

The Environmental Cost of Mining: Acid Mine Drainage

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1 Background

The importance of mining is definitely significant throughout the world; the metals we use to structure buildings, the coal we use to create energy, the gold people wear as a sign of wealth, all come from the immense industry of mining. While it is an important industry that provides us with geological materials necessary for survival, it does come at a price to the environment.

AMD, or Acid Mine Drainage, is currently the main pollutant of surface water in the mid-Atlantic region. Essentially, AMD is metal-rich water that is formed from chemical reactions between water and rocks with sulfur-bearing minerals. The runoff formed, typically acidic, usually forms where ore or coal mining activities have exposed pyrite, an iron sulfide compound. When exposed to air and water, pyrite reacts to form sulfuric acid and dissolved iron. The iron gives AMD its characteristic red-orange color, as is shown in the photos. AMD occurs naturally in some environments as part of the rock weathering process, but it is made worse by large-scale land disturbances such as mining.

Acid Mine Drainage leads to a variety of problems, including contamination of drinking water, adverse effects to plants and wildlife, and corroding effects of acid on infrastructures. It causes an adverse drop in pH levels, with some streams having a pH of 4 or lower. In addition, it also poses economic issues, as it contributes to declines in tourism to the afflicted area, and causes a decline in valuable fish species such as trout. The overall effects caused by mining are immense, and greatly damage the health of environment.

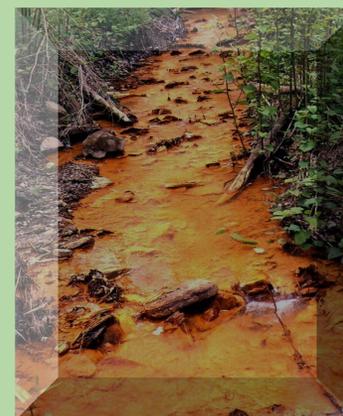
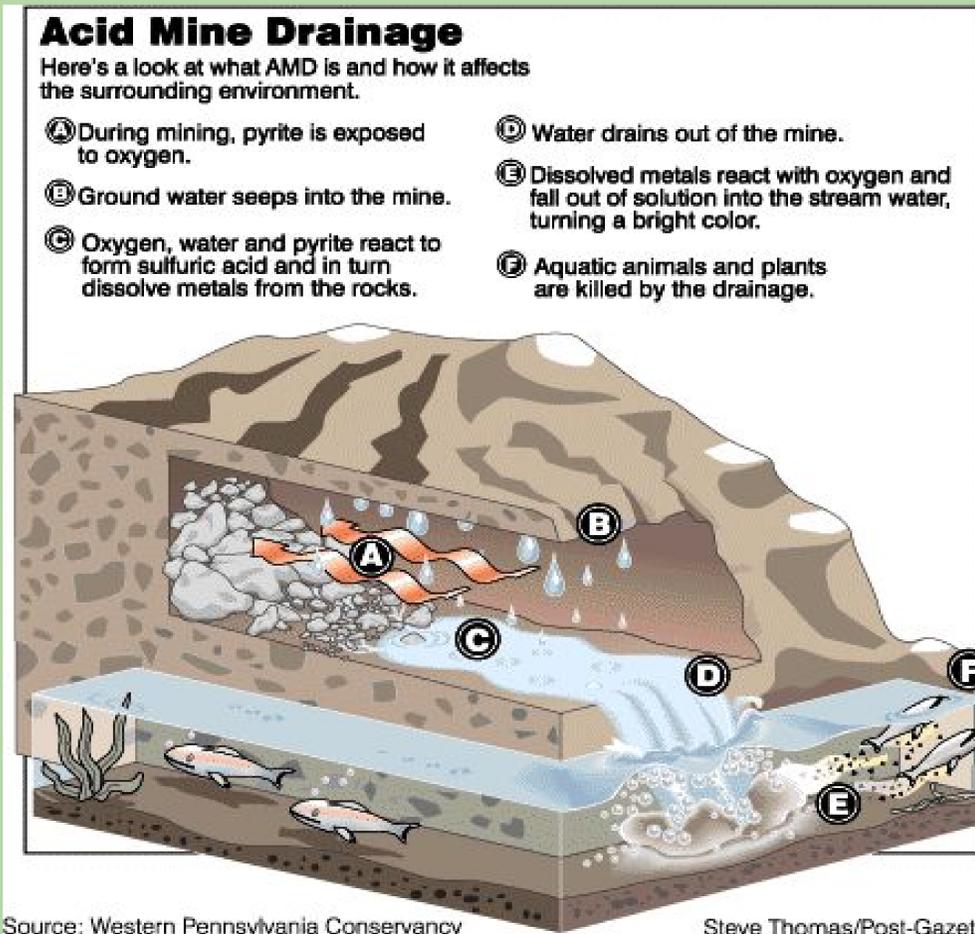
2 Methods

To procure information on the effects and cost of mining on our environment, we conducted three different case studies on three different mining operations of three different resources being mined. We attempted to find commonalities between the three, where a general cost and or effect of mining could be determined.

Together we looked into as diverse a set of mining operations as possible. The following mining operations were the ones that we had looked into:

- Copper Mining in Montana of America
- Gold Mining in Witwatersrand of Africa
- Coal Mining in Santa Catarina of Brazil

3 The Process



4 Environmental Damage

Mining can prove to be extremely detrimental to both the health of local ecosystems, as well as nearby humans inhabiting the area. In the case of Butte, Montana, where the Berkeley Pit is located, over 40 billion gallons of highly acidic water remain untreated. If the pit were to overflow, the local watershed would become too toxic to support surrounding life, such as flora and animals. If the toxins were to enter the food chain through small animals consuming it, then it would almost certainly reach humans at the top. Even a small amount of the highly toxic water is dangerous to humans. Being subject to heavy metal toxicity could cause inflammatory diseases, cardiac functional disorders and even potentially cancer.

Gold mines in South Africa result in a multitude of environmental issues, including groundwater and surface water pollution, soil damage and pollution, and air pollution caused by dust particles. Water pollution is primarily caused by chemical contamination associated with mine operations. Acid Mine Drainage is a particularly notable issue: Oxidized pyrite, which forms sulfuric acid, seeps into groundwater. The pollution of water continues more than 10 kilometers from the source. Depending on the area, the water is contaminated with different levels of salts, sulphate, iron, aluminium, toxic heavy metals like cadmium and cobalt, lead and radioactive elements such as uranium. The contamination causes the pH of the water to reach such acidic levels that animals can no longer survive. The same can be said about mining in Brazil. Essentially, the bioaccumulation of acid mine drainage is the biggest environmental threat posed by mining.

5 Remediation

Calcium oxide is used to raise the pH levels and lower the acidity of the water. As the pH rises, the metals are able to be removed from what is now a sludge. This is performed at water treatment plants that can be located at the source of the AMD. For example, the Horse Shoe Bend Water Treatment Facility in Butte, Montana is able to treat up to 5,000 gallons of water every minute. The water that leaves the plant is capable of sustaining life.