

A Review Article on Water Pollution by Mining Activity

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Abstract -Water serves many ways in a different country like domestic purposes, industrial purposes, drinking purpose and agriculture purpose. But due to some anthropogenic activity day by day our water is polluted. It is the major concern now a days because agriculture, industrial, municipal waste containing pesticides, fertilizer residue, heavy metals that leads to reach in the water through process of leaching. Mainly in this article we see the impact of mining activity on surface and ground water. Mining shows impact on water due to spill erosion, Sedimentation, acid mine drainage, lowering water table, change the pattern of hydrological cycle and rainfall. Acid mine drainage shows the most negative impacts on available ground and surface resources. Also having the ability to show long-term effects on our rivers, wells, streams can disturb aquatic life. In the other side mining is the process of extracting valuable materials. Mining also Play a vital role in national economic development. By creating high-paying jobs and supplying the essential materials to every sector of our economy, minerals mining supports stimulate economic growth. Mining is an important economic activity in India. India is one of the largest exporters of iron ore, chromite, bauxite, mica, and manganese, and it is ranked fifth among the mineral-producing countries terms of volume of production. Mining sector helps nearly 2.4% to India's GDP. Recently interest in the Mining industry issues related risk assessment and management. But mining activity hampered the ground water pollution as well as cause air pollution, damaging ecosystem, and natural habitat of many species. Previously there were many accidents that had been shown by mining. This article study briefly about mining impacts with mainly focusing on water contamination an outlook of Indian scenario.

Key word – Mining, pollution, Surface water, Groundwater resources, Heavy metals, Leaching, Accidents by mining activity.

1. INTRODUCTION

Mining is the process of extracting useful materials from the earth. substances that are mined include coal,

gold, or iron ore. Iron ore is the material from which metal iron is produced. The process of mining dates to prehistoric times. Prehistoric people first mined flint, which was ideal for tools and weapons since it breaks into shards with sharp edges. The mining of gold and copper also dates to prehistoric times. These profitable substances that are mined from the earth are called minerals.

A mineral is typically an inorganic substance that has specific chemical composition and crystal structure. The minerals are valuable in their pure form, but on the earth, they are mixed with other, unwanted rocks and minerals.[1] This mix of rock and minerals is usually carried away from the mine together, then later processed and refined to isolate the desired mineral. The two major categories of modern mining include surface mining and underground mining. In surface mining, the ground is blasted so that ores near Earth's surface can be removed and carried to refineries to extract the minerals. Surface mining can be destructive to the surrounding landscape, leaving huge open pits behind. In underground mining, ores are removed from deep within the earth. Miners blast tunnels into the rock to reach the ore deposits. This process can lead to accidents that trap miners underground. Along with accidents, a career in mining can also be dangerous since it can lead to health problems. Breathing in dust particles produced by mining can lead to lung disease. (et al. Tyson Brown, Gina Borgia, National Geographic society)

One of the most common forms is black lung disease, which is caused when coal miners breathe in coal dust. Many other types of mining produce silica dust, which causes diseases like black lung disease. These are incurable diseases that cause breathing impairment and can be fatal. The mining process can also harm the environment in other ways. Mining creates a type of water pollution known as acidmine drainage. First, mining exposes sulfides in the soil. When the rainwater or streams dissolve the sulfides, they

form acids. This acidic water damages aquatic plants and animals. Along with acid mine drainage, the disposal of mine waste can also cause severe water pollution from toxic metals. The toxic metals commonly found in mine waste, such as arsenic and mercury, are harmful to the health of people and wildlife if they are released into nearby streams. (et al. Tyson Brown, Gina Borgia, National Geographic society)

2. HISTORY OF MINING IN INDIA

Minerals constitute the backbone of economic growth of any nation and India has been eminently endowed with this gift of nature. There is much evidence that exploitation of minerals like coal, iron-ore, copper, lead-zinc has been going on in the country from time immemorial. However, the first recorded history of mining in India dates to 1774 when an English Company was granted permission by the East India Company for mining coal in Raniganj. M/s John Taylor & Sons Ltd. started gold mining in Kolar Gold Fields in the year 1880. The first oil well was drilled in Digboi in the year 1866 - just seven years after the first ever oil well was drilled anywhere in the world viz. in Pennsylvania State, USA in 1859. Mining activities in the country however remained primitive in nature and modest in scale until the beginning of the current century. Thereafter, with progressive industrialization the demand for and hence the production of various minerals gradually went up.

After India became independent, the growth of mining under the impact of successive Five-Year Plans has been very fast. There are ambitious plans in coal, metalliferous and oil sectors to increase production of minerals during the 8th Five Year Plan and thereafter. (et al. www.dgms.net>mining_industry in India)

3. LIST OF COAL MINES IN INDIA

Before heading towards the list of important coalfields in India, let us understand the categories in which these fields are divided.

