Environmental Science

Lecture 4

Mining and Extraction

Surface mining can make use of any of the following three types:- You have **Open-Pit Mining** in which machines dig deep holes and remove the ores. This is done in cases for Copper, Iron, Gravel, Limestone, Marble and Granite. **Dredging** is a kind where chained buckets and draglines are used which scrap up minerals from under-water mineral deposits. **Strip Mining** in which the ore is stripped off by using bull dozers or power shovels and stripping wheels. This is done for Phosphorus and Phosphate rocks.

If you look at the **Mineral Resource Development Cycle**, first you have **available land resources**. You then have **an explanation** which is done for nearly 8 to 10 years. Then you need to get **an environmental assessment and approval**, to prove that mining here is not going to be an issue, and if at all there are going to be issues how are you going to go about dealing with it. So you will have **stake holder consultation**. Then the **construction of the mine** will go on for about one to three years. **Operation of the mine** depending on the ore goes on to about 10 to 30 years. Then the **closure.** Once they exhaust, the ore is completely exhausted, the closure of the mine according to safety norms takes about 1 to 2 years. **Reclamation of that land** takes that is the land can be used for something else, takes for about 1 to 4 years and **monitoring** for that 5 years. And that again becomes available land either for agriculture, urban development, forest development, whatever. But that can be done only if the closure operation as well as construction is done based on certain norms that have been declared by the environmental authorities and when reclamation is happening and the monitoring phase is happening, it has to be done in an appropriate phased manner.

Now if you look at the **Different Problems** that you face. You have **surface water pollution, air pollution**, and **occupational health hazards**.

The **Remedial Measures** that we have are **low grade ores can be better utilized by using microbial – leaching technique**. This biological method is helpful from economic as well as environmental point of view. **Restoration of mined areas by re-vegetating them**, that is making sure the land is going to be utilized either may be not for agriculture but at least as a forest cover.

Mining and the Law:-Law actually plays a very crucial role in moulding the approach of the mining industry with sustainable methods- Mining companies are made to comply with certain prescribed environmental obligations at mining sites. You have punishable offenses and penalties under criminal offences for mining. Mining companies that do not comprehend or do not follow these laws and actually cause serious or material harm or nuisance to the land or the people around them. An official permission or grant or authorization is definitely required from the governing authority under the ministry of mines before undertaking exploration of mining activities. Forget even going to the construction phase, to just explore you need to get permission because even exploration involves a lot of damage that is done to the land by probing and all of that. Mining companies are required to have certain environmental protection management systems installed in place for their mining sites. This is

very important for the people, the workers who are going to be involved in the mining process. There should be a fire engine. There should be certain mitigating elements that are there to ensure that if there is a leakage of a poisonous gas , there should gas mask available, Evacuation systems in place, many other such systems that are required by the authorities. Mining companies can have to pay something like a deposit money . Like how a tenant pays a deposit money to the owner. The same way does the mining company does the same way such that, that when the clearing up, the mine is shut down and clearing up of the mine is taking place, if that money will be utilized for the same process without having the government to pay for it.

Regulatory Framework for Management of Environmental Problems of the mining sector:- **The Forest Conservation Act of 1980 and rules 1981.** The Forest Conservation Act actually prohibits diversion of any forest land to the non forestry activities including mining. However, with special permission from the Government of India, this diversion is permitted. For instance, if the mineral ore is quintessential for the development of the country, for the development of the economy, there have been instances were deviations have been permitted. And if the area approved for mining does not contain any bio-diversity and does not harm the eco-system directly. All the mining projects, existing or old sanctioned, before the enactment of the act, are to be reviewed, before renewing the lease.

The Water Act 1974

The Water Prevention and Control of Pollution Act 1974;-This actually establishes an institutional structure for preventing and abating water pollution. It establishes standards for water quality and effluent, that is any discharges for the mining or related industries. Polluting industries must seek permission to discharge waste into effluent bodies. Under this act consents are required- to establish a mining project; to operate a mining project. While issues of these consents, the Pollution Control Board specifies the standards for water pollutants and monitors the same. The Water Prevention And Control Pollution Cess Act 1977- provides framework for collection of levy and Cess on water consumed by industries including the mining industry. The Cess collected is to be used by CPCB and the PCB's to prevent and control water pollution. So they to garnered the same Act like a deposit is being collected, which actually makes sure that people abide by these rules, and if they do not, there is a surcharge they have to pay for the same.

