Chapter 9

Environmental Impact and Economics of Metal Ore Extraction

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Spring 2022

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Introduction

- Metal ores are obtained by mining/quarrying and that this involved digging up and processing large amounts of rock.
- Most ores are mined have to be concentrated before the metal is extracted and purified. This often results in lots of waste material that must be dealt with from an environment of view.
- This means that metal or mineral extraction results in problems and issues in balancing ecological, environmental, economic, social advantage factors.
- Brazil is one of the world's primary supplier of gold. What people don't know is that mercury is needed in the extraction of gold. Now, the abundance of mercury in the soil and water has led to an increased mercury level in fish, which is very toxic not only to animals but to humans as well.

- The same can be said of metal extraction. Metal extraction can drastically affect the quality of air in the surrounding areas, what with the high levels of dust and gas in the area. There's also the noise pollution that it creates, which is affecting the natural habitat of animals. Last, metal extraction disfigures the landscape.
- Now, if companies continually extract metal, the land will forever be disfigured, causing flooding and soil erosion in the area. It will also cause large-scale natural habitat destruction, causing so many species to be uprooted. There's also the air and water pollution to consider.

Advantages

Examples of advantages of exploiting mineral resources:

- Useful products can be made from metal to enhance our lives – most consumer products we take for granted i.e.; we expect to have them at our disposal.
- Valuable revenue if the mineral or its products are exported.
- Jobs for people, especially new sources of employment in poor countries or areas of high unemployment in developed countries.
- Wages earned go into the local/national economy leading to improvements in schools, health service and transport etc.
- Increase in local facilities promoted e.g., transport systems, like roads, recreational and health social facilities.

Disadvantages

Examples of disadvantages of exploitation of mineral resources and reduction of its social and environmental impact:

- Dust from mining-quarrying or processing can be reduced by air filter and precipitation systems and even hosing water on dusty areas or spoil heaps or carried away to somewhere else via tall chimneys.
- Scarring of the landscape from mining, quarrying, waste tips etc. as well as loss of wildlife

- *Noise from process operation or transport of raw materials and products (lorries/trucks/wagons).*
- *Difficult to deal with, sound-proofing often not practical, but operations can be reduced for unsociable hours e.g., evening movement.*
- *Mining operations will disfigure the landscape BUT it can be re-claimed and 'landscaped' in an attempt to restore the original flora and fauna.*

Pollution can be reduced by cleaning the 'waste' or 'used' air, water and waste gases etc. of toxic or acidic materials e.g.:

1. Toxic carbon monoxide from the blast furnace extraction of iron, it can be burnt as a fuel, but it must not be released into the air unless converted to biologically harmless carbon dioxide.

2. Acidic gases like Sulphur dioxide can be removed by bubbling through an alkali solution such as calcium hydroxide solution ('limewater') where it is neutralized and oxidized to harmless calcium sulphate. Cleaning a gas in this way is called 'gas scrubbing'.

3. Sulphur dioxide gas from copper extraction of its sulphide ore is an irritating poisonous gas which can also cause acid rain, but it can be converted to the useful, therefore saleable, industrial chemical concentrated sulphuric acid, so you can remove a harmful pollutant and recover back some of the metal extraction costs, good green economics?

Cost of Extracting

The cost of extracting and purifying metals is quite varied for several reasons:

1. If the ore is plentiful, it is cheaper e.g., iron ore, but silver ores and gold are much rarer and, on that basis, alone they would be a more valuable commodity.
2. Reduction of ores using coke (e.g., iron), made from cheap coal, is cheaper than the electricity bill for extracting aluminum from its molten oxide by electrolysis, but different metals have different properties best suited for particular and different uses.
3. Generally speaking, more reactive metals (like Al) are more costly to extract than less reactive metals (like Fe) because of the different energy demands and ease of extraction, which may sometimes be due to more costly technology.

Recycling

RECYCLING is a very good idea because mineral resources are limited and manufacturing costs of many metals from their naturally occurring ores involves costly energy and environmental issues.

Collection of material to obtain metals from the recycle

1. Before any metals can be recycled the scrap metal must be collected.
2. The main problem is separating the useful metal from the rest of the rubbish.
3. For example, in domestic recycling plants iron and steel objects can be plucked out with a magnet, since most other materials are not magnetic.

- The recycling process e.g., scrap iron is added to newly extracted from a blast furnace being converted into steel.
- The supply of copper-rich ores is limited so it is important to recycle as much copper as possible especially as demand for copper is growing as the economies of African countries, India, China and Brazil etc. are rapidly developing and becoming increasingly industrialized with the ensuing consumer demands for all the e.g., electrical products that the West take for granted.

Why Recycle Metals?

1. Saves valuable finite natural mineral resources – mineral sources cannot last forever!
2. Saves energy, so fewer fossil fuels burned,
3. Reduces a waste disposal problem e.g., less piles of rusting cars and reduces environmental problems in general.

- Any reduction in landfill waste sites is a blessing on the environment, so this is now a real drive to recycle metals, plastics, glass and paper. Landfill rubbish sites are source of environmental pollutions from toxic materials leaching out and a health hazard from rotting decomposing organic material.

- Apart from reducing the accumulation of waste, there are waste disposal management issues e.g., how to store the waste? how dangerous is it? and environmental scientists/technicians are needed to monitor possible pollution of the surrounding air, water or land – more costs!

4. It is less expensive than mining the original ore and extracting the metal, both these processes are eliminated and far less energy is used overall, so on several counts it will cost less money i.e., much more economic.

The Future of Metal Extraction

- There are still huge deposits of mineral ores around the world which are and will be for some time fully exploited by the industrialized nations – soon most of the world?
- However, metal-rich ores are being depleted and because traditional mining and extraction methods have major environmental impacts, there are important issues involved and to be resolved in the future exploitation of metal ore reserves.
- Because of these issues, new ways of extracting metals like copper from low-grade ores are being researched hopefully to limit the environmental impact of traditional mining.
- For example, copper can be extracted by Phyto mining, or by bioleaching.