The Gondwana Coalfields-

Gondwana coal makes up to 98% of the total coal reserves in India and 99% of the coal production in India. Gondwana coal is free from moisture and contains phosphorus and Sulphur. The carbon content in Gondwana coal is less compared to the Carboniferous coal that is 350 million years old which is almost absent in India because of its much younger age.

Tertiary Coal Fields-

Carbon content is very low but is rich in moisture and Sulphur. Tertiary coalfields are mainly confined to extra-peninsular regions. Important areas include Assam, Meghalaya, Nagaland, Arunachal Pradesh, Jammu and Kashmir, Himalayan foothills of Darjeeling in West Bengal, Rajasthan, Uttar Pradesh, and Kerala. (et al. Byjus.com)

Coal mines in India [Table:1]

Coal Mine	States	Features/Prominence
Jharia, Dhanbad, Bokaro, Jayanti, Godda, Giridih (Karbhari Coal Field), Ramgarh, Karan Pura, Dalton Ganj	Jharkhand	Dhanbad – One of the oldest in Jharkhand and the richest coalfields of India. It is the storehouse of the best metallurgical coal, i.e., coking coal. Gondwana Coalfield. Giridih (Karbhari Coal Field) gives the finest coking coal in India for metallurgical purposes.
Raniganj Coalfield, Dalingkot (Darjeeling) Birbhum, Chinakuri	West Bengal	Darjeeling and Jalpaiguri are the chief producing districts. Gondwana Coalfields
Korba, Bishrampur, Sonhat, Jhilmil, Hasdo-Arand	Chhattisgarh	Gondwana Coalfields

Jharsuguda, Himgiri, Rampur, Talcher	Odisha	Talcher – Ranks 2nd in reserves after Raniganj i.e. (24,374 million tone’s) Most of the coal is suitable for steam and gas production and utilized in thermal power plants at Talcher. Gondwana Coalfields
Singareni, Kothagudem, Kantapalli	Telangana/ Andhra Pradesh	Most of the coal reserves are in Godavari valley. Non-coking variety is explored. The workable collieries are situated at Kothagudem and Singareni. Gondwana Coalfields
Neyveli	Tamil Nadu	Tertiary coalfield
Kamp tee (Nagpur), Wun field, Wardha, Walarpur, Ghughus and Warora	Maharashtra	Gondwana Coalfields
Ledo, Makum, Najera, Janji, Jaipur	Assam	Assam coals have low ash and high coking qualities. Sulphur content is high, good for metallurgical purposes. Coal is best for making liquid fuels and hydrogenation processes. Tertiary Coalfields
Darrangiri (Garo hills), Cherrapunji, Liotryngew, Maolong and Langerin coalfields (Khasi & Jainita Hills)	Meghalaya	Tertiary Coal Field
Singrauli, Sohagpur, Johila, Umaria, Satpura coalfield	Madhya Pradesh	Singrauli is the largest coalfield of MP. Gondwana Coalfields.

[Source- List of coal mines in India et al. Byjus.com]

4. TYPES OF WATER POLLUTION FROM MINING

There are four main types of mining impacts on water quality

4.1. Acid Mine Drainage

Acid Rock Drainage (ARD) is a natural process whereby sulphury acid is produced when sulphides in rocks are exposed to air and water. Acid Mine Drainage (AMD) is essentially the same process, greatly magnified. When large quantities of rock containing sulphide minerals are excavated from an open pit or opened in an underground mine, it reacts with water and oxygen to create sulphury acid. When the water reaches a certain level of acidity, a naturally

occurring type of bacteria called Thiobacillus ferroxidase may kick in, accelerating the oxidation and acidification processes, leaching even more trace metals from the waste. The acid will leach from the rock if its source rock is exposed to air and water and until the sulphides are leached out – a process that can last hundreds, even thousands of years. Acid is carried off the mine site by rainwater or surface drainage and deposited into nearby streams, rivers, lakes, and groundwater. AMD severely degrades water quality and can kill aquatic life and make water virtually unusable. (et al., Dobb, Edwin. October 1996. Harper’s magazine: pennies from hell) (et al., National Academy of Science .1999. Hardrock Mining on Federal Lands)



[Figure:1 Acid mine drainage] [Source – et al, Wikipedia]

4.2. Heavy Metals Contamination & Leaching

Heavy metal pollution is caused when such metals as arsenic, cobalt, copper, cadmium, lead, silver, and zinc contained in excavated rock or exposed in an underground mine meet water. Metals are leached out and carried downstream as water washes over the rock surface. Although metals can become mobile in

neutral pH conditions, leaching is particularly accelerated in the low pH conditions such as are created by Acid Mine Drainage. (et al., Dobb, Edwin. October 1996. Harper’s magazine: pennies from hell) (et al., National Academy of Science .1999. Hardrock Mining on Federal Lands)

