

BEFORE THE NATIONAL GREEN TRIBUNAL SITTING AT CHENNAI (SZ)

Appeal No.58 of 2021

Between:

Prince

S/o Durairaj Jesubatham

3/26 West Street

Marakattuvilai, Karaichuthu Navaladi

Tisaiyanvilai Taluk, Tirunelveli District

... Appellant

And

1. Member Secretary

State Level Environment Impact Assessment Authority - Tamil Nadu

3rd Floor, Panagal Maaligai

No.1 Jeenis Road, SAidapet

Chennai – 15 email: mstnseiaa@yahoo.com 2 Others

... Respondents

INDEX TO ADDITIONAL DOCUMENTS (FOR Ground Water Table of Project Area)

Sl. No	DESCRIPTION	Page No.
1.	TWAD Board Tirunelveli District Profile – Ground water	2-4
2.	Research Paper on Impact of Mining Activity on Water Resource : An Overview study	5-12
3.	Photograph showing dug well water table level	13-15


 Counsel for Appellant



- ❖ Tirunelveli district is bounded by Virudhunagar district in the north, Thoothukudi district in the east, in the south by Gulf of Mannar and by Kerala State in the west and Kanyakumari in the southwest.
- ❖ The District lies between 08°08'09"N to 09°24'30"N Latitude, 77°08'30"E to 77°58'30"E Longitude and has an area of 6810 sq.km.

💧 Physiography and Drainage:

- ❖ Tirunelveli district falls in Tamiraparani river basin, which is the main river of the district.
- ❖ The river has a large network of tributaries which includes the Peyar, Ullar, Karaiyar, Servalar, Pampar, Manimuthar, Varahanatha, Ramanathi, Jambunatha, Gadana nathi, Kallar, Karunaiyar, Pachaiyar, Chittar, Gundar, Aintharuviar, Hanumanathi, Karuppanathi and Aluthakanniar draining the district.
- ❖ The river Tamiraparani originates from the hills in the west and enters Thoothukudi District.
- ❖ The other two rivers draining the district are river Nambiar and Hanumanathi of Nanguneri taluk in the south that are not part of the Tamiraparani river basin.
- ❖ The small part of the district in the northern part falls in river Vaippar basin.

💧 Rainfall:

The average annual rainfall and the 5 years rainfall collected from IMD, Chennai is as follows:

Actual Rainfall In Mm					Normal Rainfall In Mm
2017	2018	2019	2020	2021	
1127.0	1137.8	1057.7	790.2	1569.3	985

💧 Geology:

Rock Type	Geological Formation
Hard Rock 90% Sedimentary Rock 10%	Charnockite, Gneiss, Granite, Granite, Pegmatite, Sandstone, Limestone, Sandy clay, Alluvium

Ground Water Level:



TWAD BOARD

The Ground Water Levels from the 63 number of observation wells of TWAD have been analyzed for Post-Monsoon and Pre-Monsoon. 5 years average Ground water level in m Below Ground Level for pre and post monsoon is as follows:

Jan 2017	May 2017	Jan 2018	May 2018	Jan 2019	May 2019	Jan 2020	May 2020	Jan 2021	May 2021	5 Years Pre Monsoon Average	5Years Post Monsoon Average
11.5	23.9	6.3	7.0	5.5	9.8	3.5	18.2	7.8	11.5	12.8	5.1

Sustainability:

With a view to enhance the Sustainability of the drinking water sources, recharge structures are being implemented by the TWAD Board under various State and Central Government assistance.

The Recharge Structures implemented so far in the district are as under.

Recharge Structures										
Check Dam	Percolation Pond	Recharge Pit	Recharge Trench	Others	Ooranies	Defunct Bore Well Recharge	Recharge Shaft	Rooftop RWH	Hydro Fracturing	Total
220	54	3		2	5	28		30		342

Categorization of Firkas:

The status of Categorization of firkas as of March 2020 for the District in is shown below.