The Air Prevention and Control of Pollution Act :- This provides for the control and abatement of air pollution. It entrust the power of enforcing the act to the CPCB. This law has defined an air pollutant, as any solid, liquid or gaseous substance present in the atmosphere, in such a concentration, that it may tend to be injurious to human beings, or other living creatures, or plants, or property, or the environment. So it encompasses a vast spectrum of chemical, either in the solid, gaseous or liquid state. Under this act consents are required to establish a mining project, to operate the project and while issue of these consents, as the Pollution Control Board specifies the standards for air. There is a particular particulate per million that is allowed. There is a particular thing similarly for water. So all of these standards have to be maintained and during the course of the operation there could be sudden checks and if any of these values are too high or too low, then the mining operations might have to be altered or changed.

The Environment Protection Act 1986:-This authorizes the Central government to protect and improve environmental quality, control and reduce pollution, from all sources and prohibit or restrict the setting or operation of industrial facility on environmental grounds. It is under this act that makes it mandatory for the specified 30 categories of industries, which includes mining, which have investment beyond certain threshold, that an Environment Impact Assessment is required. And this usually is garnered for the mining industry during the phase where they are looking at the site for mining operations and again during the operational phase when it starts the work starts happening.

The Wildlife Protection Act of 1972 and again it was amended in 1991:- This provides for the protection of birds and animals, and for all matters that are connected to it, whether let it be the Habitat, or the waterhole or the forest that sustain them. In case of sanctuaries and the national parks, diversion is not generally allowed, unless the project is of national importance and no other alternative is available. In such cases then a no objection has to be initially accorded by the Indian Board of Wildlife and state legislature before consideration by MOEF for diversions. So it is very important that we analyze what is the level of national importance and what are the levels of alternatives that are available. Especially in a developing country, like India the importance is obviously given to growth and development of the country and economics of the country. But what we fail to understand is we cannot actually assign a value towards bio-diversity or towards the forest or the wildlife. Because later on, it is us ,that we are terribly affected by these consequences. Right now the consequences may not seem to dire but as a result of this , this could just be a beginning of a huge chain reaction.

We'll study a couple **of case studies**:- This is the mining in Sariska Tiger Reserves in the Aravallis- The Aravalli is a range that is spread around 692 km in the north west India, covering Gujarat, Rajasthan , Harayana and Delhi. This hilly region is very rich in Bio-diversity as well as mineral resources .The Sariska Tiger Reserve has a gentle sloppy hill, vertical rocky valleys, flat plains as well as deep gorges. The reserve is very rich in wildlife and has enormous mineral reserves like quartzite, schists, marble, granite in abundance. Mining operations within and around the Sariska Tiger Reserve has left many areas permanently infertile and barren. The precious wildlife is now under serious threat. We must preserve the Aravallis Series as a national heritage and the Supreme court on December 31st, 1991 , has given a judgement in response to a Public Interest Litigation of Tarun Bharat Singh , an NGO where both the centre and the state government of Rajasthan have been directed to ensure that all mining activity within the park be stopped. More than 400 mines were shut down, but still some illegal mining is in progress. So the laws have been amended and this was in '91 when the amendment of the Wildlife Act also happened as a result of the Aravalli hills. The Tigers were dropping dead and because the mining operations were happening , people were moving in and out of the reserve and because of this it lead to illegal poaching of tigers and the water holes were getting polluted, the tigers were getting polluted. It was leading to infertility among the female tigers and they couldn't have cubs. And because of that the species has come to state where it became nearly came to extinct.

This is another **case study in Udaipur**:-**Mining and Quarrying in Udaipur**-About 200 open cast mining and quarrying centres in Udaipur , about half of which are illegal and are involved in stone mining including soapstone, building stone, rock phosphate and dolomite. These mines are spread over 15,000 hectares in Udaipur and have caused many adverse impacts on the environment. About 150 tonnes of

explosives are used per month in blasting. The over burden , wash off, discharge of mine water extra pollutes all the surrounding water bodies and because of the scarring, it actually leads to runoff and soil erosion and basic erosion of the fertile area.