[Table-2 Heavy Metals and its Impact on Water]

Heavy metals	Impacts to water	Reference
Lead	Acute toxicity to plants, animals	Et al., (2003) stocia, Ugya and Ali bade
Mercury	Chronic effects	Branescu, et al., (2007), Ugya and Ali bade
Cadmium	Poisonous to Flora and Fauna	Branescu, et al., (2007) Ugya and Ali bade
Copper	Very toxic to water plants	Palamaru et al., (1997) Ugya and Ali bade
Iron	Showing toxicity	Palamaru et al, Ugya and Ali bade
Chromium	Poisonous to marine plankton and fish	Xia and Liu, (2004) et al., Ugya and Ali bade
Nickle	Highly toxic to Plants 8 times more toxic than zinc	Et al, Ugya and Ali bade
Arsenic	Affects the growth of plants	Xia and Liu (2004) et al., Ugya and Ali bade
Zinc	Change the physiochemical and physical properties, reduce biological activity	Xia and Liu (2004) et al, Ugya and Ali bade

[Source, jucan et al., 2016]

4.3. Processing Chemicals Pollution

This kind of pollution occurs when chemical agents (such as cyanide or sulphury acid used by mining companies to separate the target mineral from the ore) spill, leak, or leak from the mine site into nearby water

bodies. These chemicals can be highly toxic to humans and wildlife. (et al., Dobb, Edwin. October 1996. Harper’s magazine: pennies from hell) (et al., National Academy of Science .1999. Hardrock Mining on Federal Lands)

4.4. Erosion and sedimentation

Mineral development disturbs soil and rock while constructing and maintaining roads, open pits, and waste impoundments. In the absence of adequate prevention and control strategies, erosion of the exposed earth may carry substantial amounts of

sediment into streams, rivers, and lakes. Excessive sediment can clog riverbeds and smother watershed vegetation, wildlife habitat and aquatic organisms. (et al., Dobb, Edwin. October 1996. Harper’s magazine: pennies from hell) (et al., National Academy of Science .1999. Hardrock Mining on Federal Lands)

5. MINING ACCIDENTS IN INDIA

Accidents during mine activities - 2022

Sl.No.	Date of accident	Name of Mine	Killed	Injured	Brief Cause
1.	05.07.2022	Rajgamar mine of SECL, Korba, Chhattisgarh	01	00	Overhead coal collection container fell on a truck parked underneath
2.	09.05.2022	Illegal mining site of Kaparsa Colliery of Eastern Coalfields Limited (ECL), Nirsa block, Dhanbad, Jharkhand	03	00	Due to mine roof collapse
3.	22.02.2022	Illegal mine in Khadakwani, Khargone District, Madhya Pradesh	01	00	Due to mine collapse
4.	16.02.2022	Coal mine in Shallang area of West Khasi Hills, Meghalaya	02	00	Due to asphyxiation
5.	02.02.2022	Abandoned coal mine - Gopinathpur Open Cast Project (OCP) of Eastern Coalfield Limited (ECL), Nirsa, Jharkhand	05	00	The sealed coal mine caved in after a mining equipment fell from a height of 20 feet
6.	02.01.2022	Bhiwani mining site, Dadam zone in Bhiwani district, Haryana	05	02	Over-exploitation of the mine beyond the permissible limit led to the landslide

Table 3 shows Accidents during mine activity 2022 [et al, ENVIS center of Environmental Problems of Mining]

Accidents during mine activities - 2021

Sl.No.	Date of accident	Name of Mine	Killed	Injured	Brief Cause
1.	10.11.2021	SRP-3 mine in Srirampur in Mancherial district, Singareni Collieries (SCCL)	04	0	Mining roof collapse
2.	11.08.2021	Mining site for quartz stones, Lochhead village, Bhilwara district of Rajasthan	07	0	Stone mine collapsed
3.	09.07.2021	Central Asset Mine- OCS Teng khat, Dhulia Jan, Assam	01	0	While 04 Work persons were testing/setting the safety relief valve on a portable test bench in an OCS (Oil Collecting Station) of an Oil Mine, the Safety Valve failed, and test bench got dislodged (due to air pressure releasing from safety valve) causing fatal injuries to one of the work persons while others escaped unhurt.
4.	28.06.2021	Rampura Agucha (zinc and lead) Mine, Bhilwara district of Rajasthan	02	0	Heavy boulder fell on them while engaged in mining activity
5.	23.06.2021	Sonepur Bazar Opencast Project Mine, M/s Eastern Coalfields Limited	02	0	While two Work persons were removing the wheel nuts from a type mounted on Dumper which was gripped by type handler, Rim