Categorisation Based On Extraction (As On 2020)	No. Of Firkas	Firkas
Over Exploited (>100%)	2	Pazhavor, Vannikonenthal
Critical (90%-100%)	1	Radhapuram
Semi Critical (70%-90%)	6	Levinjipuram, Manur, Moolakaraipatti, Sivanthipatti, Thalaiyuthu, Vijayanarayanapuram
Safe (<70%)	20	Ambasamudram, Cheranmahadevi, Eruvadi, Gangaikondan, Kalakadu, Madhavakurichi, Melapattam, Melaseval, Mukkudal, Muneerpallam, Nanguneri, Naranammalpuram, Palayamkottai, Panagudi, Poolam, Samugarengapuram, Singampatti, Tirunelveli, Tisayanvilai, Valliyoor
Others (Poor & Saline)	0	

Total

29
TWAD BOARD

TamilNadu Water Supply And Drainage Board

(Under Municipal Administration and Water Supply Department - MAWS)



Rural Habitations

Total No. of Rural Habitations: 2511

Partially covered	275 (10-39 lpcd)
Fully covered	2236 (40 lpcd and above)

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/301522857>

Impact of Mining Activity on Water Resource : An Overview study

Conference Paper · February 2016

CITATIONS

14

READS

37,170

3 authors, including:



Dalchand Jhariya

National Institute of Technology Raipur

120 PUBLICATIONS 644 CITATIONS

SEE PROFILE



Rubia Khan

National Institute of Technology Raipur

13 PUBLICATIONS 227 CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:



Topic is related to Research scholar who is doing Doctoral research [View project](#)



Identification of Potential Groundwater Artificial Recharge Zones for Rainwater Harvesting [View project](#)



Impact of Mining Activity on Water Resource : An Overview study

D.C. Jhariya*, Rubia Khan, G.S. Thakur

National Institute of Technology, Raipur
Raipur, India

*dcjhariya.geo@nitrr.ac.in

Abstract— Mining plays an important role in national economy and on the other hand mining adversely impact our environment. Mining exert pressure on environment at many stages of mining operation. The environmental problems arising due to mining activities are Land degradation, Degradation of forest and loss of biodiversity, Soil contamination, Air pollution, Surface and ground water pollution, noise and vibrations, Deterioration of natural drainage system. Perhaps the most significant impact of a mining is, its effects on water resources. The impact of mining on surface and groundwater is due to spill/tailing, erosion, sedimentation, acid mine drainage, lowering of water table, subsidence, disturbance on hydrological cycle and rainfall. Acid mine drainage is considered one of mining's most serious threats to water resources. A mine with acid drainage has the potential for long term devastating impacts on rivers, streams and aquatic life. Acid mine drainage may be released from any part of the mine where sulfides are exposed to air and water, including waste rock piles, tailings, open pits,

underground tunnels, and leach pads. For minimizing the problem Stakeholders and Government should aware about the Rules and Regulation which comes under "The Environmental Protection Act, 1987". Present study is a review study of impact of mining and its impact on water resources.

I. INTRODUCTION

Mining refers to the process of extracting metals and minerals from the earth (Hudson, 2012). Mining Industry works to extract the metals and minerals that our society needs for agriculture, housing, music, telecommunication, the environmental industry, construction, space exploration and medicines (Sumi et al., 2001). Now, today we can't think to leave without minerals (Jhariya and Chourasia, 2010). Mining Industry not only provides comfort in our daily life but also provide many employment opportunities(Fig.1).

