Indian J.Sci.Res. 4(2) : 139-142, 2013 ISSN : 0976-2876 (Print)
ISSN : 2250-0138 (Online)

WASTE MANAGEMENT IN MINING INDUSTRY

RAJDEEP DAS[a1] AND IPSEET CHOUDHURY[b]

[ab]Department of Mining Engineering, Godavari Institute of Engineering and Technology, Rajahmundry, A. P., India

ABSTRACT

This paper with the title Waste Management in Mining Industry mainly deals with the large amount of waste generated by the mining industry in the process of extraction of minerals which is a great threat to the environment leading to air pollution soil pollution and many other hazardous effects to the environment as well as human lives . This paper broadly discusses about the different type of mine waste generated during the entire mining process right from the mineral extracting to the beneficiation process which provides a complete view of the mine waste generated by the different mining methods like surface mining, underground mining etc used in the extraction process of minerals from the earth's crust. It also gives the details about the amount of waste materials generated in extracting different minerals like gold, diamond etc., especially in extracting radioactive mineral like uranium. It also discusses about tailings. The result material created by the mineral beneficiation or milling process and various method of disposing this tailings without effecting the environment. This paper also reviews about the impacts of this mine waste on the environment and how it is a threat to the human lives. It also discusses the most efficient methods to deal with this global problem faced by people all over the world as it is the concern of our extinction in this beautiful earth.

KEYWORDS : Waste, Mining, Mineral, Extracting, Milling

The wastes being generated by the mining industry is mainly during the process of extraction, beneficiation and processing of minerals. Extraction which is the first phase that consists of initial removal of ore from the earthcrust which is done by the process of blasting which results in generation of large volume of waste such as soil, debris and other material which is useless for the industry and is just stored in big piles within the mine lease area, and sometimes, on public land. This is one of the way by which large amount of waste is generated by the process.

The bigger the scale of the mine, greater is the quantum of waste generated. Out of the two major types of mining methods (opencast and underground). The Opencast mining methods are therefore more pollution intensive as they generate 8 to 10 times more quantities of waste compared to the underground mines.

Current Scenario

There is no estimation that how much waste is generated by the mining industry globally. But, everyone agrees that the quantity is so huge that is unimaginable.

For example, the production of 1tonne of copper generates 110 tonnes of waste ore and 200 tones of overburden. Therefore it is a matter of concern that if the production of one metal is generating so much of waste, how much the entire industry would be generating.

Some Major Types of Waste Generated

Waste rock

Mining operations generate two types of waste rock overburden and mine development rock.

Overburden results from the development of surface mines, while mine development rock is a byproduct of mineral extraction in underground mines

The ratio of overburden excavated to the amount of mineral removed is called the overburden ratio or stripping ratio. For example a stripping ratio of 4:1 means that 4 tonnes of waste rock are removed to extract one tonne of ore.

As demand for coal increases to meet the country's energy requirement, the coal companies are digging deeper and deeper and even opting for lower grades of coal. The country is even planning for production from 300 m depths at stripping ratio of 1:15 for D and F grade quality of coal. If these mines were operational, it would mean that even if 1 million tonnes of coal were extracted, it would generate 15 million tonnes of waste material.

Tailings

This are an output of mineral beneficiation process. In this process the minerals which cannot be used for metal extraction directly has to be concentrated before it being used.

The entire process of concentration of the basic ore,is done by the grinding and milling process. Tailings are generally in the form of a slurry which contains certain hazardous contents such as arsenic, barite, calcite, cyanide, fluorite, mercury, pyrite and quartz.The slurry or the tailings is stored in a storage area called as the Tailings Dam or a

[1]**Corresponding author**

Table 1: Sector-Specific Wastes Generated During Mining

SECTOR	MINING TYPE	BENEFICIATION/ PROCESSING	PRIMARY WASTES
Gold-Silver	Surface	Cynidation	Mine water
	Underground	Elution	Overburden
	In-situ	Zinc precipitation	Spent process solutions
	Experimental	Milling	Tailings
		Base metal floatation	Spent ore
		Smelting	
		Amalgamation	
Lead-Zinc	Underground	Milling	Mine water
		Floatation	Overburden/ waste rock
		Sintering	Tailings
		Smelting	Slag
Copper	Surface	Milling	Mine water
	Underground	Floatation	Overburden/ waste rock
	In-situ	Smelting	Tailings
		Acid-leaching	Slag
		SX/EW recovery	Spent ore
		Iron precipitation	Spent leach solution
Iron	Surface	Milling	Mine water
		Magnetic separation	Overburden/ waste rock
	Underground	Gravity separation	Tailings
		Floatation	Slag
		Agglomeration	
		Blast furnace	
Bauxite	In situ (Bayer Process)	Filtering	Red mud

(Contd.)