The **Maton Mines have badly polluted the Ahar River**. The hills around the mines are devoid of any vegetation except a few scattered patches, and the hills are suffering from acute soil erosion. You can see the green effluents pouring into the water and how ,because of that there is no life at all in these water bodies. The waste water flows towards a big tank of Bag Dhara. Due to scarcity of water people are compelled to actually use this dirty water for irrigation purposes, and you can imagine the consequences of that. Because of the polluted being used for irrigation, the plants and the grains, whatever that is getting irrigated, is also getting affected, and that in turn affects the food cycle, and the human beings who are eating the food. The blasting affect has adversely affected the fauna and the animals like tiger, lion, deer and even hares that is rabbits, fox , wild cats, birds have disappeared from this area. Obviously they do not realize that dynamites can cause quite a lot of repercussions in the flora and fauna. Even plants are capable of dying because of the high decibel noise, because of the pollution, the particulate matter in the air and because of that even all these animals have become, moved away completely from that area and some have completely perished.

Moving onto **Conservation of Minerals**:-Strong dependence of industry and agriculture upon mineral deposits and substances manufactured from them. Eg:- metallurgical industries, cement industries, pharmaceutical industries, fertilizers, pesticides etc. The total volume of workable mineral deposits is an insignificant fraction that is 1% of the earth's crust. We are rapidly consuming mineral resources that require millions of years to be created and concentrated. The geological processes of mineral formation are so slow that the rates of replenishment are infinitely small in comparison to the present rates of consumption. Mineral resources are finite and non-renewable. Rich mineral deposits are our country's extremely valuable but short lived possessions. Continued extraction of ores leads to increasing coast as mineral extension comes from greater depths along the decrease in quality. A concentrated effort has to be made in order to use our mineral resources in a planned and sustainable manner. Improved technologies need to be constantly evolved to see how we can make sure low grades ores are available and how low grade ores can be used at lower costs. So this has a two way advantage we save money as well as we are using the low grade ores as well. Recycling of metals using scrap metals and other substitutes are steps in conserving our mineral resources for the future. Now to sum it up , the mining industry, the government , the local people must work together to care for the future generations. There is also a need for better planning of reclamation/ restoration system to bring back the derelict land in short time for use. The enabling framework needs more focused strengthening to ensure that the principles of the environmental management practices are adopted .there should be commitment amongst the stake holders, policy makers and regulators at the highest level on environmental protection. May be that is how we can prevent it from merely being a' Search and Destroy Mission'. So what really happens with mining is these days even though the so called reclamation phase is given about 4 to 5 years, that land becomes unusable. So we have to keep that value in mind. That value is lost, the land value is lost and we are not talking about a couple of acres, we are talking about hectares and hectares of land and surrounding flora and fauna , surrounding water bodies, everything that is

getting affected. So we have to look upon the environment protection as the foremost category of intervention. Then obviously we know the value or mineral resource can be quantified. It sells for so many dollars a gallon, so many dollars a pound. All of that is set and decided and can be quantifiable. It is only damage to the environment that cannot be quantified and specified.

Food Resources

We have thousands of plants and animals over the world, out of which 3 dozen types constitutes the major food for human beings. The main food resources include rice, wheat, pulses, millet, potato, milk and about 20 or so common fruits and vegetables, meat, fish and seafood. About half the agricultural crops rice, wheat and maize grow each year. So we have about 1500 million metric tons each year. Meat and milk are mainly consumed by more developed nations of North America, Europe and Japan who consumes about 80% of the total. Fish and seafood contribute about 70 million metric tons of high quality protein to the world's diet. Meat and dairy products are considered as a rich source of nutrients; hence take a big portion of the plate.

Moving on **to different world food problems**:- number1:- **Natural Disasters**;- Climate change is having an increased impact on food production, as droughts , flooding become more frequent and more severe. Shrinking access to fertile land and water may trigger refugee crisis and conflicts.

Poverty Ultimately the main reason why most people are unable to feed themselves is not that food is not available. There is a lot of food, abundance of food actually. But they cannot afford it. But poverty also reduces the food output. Many African farmers produce small harvests because they lack irrigation as well as supporting measures like manure and fertilizers. For example, Africa has the lowest fertilizer usage in the world. A measure of how its farmers are simply unable to afford the high inputs caused by their developed nation counterparts.