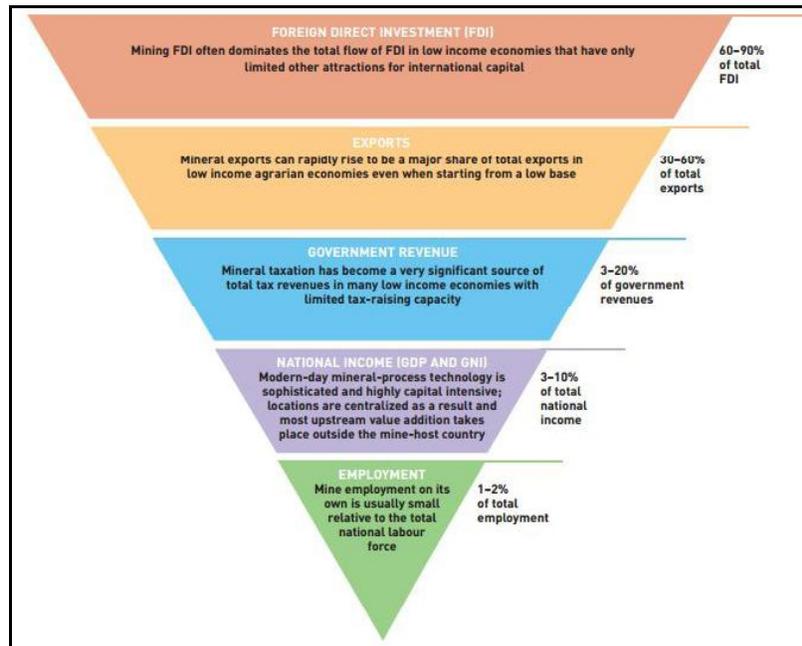


Fig.1. Macroeconomics contribution to low and middle income economics (ICMM,2012).



Recent Practices and Innovations in Mining Industry

It is well known that every aspect have to phases one is positive and other is negative. Mining is a major economic activity in many developing countries (Sumi et al., 2001, Jhariya and Chourasia, 2010). Mining operation whether small or large scale, are inherently disruptive to the environment, producing enormous quantities of waste that can have deleterious impact for decades (Sumi et al., 2001; Kitula, 2005). The environmental deterioration caused by mining occurs mainly as a result of inappropriate and wasteful working practices and rehabilitation measures (Jhariya and Chourasia, 2010 ;Mondal et al., 2014). The environmental problems arising due to mining activities are Land degradation, Degradation of forest and loss of biodiversity, Soil contamination, Air pollution, Surface and ground water pollution, noise and vibrations, Deterioration of natural drainage system (Sumi et al., 2001; Dasgupta, 2012; Mondal et al., 2014). Surface and groundwater pollution is one of the significant impacts of mining activity (Hudson, 2012). The mining sector uses large quantities of water, though some mines do reuse of their water intake (Sumi et al., 2001). Mining throws sulphide-containing minerals into the air, where they oxidize and react with water to form sulphuric acid (Sumi et al., 2001; Mehta, 2002; Hudson, 2012). This, together with various trace element impacts groundwater, both from the surface and underground mines (Hudson, 2012).

Water resources are very important for sustainable development of human life. Even for forest, wild life and aquatic life are all depend on water. Every one need fresh and clean water. Mining activities deteriorates water quality and quantity day by day. Thus protecting water quality is a high priority environmental challenge at mining and mineral processing sites. Thus, in present paper a review study is made to understand the impact of mining activities on water resource.

II. IMPACT OF MINING ON WATER RESOURCE

Water pollution is a major concern in mining operation (Sumi et al., 2001; Hudson, 2012; Dasgupta, 2012). Spill/leakage of effluent containing toxic chemicals or discharge of leachate from mine waste, surface runoff from overburden dumps, result degradation of water quality (Hudson, 2012; Karmakar et al., 2012). According to the Karnataka state Remote sensing Application centre conducted a study during 2003 in Bellary Hospet and Sandur Taluk and found silt deposition in water bodies near the mining areas. Discharge of effluent from Gold mine, containing toxic chemicals like cyanides in mine tailings from Hutti gold mines. Gold mining

causes severe water pollution due to presence of toxic chemicals like cyanide in mine tailing.

III. WATER POLLUTION

Mining process has bad impact on surrounding environment (Sumi et al., 2001; Dasgupta, 2012). The result can be unnaturally high concentration of some chemicals, such as arsenic sulfuric acid and mercury over a significant area of surface or groundwater (Kamakar et al., 2012). There is potential for massive contamination of the area surrounding mines due to the various chemicals used in the mining process as well as the potentially damaging compound and the metal removed from the ore (Hudson, 2012). Large amount of water produced from mine drainage, mine cooling, aqueous extraction and other mining processes increases the potential for these chemicals to contaminate ground and surface water (Dasgupta, 2012).

