the coalfield into two parts viz. the major south-western part (Main Basin) and a smaller north-eastern part called Moher sub-basin which is the centre of all economic activities, as on date, as far as, coal and power are concerned.

Topography
The Singrauli Coalfield stands as a high plateau over the surrounding plains covered by Talchir sediments. The Barakar sediments, project over the Talchir outcrops as scarp faces. Towards north, the Gondwana sediments is underlain by Precambrian rocks, which form a series of East-West trending prominent ridges.

Drainage
The Singrauli Coalfield is located in the drainage area of the Son and Rihand rivers. The north flowing streams in the Mohar scarp area join the Bijul River that is a tributary of the Rihand. Some debouche directly into the Rihand reservoir or join the perennial streams Balia Nala.

Climate
The climate of the area is tropical monsoon. The temperature in summer rises as high as 48^{o}C in May-June. In winter Nov-Feb., the temperature varies from 4^{o}C to 21^{o}C. The average annual rainfall is about 1200 mm of which 95% of the precipitation is during rainy season.

Physiography
It stands out as high plateau over the Talchir Plains in the south with the maximum elevations of about 540 m above MSL. The top of the plateau is undulating and is dotted by small hillocks with southerly flow in the major portion of the minefield, which in turn is connected to the Amjhar Nalla in the east and Kachni river in the west.

Coal mining & environment impact
Coal mining, particularly surface mining, requires large areas of land to be temporarily disturbed. This raises a number of environmental challenges, including soil erosion, dust, noise and water pollution, and impacts on local biodiversity. Steps are taken in modern mining operations to minimize impacts on all aspects of the environment. By carefully pre-planning

projects, implementing pollution control measures, monitoring the effects of mining and rehabilitating mined areas, the coal industry minimizes the impact of its activities on the neighboring community, the immediate environment and on long-term land capability.

Land Disturbance

In best practice, studies of the immediate environment are carried out several years before a coal mine opens in order to define the existing conditions and to identify potential problems. The studies look at the impact of mining on surface and ground water, soils, local land use, native vegetation and wildlife populations. Computer simulations can be undertaken to model impacts on the local environment. The findings are then reviewed as part of the process leading to the award of a mining permit by the relevant government authorities.

Mine Subsidence

Mine subsidence can be a problem with underground coal mining, whereby the ground level lowers as a result of coal having been mined beneath. A thorough understanding of subsistence patterns in a particular region allows the effects of underground mining on the surface to be quantified. The coal mining industry uses a range of engineering techniques to design the layout and dimensions of its underground mine workings so that surface subsidence can be anticipated and controlled. This ensures the safe, maximum recovery of a coal resource, while providing protection to other land uses.

Water Pollution

Mine operations work to improve their water management, aiming to reduce demand through efficiency, technology and the use of lower quality and recycled water. Water pollution is controlled by carefully separating the water runoff from undisturbed areas from water which contains sediments or salt from mine workings. Clean runoff can be discharged into surrounding water courses, while other water is treated and can be reused such as for dust suppression and in coal preparation plants.

Acid mine drainage

Acid mine drainage (AMD) can be a challenge at coal mining operations. AMD is metal-rich water formed from the chemical reaction between water and rocks containing sulphur-bearing minerals. The runoff formed is usually acidic and frequently comes from areas where ore- or coal mining activities have exposed rocks containing pyrite, a sulphur-bearing mineral. However, metal-rich drainage can also occur in mineralized areas that have not been mined. AMD is formed when the pyrite reacts with air and water to form sulphuric acid and dissolved iron. This acid run-off dissolves heavy metals such as copper, lead and mercury into ground and surface water.

Dust & Noise Pollution

Dust at mining operations can be caused by trucks being driven on unsealed roads, coal crushing operations, drilling operations and wind blowing over areas disturbed by mining. Dust levels can be controlled by spraying water on roads, stockpiles and conveyors. Other steps can also be taken, including fitting drills with dust collection systems and purchasing additional land surrounding the mine to act as a buffer zone. Trees planted in these buffer zones can also minimize the visual impact of mining operations on local communities. For the worker at mines should always use dust mask while working in mines. Heavy machineries are mainly responsible to produced unwanted heavy Noise can minimized by used of Muffler. And for protection of worker it should be minimized by use of constructed sound proof cabin and also wearing ear plugs at all time during inside the mine area.