Global Food Prices:- Rising Global Food prices affect people's ability to buy enough to feed their families, especially the urban poor who can spend as much as 80% of their income just on food. In 2007-2008 , the global prices of basics like rice , wheat and maize actually soared triggering many riots throughout the world.

Uncontrolled population:- the balance of production and consumption of food stuffs is also a problem. So on October 31st 2011, the world population grows upto 7 billion. So if the world population grows at the current pace, the amount of production of cereal crops is said to be unable to catch up with the population in the future. So population growth demands for more varied diets in countries like China and India. And there is a growing market for bio- fuel are putting more pressure on limited resources like land and water. if you look at the foreign companies they are taking over vast swaths of fertile farming land in poorer countries especially to grow food for export potentially diminishing the local farmers access to land and food**.**

Under nourishment – It is the lack of sufficient calories in food. According to the FAO estimate the average minimum daily requirement over the world is about 2500 calories per day. People who receive less than this calorie requirement are said to be under nourished. If the developing countries the 1 child

in 4 dies of 1 disease or due to under malnourishment or under nourishment they suffer from deafness, anemia, thyroid etc.

So you have **Malnourishment** as the next important cause. It relates to the deficiency of such nutrients in food such as proteins, vitamins or essential chemical elements. In poorer countries, not developing countries, but further down, people get malnourished because they just cannot afford a healthy diet like meat, fruit , milk and milk products and such as this leads to a variety of health problems like goiter, anemia etc.

And then you have the case of **over nutrition** like in Europe and United States where there is an excessive intake of calories and this problem has led to problems like obesity and diabetes.

Indian Scenario:-Although India is 3rd largest producer of staple crops an estimated 300 million Indians are still under nourished. Our food problems are directly related to population. Every year our food problem is killing as many people as were killed by the atomic bomb drop on Hiroshima during World War 2. World Food Summit in 1996, set up the target to reduce the number of under nourished to just half by 2015 which still means there are 410 million under nourished people on the earth.

So some of **the main problems** we will discuss- **Hunger:**- The **concept of Hunger and definition**. It actually has 3 meanings.- the uneasy or painful sensation caused by want of food; craving appetite; also the exhausted conditions caused by want of food; the want or scarcity of food in a country; a strong desire or craving. World hunger refers to the 2nd definition that is aggregated to the world level. The related technical term in this case is operationalized in medicine is malnutrition. So hunger and malnutrition are very much interconnected and it is the lack of food. The lack of food could be due to various reasons, poverty , not even having adequate land over there. Not having adequate measures even to irrigate the land all of that could be different reasons. But hunger and malnutrition do go hand in hand. So if you look at the number of hungry people in the world, Asia and Pacific take the majority of about 578 million. Developed countries have a very small slice of 19, and then you have Near East and North Africa, Latin America and the Caribbean. And main the next big chunk is the sub-Saharan Africa followed by 239 million. This census was taken in 2010.

Poverty is the **principal cause of hunger**. Harmful economic systems are the principal cause of poverty and hunger. Conflict as a cause of hunger as well as poverty could be political conflicts in countries such as refugees are coming in, or military conflicts any of these conflicts. Hunger is also a cause of poverty and thus of hunger. So it's like a viscous circle and climate change. When hunger is a prevalent issue in that place the productivity of people also reduces because they do not possess the basic stamina to work and earn a wage. And till they earn a wage they won't be able to afford the food.

Malnutrition:-if you look at it as an average minimum calorie intake on a global scale is 2500 calories per day. People receiving less than 90% of the minimum dietary calories are called under nourished. 80% is seriously under nourished. And deficiency and lack of nutrition often leads to malnutrition resulting in several diseases. So we look at a calorie intake over here, the normal ideal value is 2500. And then you have the undernourished and this is the daily calorie intake. You can see the basic population which actually gets full nourishment is just 10%, 80% basically are seriously under nourished.

What we can do is **solutions** for this;- **stopping Over Consumption**-that is the main reason. Distribute, like how we talk about redistribution of land, redistribution of water resources, even food has to be done like that. When Europe and America is facing a crisis were they are throwing food down the drain, because of having excess fruits and vegetables, we have to come up with suitable methods where this food can be channelized and given to countries that have no food at all.