IV. SURFACE WATER

Surface water like streams, lakes and even ocean water in some cases, can be degraded by accidental spill of toxic chemicals, erosion of waste material, or discharging of contaminant water from mines. Following are the important reasons which are affecting surface water due to mining activities –

A. Spills And Tailing

Accidental spills of toxic chemicals from storage or processing facilities are potential concerns where ever they are used (Sumi et al., 2001; Dasgupta, 2012; Hudson, 2012). Some leaching chemicals may be left behind after the metals have been removed, mines commonly employ a combination of rinsing, physical isolation, and detoxification of heap leach pads before they are reclaimed and contaminated surface water body adversely (Hudson, 2012). For washing coal spill of thousands of liters of the industrial chemical into the Elk River, which serves as the water supply for the countries in the middle of the state. Some 300,000 people in the region have been advised not to drink the water. Problem has also been reported from Kota village, Raichur district due to the discharge for now some major case study of chemical spill is as follow:

- Fluorite Dam failure, Staua Italy, 1995
- Cyanide spill, Baira-Mare, Romania, 2000
- Tailing spill, Baira Borsa, Romania, 2000
- Mercury spill, Yanacocha, Peru, 2000



Recent Practices and Innovations in Mining Industry

B. Erosion

Erosion of waste materials, especially waste rock and tailing, can affect surface water quality (Sumi et al., 2001; Hudson, 2012). Major sources of erosion at mining sites can include open pit areas, heap and dump leaches, waste rock and overburden piles, tailings piles and dams, haul roads and access roads, ore stockpiles, vehicle and equipment maintenance areas, exploration areas, and reclamation areas (Sills et al., 2006). Waste rock disposal areas are located as close to mines as possible to minimize haulage costs, but if they are not properly sited, metal bearing element can be eroded into streams or other bodies of water (MINEO consortium, 2000; Dasgupta, 2012).

When this occurs, the material may react with water and oxygen to release metals and other potentially undesirable elements into streams (Hudson, 2012). Metals that become dissolved in surface water in this way are more bioavailable to organisms (Hudson, 2012). For example, even trace amounts of dissolved copper affects the nervous system of fish and can lead to lesion in their gills (MINEO consortium, 2000; Hudson, 2012). Due to erosion sediment deposited in layers in flood plains or terrestrial ecosystems can produce many impacts associated with surface waters, ground water, and terrestrial ecosystems (MINEO consortium, 2000; Sills et al., 2012). Minerals associated with deposited sediments may depress the pH of surface runoff thereby mobilizing heavy metals that can infiltrate into the surrounding subsoil or can be carried away to nearby surface waters (Sumi et al., 2001).



Fig.2. Hexavalent chromium dispersed by tailing wash-off, Sukinda mining district, India (MINEO consortium, 2000).

C. Acid Drainage

Acid drainage is a major environmental problem facing the mining industry is the formation of acid drainage and the associated mobilization of contaminants (MINEO consortium, 2000, Mehta, 2002; Hudson, 2012). Commonly called acid mine drainage (AMD) or acid rock drainage (ARD), acid drainage primarily depends on the mineralogy of the rock material and the availability of water and oxygen (Hudson, 2012). Acid drainage is generated at both abandoned and active mine sites (MINEO consortium, 2000). This acidic water is able to dissolve toxic metals, such as copper, aluminum, cadmium, arsenic, lead and mercury, from the surrounding rock. These metals, particularly the iron, may coat the stream bottom with an orange-red colored slime called yellow boy (Environment Australia, 2002).