					came out hitting the persons removing the bolts causing fatal injuries to both.
6.	07.04.2021	Kakatiya Khani (KTK) coalmine in Bhupalpally Mandal, Hyderabad	02	0	Due to roof collapse
7.	24.02.2021	Monadic Coal Project area of Bharat Coking Coal Ltd (BCCL), Puki, Jharkhand	02	0	Due to roof collapse
8.	04.02.2021	Mathur quarry (a private stone quarry) at Madhur village near Thirumukkudal, in Kancheepuram district, Tamil Nadu	01	02	Crushed stones inside a stone quarry, caved in
9.	23.01.2021	Illegal mica mine in Jharkhand's Ko derma district	04	02	Mine caved in as Roof Collapsed
+10.	21.01.2021	Illegal coal mines near Rymbai village of Meghalaya's East Janita hills, district.	06	0	Fell into the mine while digging a tunnel in one of the illegal coal mines after the machine, which they were using to dig the channel, broke.

Table 4 shows Accidents during mine activity 2021 [et al, ENVIS center of Environmental Problems of Mining]
Accidents during mine activities - 2020

Sl.No.	Date of accident	Name of Mine	Killed	Injured	Brief Cause
1.	08.12.2020	Khadija Kaden mine of Eastern Coalfields Limited in Magma area	02	02	Flooding of underground mine
2.	02.09.2020	Srirampur RK 5B underground mine of the Singherian Collieries Company Limited (SCCL) in Manchuria district	01	04	Underground mine blast
3.	23.07.2020	Kuzmina OC Mine, Southeastern Coalfields Limited	01	0	Drowning in water
4.	23.06.2020	Kurasia Underground Mine, Southeastern Coalfields Limited	01	0	Explosives
5.	29.05.2020	Churcha Mine (R.O.), Southeastern Coalfields Limited	01	0	Transportation machinery (Conveyors)
6.	03.05.2020	Ananta Opencast Mine, Mahanadi Coalfields Limited	01	0	Run over by a dumper
7.	01.05.2020	Kusmunda OC Mine, Southeastern Coalfields Limited	01	0	Wheeled Trackless (Tipper)
8.	24.01.2020	Ramakrishna Opencast Project Mine, Signarama Collieries Company Limited	01	0	Accident with dumper
9.	15.01.2020	Granite Building Stone Quarry Mine, Shri Aliyarukutty M.	02	0	Falling a mass of stone
10.	14.01.2020	Hira Kund Bunia Mine, Mahanadi Coalfields Limited	0	01	Blasting

Table 5 shows Accidents during mine activity 2020 [et al, ENVIS center of Environmental Problems of Mining]

6. CONCLUSION

Water pollution is becoming the greater threat to the Environment, especially as population rise and industrial economic expand the toxic chemicals and elements reach to the manly through water, air, food. As per the analysis there are many short terms are there (examples are lack awareness to performing different activities in mining) Also there Many rules and Regulation are made by our government, but that implementation is not in a proper manner. EIA should be done before any site could Use for mining activities and address the illegal mining. Still there are many corruptions site is in India where there EIA reports are just on paper. So identified such sites and stop this kind of activities will helps to improve Environmental conditions. Because mining is posing a very critical and significant menace to ecosystem health, nearby habitat, damaging flora and fauna, disturbing water cycle, also pollute the rivers and microfauna of that river basins, also contaminate the ground water.

Proper mitigation approach should be developed to improve and develop effective removal techniques like monitoring water sample on regular bases to check the water quality, find out the main source and its affects, providing guidance and arranging mass media programs for public awareness, provide safeguards to all workers to mitigate the impacts. Day by day conditions are improving. Industries are doing their best to abet the pollution, providing safeguards to their employees. Also, we can control or mitigate the water pollution to provides best techniques to treat that wastewater (Ex- Providing Sewage effluents plants, installation of water effluents treatment plant) These techniques will help to reuse the water also they are eco- friendly approaches and some aerobic techniques like Trickling filters and oxidation Ponds are the use of natural decomposers (Ex- Bacteria, fungi, algae) to treat the wastewater. They remove the load of organic materials from the water. These techniques are cost effective. Reusing mining waste can also be helpful to prevent from pollution (Ex- Wastewater, rocks) Then, use of eco-friendly equipment (Ex- Change diesel engines with electric engines which possible to reduce the CO₂ which is produce by mining), Shutting down Illegal mining will be improving mining sustainability. Because in India politics is the biggest culprit. Also, these kinds of problem not just found in India but there

are many parts of different countries are also facing illegal sites of mining due to covetous politicians.

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