Rehabilitation

Coal mining is only a temporary use of land, so it is vital that rehabilitation of land takes place once mining operations have stopped. In best practice a detailed rehabilitation or reclamation plan is designed and approved for each coal mine, covering the period from the start of operations until well after mining has finished. As mining operations cease in one section of a surface mine, bulldozers and scrapers are used to reshape the disturbed area. Drainage within and off the site is carefully designed to make the new land surface as stable and resistant to soil erosion as the local environment allows. Based on the soil requirements, the land is suitably fertilised and revegetated. Reclaimed land can have many uses, including agriculture, forestry, wildlife habitation and recreation.

Environmental control measures

NCL is very much alive to the Environment conservation & pollution control. All necessary steps have been taken to maintain healthy and hygienic condition by keeping air, water, dust and noise pollution under control.

Environment Conservation

Area of non-forest land identified for compensatory afforestation 4320 Ha. against available forest land for coal mining. Amount deposited by NCL to State Forest Departments (MP&UP) Rs.32.96 Crores for compensatory afforestation (NCL Report).

Pollution Control

Liaisoning with SPCB for meeting the stipulation and obtaining clearance for operations accordingly.

Air Pollution

Air pollution control measures adopted by NCL are drills are provided with dust extractors to control dust at source. Approach roads to mines and service roads are provided with black topping to reduce dust generation. Water sprinklers of fixed type and mobile type are deployed for dust suppression on haul roads. Automatic sprinklers, actuated through sensors, are installed at receiving pits. Fixed sprinklers are provided and operated through valve control system at coal bunkers, transfer points and loading points. Dust cyclones are provided at bottom of receiving pits of crusher.

Water Pollution

Sewage Treatment Plant (STP)

Domestic STPs have been constructed in the township with activated sludge process. Plant contains aeration units for oxidation, clarifiers for removal of suspended solids, sludge

drying beds, grit removal facilities, sewer lines, manholes, pump houses, control room, etc. Treated water is taken for reuse in tree plantation, horticulture, construction activities. Dried sludge is valuable manure for tree plantation and horticulture works.

Effluent Treatment Plant (ETP)

Integrated Industrial ETPs are designed for average discharge from mines, workshops and CHPs The plant contains traps for recovery of oil & grease, clarifiers for removal of suspended solids, flush mixers for chemical dosing, sludge drying beds and pumping arrangements. Treated water is reused for tanker filling, sprinklers, etc. Dried sludge are buried in lined pits.

Silt Arrestors

Substantial amount of silts are carried along with runoff water. Catch drains with silt arrestors are provided in mines area. Those are cleaned at regular intervals. Check dams and siltation ponds are provided to arrest silt flowing into the watercourse. Gabions (loose boulders packed in wire crates) are provided at toe of the active dumps and across the water course with filter pad to stop silt escape into water body.

Oil Recovery

Floating oils recovered from traps are collected in drums and then stored on a raised paved area having drains to collect back spillages. Permission has been obtained from SPCB for handling waste oils. Oils in drums are sold to the distillation units having requisite license through Metal Scrap Trading Corporation (MSTC), a Govt. of India undertaking, by way of press advertisement.

Conclusion

There are mine management methods that can minimize the problem of AMD, and effective mine design can keep water away from acid generating materials and help prevent AMD occurring. AMD can be treated actively or passively. Active treatment involves installing a water treatment plant, where the AMD is first dosed with lime to neutralize the acid and then passed through settling tanks to remove the sediment and particulate metals. Passive treatment aims to develop a self-operating system that can treat the effluent without constant human intervention. Noise can be controlled through the careful selection of equipment and insulation and sound enclosures around machinery. Companies carefully monitor the progress of rehabilitation and usually prohibit the use of the land until the vegetation is self-supporting. The cost of the rehabilitation of the mined land is factored into the mine's operating costs. While coal is not the only source of methane emissions agricultural activities are major emitters methane from coal seams can be utilized rather than released to the atmosphere with a significant environmental benefit. Air pollution control measures adopted by NCL are Drills are provided with dust extractors to control dust at source.

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