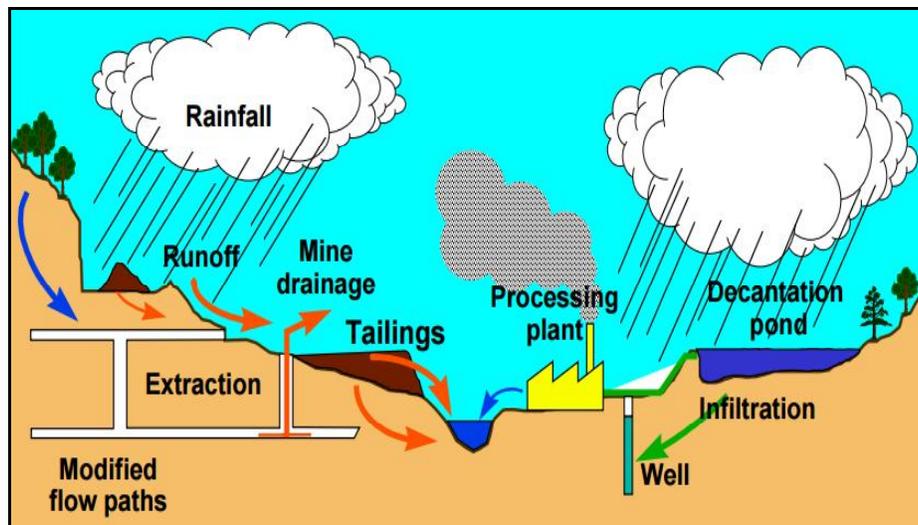


Fig.3. General sketch of surface and ground water by mining operation (MINEO consortium, 2000)



Recent Practices and Innovations in Mining Industry

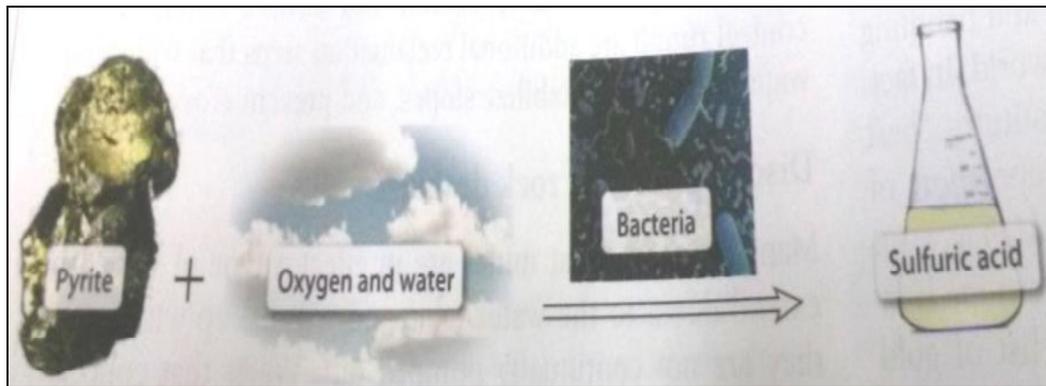


Fig.4. Generation of Acidic rock drainage(Hudson, 2012)

V. GROUNDWATER :

The quality and quantity of groundwater may get affected through various factors like surface hydrology, soil texture and terrestrial vegetation (MINEO consortium, 2000, Sumi et al., 2001). Though the quantity of water may be intercepted and pumped out or lost by evaporation thereby lowering the water table (Hudson, 2012). Groundwater quality is affected when wastewater infiltrate through surface water into groundwater and hydraulic connection between groundwater and surface water also contaminating the groundwater. A research done by National Environment Engineering Research Institute in 2002 revealed during monsoon period in the Bellary Hospet region, the fine material from dump site get carried away along the hill slopes through surface run-off and enters in to the nearby water bodies. Poor water quality due to presence of iron and manganese in groundwater resources around mining areas has been found in this area.

Impacts of mining activities on groundwater are as follows-

A. Groundwater quality

Mining operation and acid drainage can also affect groundwater (Jhariya and Chourasia, 2010). However, it is commonly necessary to place an impermeable barrier at the base of the tailing pond to prevent acidic drainage seepage. Older tailing ponds that were constructed without impermeable bases have generated acidic drainage that causes groundwater contamination (Hudson, 2012). Acidic water migrates into groundwater and eventually lose its acidity and able to dissolve heavy metal present in rocks and contaminate ground water quality (Hudson, 2012).

