Where's That Mine of Mine Additional Resources

For more information regarding this and other mining and minerals education materials, please visit MineralsEducationCoalition.org.

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Vocabulary

Aggregate - Coarse- to medium-grained particulate material used in construction, including sand, gravel, crushed stone, slag, recycled concrete and geosynthetic aggregates. Aggregates are the most mined materials in the world.

Element - A pure substance consisting only of atoms that all have the same numbers of protons in their nuclei. Unlike chemical compounds, chemical elements cannot be broken down into simpler substances by any chemical reaction.

Green energy - Green energy is any energy type that is generated from natural resources, such as sunlight, wind or water. It is considered a subset of renewable energy.

Infrastructure - Physical and organizational structures or facilities (such roads, buildings and sources of power) needed for the basic operation of a business, organization or society.

Metal - A material that, when freshly prepared, polished, or fractured, shows a lustrous (shiny) appearance. Most metals conduct electricity relatively well and some conduct heat.

Mineral – A naturally occurring inorganic solid that has a specific chemical composition, crystal structure and physical properties.

Mining – The process of extracting (removing) useful materials from the earth.

Natural resource - Any material, substance, or organism found in nature that is useful to people.

Non-renewable resource – A natural resource that cannot be readily replaced by natural means at a pace quickly enough to keep up with consumption. Coal is classified as a non-renewable energy source because it takes millions of years to form. Coal contains the energy stored by plants that lived hundreds of millions of years ago in swampy forests.

Ore - A naturally occurring solid material from which a metal or mineral can be extracted in an economically feasible manner.

Overburden – The unwanted material, rocks and other minerals that surround a more valuable material.

Reclamation - The combined process by which adverse environmental effects of surface mining are minimized and mined lands are returned to a beneficial end use.

Renewable energy – Energy that is collected from resources that are naturally replenished on a human timescale. It includes sources such as sunlight, wind, rain, tides, waves, and geothermal heat.

Surface mining - A broad category of mining in which soil and rock overlying the mineral deposit (overburden) are removed by blasting and excavating an open pit.

Sustainability - Managing inevitable change so as to satisfy present day environmental, economic and social priorities while not preventing future generations from doing the same.

Underground mining – A category of mining which is more selective than surface mining in the way minerals are extracted. The overlying rock is left in place, and the mineral is removed through shafts or tunnels. The exact method is determined by the geometry (shape) of the mineral deposit.

More About Mine Permitting, Reclamation Plans and Regulation

All exploration and mining activities require prior approval from the relevant government agency – or agencies, as the case may be. The process to receive a permit, often referred to as permitting, requires a detailed assessment of environmental issues in a report known as an Environmental Impact Study. The permitting process is extremely rigorous in most jurisdictions around the world and can often take many years.

A modern mining permit application requires the operator to submit an operating plan that illustrates how the land will be affected by mining operations and how the operation will progress from exploration to development, through mining and reclamation. This will often include details such as:

- Locations of all operations; including equipment, stockpiles, settling ponds, interim drainage, water pollution prevention systems and mineral deposits.
- How excavations will progress as the mine operates.
- Provisions for worker safety and that of the local community.

The reclamation plan describes how the mined land will be restored for future use. This includes how the mine will handle simultaneous excavation and reclamation, as well as the time between final mining activities and completion of reclamation once the mine shuts down. All plans are reviewed by governmental bodies where the mine is located, and public hearings are scheduled to receive comments on the proposed reclamation plan.

Once permits are issued, but before mining begins, the operator will be required to post a bond obligating the company to perform the activities specified in the reclamation plan, or make other financial assurance to ensure reclamation takes place. In the United States, the bond is usually posted with the state.

Reclamation bonds or assurances can only be released if the state finds that enough work has been completed to allow the property to be returned to a productive use, as set forth in the operator's reclamation plan. If the operator fails to comply with the plan, the state may file a claim against the amount of the bond, and then use the proceeds to complete reclamation of the mined land. This is to guarantee that work outlined in the reclamation plan will be completed as described in the plan within the specified time limits.

If an approved mining operation is sold or ownership is transferred, the original bond regarding reclamation must remain in effect until a new one is in place. The original bond will be released only when the new one has been approved. This reduces the risk of abandoned mines not being properly reclaimed.

Mines are also required to be inspected annually. The field inspection is generally for compliance with the conditions of use as outlined in their permit. There may also be additional

periodic inspections as conditions or situations dictate. In the US, mine inspections are performed annually by state representatives; progress is mapped via aerial photography.

