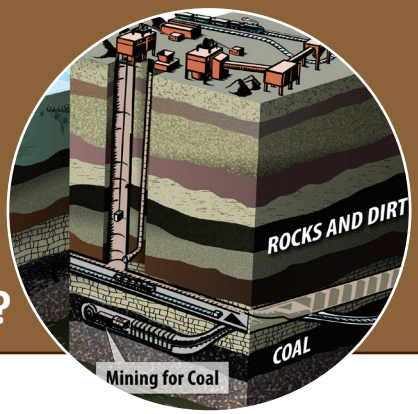
Grade: 6-8 | Time: 2 hours

SOLVING THE CHALLENGES OF MINING

Essential Question:

What are the Impacts of Mining and Using Minerals?



Overview

Students learn about new mining projects proposed for Alaska, and do research to propose solutions to a challenge related to one of the proposed mines.

Assessment

Can students:

Propose and defend a solution to a problem related to the development of a new mine?

Vocabulary

- Tailings
- Case Study
- Precedent
- Opposition
- Impoundment

Teacher Information and Procedure

Prior knowledge for students: Some experience with internet research

Source: Adapted from Alaska Resources Kit: Minerals and Energy, Module D-Ecology/Economy Rev 1996 (Graphics from www.NEED.org and Depositphotos.com)

Materials needed

Internet access

What to do in advance

Read through the lesson and the case studies. If there is a different mine that you would like to study, develop a new case study. You may want to do some advanced research so that you can suggest sources to your students.

Teaching the lesson

Gear-up

Use the handout, "New Mines in Alaska" as an introduction to the case study activity. Have students

Alaska Standards Addressed

Science GLEs

The student demonstrates an understanding
- that solving problems involves different ways of thinking by: [6] SE2.1 identifying and designing a solution to a problem. [6][7] SE2.2 comparing the student's work to the work of peers in order to identify multiple paths that can be used to investigate a question or problem. (L)
[7] [8] SE2.1 identifying, designing, testing, and revising solutions to a local problem. (L) [8] SE2.2 comparing the student's work to the work of peers in order to identify multiple paths that can be used to investigate and evaluate potential solutions to a question or problem. (L)
-that interactions with the environment provide an opportunity for understanding scientific concepts by: [6] SA3.1 gathering data to build a knowledge base that contributes to the development of questions about the local environment (e.g., moose browsing, trail usage, river erosion). (L) [7] SA3.1 designing and conducting a simple investigation about the local environment. [8] SA3.1 conducting research to learn how the local environment is used by a variety of competing interests (e.g., competition for habitat/ resources, tourism, oil and mining companies, hunting groups). (L)

-of the attitudes and approaches to scientific inquiry by: [6] SA2.1 identifying and differentiating fact from opinion. 7] SA2.1 identifying and evaluating the sources used to support scientific statements [8] SA2.1 recognizing and analyzing differing scientific explanations and models

-of how to integrate scientific knowledge and technology to address problems by:
[6] SE1.1 recognizing that technology cannot always provide successful solutions
[7] SE1.1 describing how public policy affects the student's life. (e.g., public waste disposal). (L) [8] SE1.1 describing how public policy affects their lives and participating diplomatically in evidence-based discussions relating to their community.

Alaska English/ Language Arts and Mathematics Standards (2012)

- RSL.6-8.2, RSL.6-8.4, RSL.6-8.7, RSL.6-8.8, RSL.6-8.9
- WL.6-8.1, WL.6-8.2, WL.6-8.7, WL.6-8.9

read the handout and summarize it by filling in the table.

Explore

Discuss some of the pros and cons of developing new mines. What are some of the benefits of having a mine near your community and what are some of the drawbacks? Is it easy to develop a mine?

Use the "Develop a Mine" worksheet to discuss all of the steps that must be taken before mining takes place. Can you think of any more steps?

Choose a case study related to one of the mines as a class project. Three possible case studies are included as examples, or you may develop your own. Depending on the age and experience of your students and the size of your class, you may want to divide the students into groups to do several different case studies.

Read the case study, and ask students to think about how they would solve the problem. What information would they need to come up with a good solution?

Generate a list of questions as a class, including some or all of the questions suggested on the handout. Divide research tasks among the class, and use the internet and other sources to find answers to the questions. Remind researchers to document their sources.

When the researchers have completed their tasks, have them share their information with the class by preparing a written handout and/or presenting the information orally.