B. Groundwater level

Mining process creates disturbance on surface contour, drainage system and includes withdrawing

groundwater for mine working which lower the water table and change the way groundwater migrate in the subsurface (Jhariya and Chourasia, 2010; Hudson, 2012; karmakar et al., 2012). Chauhan, (2010) studied that in the Bijolia Mine, material mined is sandstone, it generates dust particles composed only of silica, which is not soluble and being heavy settles down at the bottom of reservoir like ponds, wells and does not affect the portability but affect recharging capacity of the ground water which lower the water level.

1. Dewatering mine: When an open pit intersect with water table groundwater flows into the open pit (Hudson, 2012). Pumping and discharging mine water causes a unique set of environmental impacts. For mining operation when groundwater pumped from wells surrounding the mine, create a cone of depression in the groundwater table, thereby reducing infiltration and groundwater level (Karmakar et al., 2012).

2. Loss of vegetation: Mining process involves loss of vegetation because of which runoff take place and reduces infiltration. And, ultimately lower the groundwater level (Jhariya and Chourasia, 2010).

3. Subsidence: Mining process involves excavation of minerals from earth which some time causes subsidence of above material which change the migration of groundwater flow, changes the catchment area and groundwater level (Karmakar et al., 2012).

4. Rise of temperature: In mining areas it is generally noted that temperature of mining area is high as compare to adjacent surrounding area (Sumi et al., 2001; Karmakar et al., 2012). As mining start cleaning of trees are involve which controls the process of evapotranspiration and increases amount of Carbon dioxide in the atmosphere which responsible for increase in temperature. And, ultimately affect the groundwater level (karmakar et al., 2012)



Recent Practices and Innovations in Mining Industry

VI. IMPACT ON HYDROLOGICAL CYCLE AND RAINFALL

Mining process imbalances the ecosystem, which in turn affect the hydrological cycle and rainfall (Jhariya and Chourasia, 2010). Reduction of moisture in soil and air, disturbance of drainage system, deforestation etc. will responsible for erratic hydrological cycle and unpredictable rainfall (Jhariya and Chourasia, 2010; Karmakar et al., 2012). Due to mining green cover declines, and forest play a significant role in the hydrological cycle through evapotranspiration and contribute greatly to the atmospheric water leading to precipitation (Jhariya and Chourasia, 2010; Dubey et al., 2011; Frelich, 2014). Evapotranspiration is an important part of the hydrological cycle. And, thus disturb hydrological cycle.

VII. MITIGATION MEASURE FOR CONTROL THE IMPACT OF MINING ON WATER RESOURCE

The use of water in mining areas is very risky. Mining activities will invariably have an impact on water environment through direct or indirect contact of either the surface or groundwater. Therefore, industries must invest in ensuring that water is not contaminated or where contamination does occur, they invest in treatment or containment within appropriate reservoirs, pipelines, canals or other storage facilities. Mining industries must encourage adopting practices and technologies which are environment friendly. The practice that must be followed by the industries is as follows:

- Resource conservation and management by scientific way with minimum waste, finding
- substitutes of the mineral widely used at present.
- Proper recycling of used metals.
- Adoption of environmental friendly technologies.
- Efficient use of energy.
- Afforestation and preservation of biological diversity.
- Government should not permit mining operation in ecologically sensitive areas.
- Follow Acts, Rules and Regulation made by Ministry of Environment, Forest and climate change.

