

Lab: Cookie Mining MAKEUP ASSIGNMENT

Background: The mining and processing of minerals provides us with the building blocks required to form much of the infrastructure needed to support modern societies. In 2020, the top 40 mining companies had together accumulated a total revenue of \$544 billion. While demand for some resources such as coal is falling, other resources such as copper are seeing increasing demand as new products and technologies require different materials. For example, a single lithium-ion electric vehicle battery pack uses around 16kg of lithium, 46kg of nickel, 46kg of cobalt and 43kg of manganese.



However, the process of mining remains intense and invasive, and operations often leave large environmental impacts on the local surroundings as well as wider implications for the environmental health of the planet. There have been many documented instances of environmental pollution caused by mining operations, which are often caused by leakages of mining tailings. Mining tailings are the materials left behind after the economically valuable fraction of material has been extracted. These materials are often radioactive, toxic or acidic. Tailings consist of valuable substances used in the extraction process such as cyanide, mercury or arsenic; therefore, modern mining often aims to remove these harmful but valuable chemicals to reuse for further mineral separation. In addition to improving efficiency and cutting costs, this minimizes the risk of environmental damage by reducing the toxicity of the tailings. Another key environmental problem associated with mining projects is the land use change that occurs, not only from drilling and excavating open pit mines but also the changes that occur as result of the development of surrounding infrastructure. The latter can include camps to provide accommodation for the miners as well as the railways and roads needed to transport the mined materials. The infrastructure created by mining operations in remote, untouched landscapes can lead to improved access to these regions which may result in further human-caused disturbance to the local ecological systems. The impact of mining operations on the surrounding land is also closely linked to the ecological setting of the mining sites. For example, the deforestation of primary forests caused by mining for iron ore in the tropical rainforests of Gabon is likely to leave more devastating and longer term ecological damage compared to mining iron ore in the deserts of northern Australia. However, compared to many other industries such as agriculture, mining uses relatively small pockets of land, and the future of mining could move to using techniques that are arguably even less invasive on the environment by using less land and emitting less pollution. Methods could include underground mining where ore is extracted below the surface with little waste and minimal ecological scarring of the Earth's surface; phytomining where plants accumulate high concentrations of metals which can then be processed; or even asteroid mining where materials from asteroids could be harvested for their use on Earth. (Earth.org)

What We Did in Class:

Students mined a cookie for the valuable chocolate chips inside. They then assessed the environmental damage, relevant costs and resulting profit for their mining company. It was fun! We missed you. As a makeup, please answer the questions.

Analysis Questions:

1. How does the demand for coal relate to the demand for copper?
2. What metals are needed for the manufacturing of lithium-ion batteries?
3. What are mining tailings and why are they dangerous?
4. What necessary infrastructure often accompanies mining operations?
5. Describe two methods of extracting metals that have less impact than surface mining.

Watch the video (https://www.youtube.com/watch?v=LI0Zh_7XUdw) and answer the following questions:

6. What does the 1872 General Mining Act do?
7. What does the 1972 Surface Mining and Reclamation Act do?
8. How is mining, minerals and rocks all related?
9. What is “peak level” of a mineral resource?
10. How is surface mining accomplished?
11. How is strip mining accomplished?
12. Describe the environmental impacts of mining.
13. What did you learn from this makeup lab?