In the US, there are numerous federal laws that regulate mining. These include, but are not limited to, the Mine Safety and Health Act, National Environmental Policy Act, Clean Air Act, Resource Conservation and Recovery Act, Clean Water Act, Toxic Substances Control Act, and the Comprehensive Environmental Response, Compensation, and Liability Act. State and local agencies also regulate mining.

Other Excellent Sources of Educational Mining and Mineral Resources

- **U.S. Geological Survey–National Minerals Information Center**
  usgs.gov/centers/nmic

- **U.S. Geological Survey–Mineral Resources Program**
  usgs.gov/energy-and-minerals/mineral-resources-program

- **Mine Safety and Health Administration–List of State Mining Agencies**
  msha.gov/support-resources/external-mining-resources/state-mining-agencies

- **Mineralogical Society of America**
  mineralogy4kids.org

- **U.S. Bureau of Land Management–Abandoned Mines**
  blm.gov/programs/public-safety-and-fire/abandoned-mine-lands

- **The Society for Mining, Metallurgy & Exploration (SME)**
  smenet.org

- **Mining History Association**
  mininghistoryassociation.org

- **National Mining Hall of Fame and Museum**
  mininghalloffame.org

Sources of local information, guest speakers or amazing out-of-school experiences

- Colleges and universities with programs in mining engineering, geology and other earth sciences
- Mines and aggregate producers (i.e., quarry operations)
- Mining and aggregate industry associations (including local chapters)
- Manufacturers and dealers of equipment for mining and quarry operations
- Offices of state and federal mining and land management agencies
- Historical societies with an emphasis on mining
- Science and industry museums

Related Next Generation Science Standards

HIGH SCHOOL
HS-ESS3 – *Human Sustainability - Earth and Human Activity* [1]

Students who demonstrate understanding can:
HS-ESS3-2 - Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

Science and Engineering Practices: Analyzing and Interpreting Data, Constructing Explanations and Designing Solutions, Engaging in Argument from Evidence

Disciplinary Core Ideas:

- ESS3.A - Natural Resources
- ESS3.C - Human Impacts on Earth Systems
- ETS1.B - Developing Possible Solutions

Crosscutting Concepts:

- ***Connections to Engineering, Technology, and Applications of Science***
  Influence of Science, Engineering, and Technology on Society and the Natural World
  Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ESS3-2)

- ***Connections to Nature of Science***
  Science Addresses Questions about the Natural and Material World
  Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions. (HS-ESS3-2)

  Science knowledge indicates what can happen in natural systems—not what should happen. The latter involves ethics, values, and human decisions about the use of knowledge. (HS-ESS3-2)

  Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues. (HS-ESS3-2)

MIDDLE SCHOOL
MS-ESS3 - *Earth and Human Activity*[2]

Students who demonstrate understanding can:
MS-ESS3-1. - Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

Science and Engineering Practices: Constructing Explanations and Designing Solutions

Disciplinary Core Ideas:

- ESS3.A - Natural Resources

[1] Source: https://www.nextgenscience.org/dci-arrangement/hs-ess3-earth-and-human-activity
[2] Source: https://www.nextgenscience.org/pe/ms-ess3-1-earth-and-human-activity

Crosscutting Concepts:

- ***Cause and Effect***
  Cause and effect relationships may be used to predict phenomena in natural or designed systems.

- ***Connections to Engineering, Technology, and Applications of Science***
  Influence of Science, Engineering, and Technology on Society and the Natural World
  All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.

Go to MineralsEducationCoalition.org/standards to search for detailed correlations with the full array of Next Generation Science Standards and Common Core standards and all state standards.

Feedback on Mining Unit (*Where's That Mine of Mine?*)

Please complete, scan and email this page to MEC@smenet.org

Name _____ School _____ Email _____

City _____ State _____ Grade Level _____ # of Student Taught _____

Class/Subject _____

Question	***Circle One***		
Did you use the entire lesson plan (discussions, film, activity)?	Yes	No	
Were the instructions clear and easy to follow?	Yes	No	
Did the activity meet your academic objectives?	Yes	No	
Was the activity age appropriate?	Yes	No	
Was the amount of preparation acceptable for the activity?	Yes	No	
Were the students interested and motivated?	Yes	No	
Was the mining/mineral content age appropriate?	Yes	No	
Would you teach this lesson again?	Yes	No	
How would you rate the activity and lesson overall?	Excellent	Good	Poor
How would your students rate the activity and lesson overall?	Excellent	Good	Poor

What would make the lesson and activity more useful to you?

_____

_____

Other Comments (Please explain any "no" answers from above)

_____

_____