VIII. THE ENVIRONMENT PROTECTION ACT, 1987

An act to provide for the protection and

Improvement of environment and or matters connected with. The act was established at the United Nations Conference on the Human Environment held at Stockholm in June, 1972. In which India participated, to take appropriate steps for the protection and improvement of environment. Silent features of the act are as follows:

- It extends to the whole of India.
- "Environment" includes water, air and land and the interrelationship which exist among and between water, air and land, and human being, other living creatures, plants, microorganisms and property.
- "Environment pollutant" means any solid, liquid or gaseous substance present in such concentration as may be, or tend to be injurious to environment.
- "Environment pollution" means the presence in the environment of any environmental pollutant.
- "Handling" in relation to any substance, means the manufacture, processing, treatment, package, storage, transportation use, collection, and destruction, conversion, offering for sale, transfer or the like of such substance.
- "Hazardous substance" means any substance or preparation which, by reason of its chemical or physico-chemical properties or handling is liable to cause harm to human beings, other living creatures, plants, micro organisms, property or the environment.
- "Occupier" in relation to any factory or premises, means a person who has control over the affairs of the factory or the premises and includes, in relation to any substance, the person in possession of the substance.
- "Prescribed" means prescribed by rules made under this Act.

General Powers of the Central Government include-

- Power of Central Government to take measures,
- Protect and improve environment,
- Appointment of officers and their powers and function,
- Powers to give direction,
- Made rules to regulate environmental pollution,



Recent Practices and Innovations in Mining Industry

A. *Prevention, Control and Abatement of Environmental Pollution*

- Person carrying on industry operation etc. not to allow emission or discharge of
- environmental pollution in excess of the standard,
- Furnishing of information to authorities and agencies in certain cases,
- Powers of entry and inspection,
- Power to take sample procedure to be followed in connection therewith,
- Environmental laboratories,
- Government analysis,
- Reports of government analysis,
- Penalty for contravention of the provisions of the act and the rules, orders and directions,
- Offences by companies,
- Offences by Government department.

X. WATER POLLUTION RULES AND REGULATION

The Water (Prevention and Control of Pollution) Act was enacted in 1974 to provide for the prevention and control of water pollution, and for the maintaining or restoring of wholesomeness of water in the country. The Act was amended in 1988. The Water (Prevention and Control of Pollution) Cess Act was enacted in 1977, to provide for the levy and collection of a cess on water consumed by persons operating and carrying on certain types of industrial activities. This cess is collected with a view to augment the resources of the Central Board and the State Boards for the prevention and control of water pollution constituted under the Water (Prevention and Control of Pollution) Act, 1974. The Act was last amended in 2003.

A. *Acts*

- No.36 of 1977, [7/12/1977] - The Water (Prevention and Control of Pollution) Cess Act, 1977,
- No.19 of 2003, [17/3/2003] - The Water (Prevention and Control of Pollution) Cess (Amendment) Act,2003,
- No.6 of 1974, [23/3/1974] - The Water (Prevention and Control of Pollution) Act, 1974, amended 1988.

B. *Rules*

- G.S.R.860(E), [30/11/2012] - The Central Pollution Control Board (Qualifications and other Terms and Conditions of Service of Chairman)(Amendment) Rules, 2012.
- G.S.R.840(E), [22/11/2012] - The Central Pollution Control Board (Member-Secretary, Terms and Conditions of Service and Recruitment) Rules, 2012.
- G.S.R.830(E), [24/11/2011] - The Water (Prevention and Control of Pollution) Amendment Rules, 2011.
- G.S.R.378(E), [24/7/1978] - The Water (Prevention and Control of Pollution) Cess Rules, 1978.
- G.S.R.58(E), [27/2/1975] - The Water (Prevention and Control of Pollution) Rules, 1975.
- Central Board for the prevention and control of water pollution (Procedure for Transaction of Business) Rules, 1975 amended 1976.

IX. CONCLUSION

- Mining practices caused serious environmental impacts related to water pollution, land degradation, loss of biodiversity, air pollution, increase in health related problems, noise pollution, vibration, land subsidence and landslides, surface and groundwater pollution is one of the significant impacts of mining activity.
- The government should aim at providing technical support to local mine stakeholders such as training in facilitation and management task to local stakeholders. New technology has to be developed that uses fewer chemicals during extraction and processing, and mine waste should regulate and turned into a non-harmful form before it is discharged to waste ponds.
- It has to be mandatory for all mining activities taking place, at both at large and small scale, to submit true environmental impact assessment report to get mine license.
- Government should strictly implement the act " The Environmental Protection Act, 1987" to all mine sector and should appoint inspection officer to check whether the mine holder following the act or not.