		Smelting	Various chemical emissions like Fluoride, PAHs, Sulphur Dioxide, Carbon Dioxide, Inorganic Fluorides, etc.
		Electrolysis	Cathode Waste
	Underground	Milling	Overburden
Limestone	Underground	Milling	Overburden & Intraburden

Tailings Management Facility (TMF).

As this tailings are very hazardous both for the human beings and too for the environment so a proper disposal method of the tailings is to be done.

TAILINGS DISPOSAL METHOD

Pond storage

In this method the exhausted open pit mines are refilled with the tailings.

Dry sacking

Here in this process the dewatering of tailings is done using vacuums and filters which save the water and reduces the impact on the environment.

Disposal into underground workings

In this process the disposal of the tailings is done in the exhausted underground mines which is truly a complex method.

Disposal into the oceans

It is also known as STD (Submarine Tailings Disposal) or Deep Sea Tailings Disposal. Tailings can be conveyed using a pipeline then discharged so as to eventually descend into the depths. Practically, it is not an ideal method, as the close proximity to off-shelf depths is rare. STD is used, the depth of discharge is often what would be considered shallow, and extensive damage to the seafloor can result due to covering by the tailings product. It is also critical to control the density and temperature of the tailings product, to prevent it from travelling long distances or even floating to the surface.

Phytostabilisation

Phytostabilisation is a form of phytoremediation that uses plants for long-term stabilization and containment of tailings, by sequestering pollutants in soil near the roots. The plant's presence can reduce wind erosion, or the plant's roots can prevent water erosion, immobilize metals by adsorption or accumulation, and provide a zone around the roots where the metals can precipitate and stabilize. Pollutants become less bioavailable and livestock, wildlife, and human exposure is reduced. This approach can be especially useful in dry environments, which are subject to wind and water dispersion. Tailings are of great and growing concern in mining sector, specifically due to presence of heavy metals. The storage of tailings is commonly identified as the one of most important source of environmental impact for many mining operations. This is not surprising considering that the volume of tailings requiring storage can often exceed the in-situ total volume of the ore being mined and processed. In a single year, around 6.5 million tonnes of tailings is generated in the world.

Arsenic Contamination in Gold Mining

elevated arsenic content is found in the surface and the ground water in the gold mining areas all round the world as the high content of arsenic in the surface as well as in the ground water is hazardous to the human beings and the several species who are the habitat of that particular mining area.

So an extensive hydrological area is compulsory to be done.

Measure to be taken regarding arsenic contamination

1. More concentration should be given to the potential impacts of spent ore and waste rock disposal on the surface and ground water.
2. Many natural soils and man-made clay liners have the capacity to minimize the content of arsenic in the mine water.

Overburden Management

As a large amount of overburden is being generated by the mining industry which is a great threat to the environment, therefore a perfect well management of this overburden should be done.

The best use for overburden waste is to backfill the excavated land,

Some of the most common method of stabilization is by plantation. Overburden dumps are generally reclaimed by tree species as plantation improves the moisture contents, bulk density, pH and overall nutrient contents of soils. Tree species like Dalbergia sissoo, Eucalyptus, Cassia seamea, Acaccia mangium and Peltaphorum are ideal for bioreclamation of overburden dumps. some other preventive measure to be taken at the initial stage are

1. Excavation from a new pit should begin only after an existing pit has been exhausted.
2. Till a pit is exhausted, the overburden should be properly compacted and stacked in.

Specified locations in low-lying non-mineralized zones within the lease area.

3. The height and slope of the overburden dumps should be maintained to prevent accidents.
4. Drainage should be considered to handle heavy rainfall.
5. Sedimentation

CONCLUSION

With the present scenario where the extraction of minerals is done on a large scale it is became a highly mater of concern regarding the waste being generated by this mineral extraction, which has a severe impact on the environment , therfore a regular study should be taken in accordace with the application of latest technology inorder to sustain this earth as a beautiful earth.

REFERENCES

www.imwa.ifo
mine water and environment pdf.
Waste management wikipedia
www.nit rourkela .com
mine overburden a problem pdf