REFERENCES

- [1] Chauhan, S. S. (2010) Mining, Development and Environment: A case study of bijolia Mining area in Rajasthan, India.



Recent Practices and Innovations in Mining Industry

- [2] Dasgupta, A. (2012) Impact of mining on rural environmental and economy. A case study, Kota district, Rajasthan. *International Journal of Remote sensing and Geoscience (IJRSG)*.v.2,pp.21-26.
- [3] Dubey, K. and Dubey, P. K. (2011) Impact of Mining on tree diversity of the silica mining forest area at Shankargarh, Allahabad, India. *Journal of forestry Research*.v.22(4),pp.527-432.
- [4] Frelich, E. L. (2014) Forest and terrestrial ecosystem impacts of mining. The University of Minnesota Center for Forest Ecology.
- [5] Hudson, T. (2012) *Living with Earth, An Introduction to Environmental Geology*. PHI Learning Private Limited.
- [6] ICMM (2012) Mining contribution to sustainable development. International Council on Mining and Metals. www.icmm.com.
- [7] Jhariya, D. and Choraesia, K. (2010) Khanij utpadan ka jal sansadhan aivam jal sanrakshan par prabhav. *Bhu - Jal Sanvardhan aivam Jal sansadhano ka sanrakshan*.
- [8] Karmakar, H.N., Das, K. P. (2012) Impact of Mining on Ground & Surface water. International Mine Water Association. www.IMWA.info.
- [9] Kitula, N. G. A. (2005) The environmental and socio-economic impacts of mining on local livelihood in Tanzania: A case study of Geita District. *Journal of cleaner production*.v.14,pp.405-414.
- [10] Mehta, S. P. (2002) The Indian Mining Sector: Effects on the Environment and FDI Inflows. Conference on foreign Direct Investment and the Environment.
- [11] Mineo Consortium (2000) Review of potential environment and social impacts of mining. www.brgm.fr/mineo
- [12] Mondal, S., Bandayopahyay, J. and Chakarvarty, D. (2014) Scientific Investigation of the Environmental Impact of Mines Using Geospatial Techniques over a small part of Keonjhar District of Orissa. *International Journal of Scientific and Research Publication*.v.4,pp.1-8.
- [13] Sills, E., Pattmayak, K. S., Saha, S., Yang, C. J., Sahu, P. and Singha, A. (2006) Mine over matter? Health, wealth and forests in a mining area of Orissa. Government of Orissa, Action Planning Workshop on Growth and Environment in Orissa, Bhubaneswar, India.
- [14] Sumi, L. and Thomsen, S. (2001) Mining in Remote Areas, Issues and Impacts. *MinindWatch Canada/ Mines Alert*.
- [15] The Environment (Protection) Act, 1986, Ministry of Environment & Forests.



At the end of the day, the team had a meeting to discuss the day's findings. The team leader, Mr. Sharma, was very pleased with the progress made. He said that the team had done a great job and that they were looking forward to the next day's work. The team members were also very happy and proud of their work. They had learned a lot from the excavation and were looking forward to sharing their findings with the public. The team leader also mentioned that they had found some interesting artifacts, including a small pot and some tools. He said that they would be studying these artifacts in more detail in the coming days. The team members were also very interested in the findings and were looking forward to seeing the artifacts in person. The team leader also mentioned that they had found some interesting structures, including a large wall and a small building. He said that they would be studying these structures in more detail in the coming days. The team members were also very interested in the findings and were looking forward to seeing the structures in person. The team leader also mentioned that they had found some interesting artifacts, including a small pot and some tools. He said that they would be studying these artifacts in more detail in the coming days. The team members were also very interested in the findings and were looking forward to seeing the artifacts in person.