Generalize

Discuss the mining companies' proposed solution(s) to the problem posed in the case study, and have students evaluate them based on the information compiled. Encourage students to suggest new solutions to the problem.

Assess

Have each student write a paper or letter describing the problem and outlining the solution that they prefer. They should support their position with facts gathered by the class.

Extensions, adaptations, and more resources

Follow the news related to one or more proposed mines throughout the school year. Use newspapers or newspaper and radio web sites to compile stories, articles, and letters to the editor related to the mining project.

Company Name _____

ALASKA MINES AND PROJECTS

NAME OF MINE OR PROJECT	LOCATION	MINERAL RESOURCE(S)	TYPE OF MINE OR PROJECT *(PIT OR UNDERGROUND)*	NOTES
Fort Knox				
Greens Creek				
Kensington*				
Pogo				
Red Dog				
Donlin Gold Project**				
Pebble Project				

Helpful Links: http://www.donlingold.com/our-plan

Selected Exploration and Development Projects

* Coeur Alaska continued development investment at the Kensington Gold Project in 2005. The property is located near Juneau. Construction costs are estimated at $91 million. Construction began in July 2005, but was halted later in the year after the U.S. Corps of Engineers withdrew key permits for further review, partly in response to litigation initiated by environmental groups. Construction is anticipated to take 18 months with production commencing in 2007. The project contains a probable reserve of 4,206,000 tons of ore. Gold production is estimated to be 100,000 ounces per year over a ten-year mine life.

The Donlin Creek Gold Project near Aniak is now in the advanced exploration and feasibility phase. Other joint venture owners are NovaGold Resources and Calista Corporation. The greatest challenge for the project is the requirement for 60-80 megawatts of electricity needed to process the sulfide-rich ore. Containing about 25 million ounces of gold, Donlin Creek is a very large deposit. Preliminary feasibility analysis indicate that an open-pit mining 30,000 to 40,000 tons or ore per day and producing 1 million ounces of gold per year may be economically feasible. **Source: Resource Development Council Website

Key

Case Study #1

Problem: What should be done with the tailings from the Kensington Mine?

The proposed Kensington Gold mine is located about 45 miles North of Juneau and about 35 miles south of Haines, Alaska. The land is within the boundaries of the City and Borough of Juneau. Couer Alaska Inc. is the owner of the mine project and some land owned by the US Forest Service will also be disturbed. There is no road to the mine. Fuel, equipment, and supplies will arrive by barge and mine workers will travel back and forth by helicopter. The mine and facilities will take about two years to construct and will operate for 10-12 years.

The Kensington Gold mine will be an underground mine. Crushing will take place underground, and after the crushed ore has been brought to the surface it will processed by grinding, flotation, and thickening. Concentrated gold-bearing minerals will be loaded into containers and shipped offsite for further processing.

The remaining material, called tailings, will be the consistency of beach sand. About 25% of the tailings will be mixed with cement and used to backfill the mine.

Originally, the plan was to dispose of tailings by piping them (mixed with about 18% water) to a filtering plant, removing the water, and forming them into an engineered and layered pile called a dry tailings facility. In 2001, Couer decided that instead of making a dry tailings facility they would place the tailings in an impoundment in Lower Slate Lake. In June 2005, they received federal permits that would allow them to put the tailings into the lake. One permit, the Corps of Engineers 404 permit, was later suspended due to a lawsuit by environmental groups seeking to prohibit the discharge of tailings into a lake. It was reinstated in April 2006. Construction has begun on the mine.

Environmental groups are still trying to stop the disposal of tailings into the lake. One concern is that this is the first time a federal ruling has allowed dumping of mine waste into a lake under the Clean Water Act. There is a concern that this will set a precedent and allow other mines to pollute the state's water in the future. Native groups from the Bristol Bay area have joined the lawsuit

Some suggested questions to research:

- What are mine tailings made of and what pollutants do they contain?
- How is the lake used now by fish, wild animals, and humans?
- What would be the impacts of Impacts of a dry tailings facility?
- What kind of reclamation of the lake will take place?
- What are some other options for disposing of tailings?
- How do the different options compare in cost?
- What types of new (existing or yet-to-be invented) technology could help to solve the problem?
- How are tailings disposed of to protect the environment

Case Study #2

Problem: How can sufficient affordable power be provided to the Donlin Gold?

The Donlin Gold is located in Southwestern Alaska about 12 miles north of the village of Crooked Creek, which is on the Kuskokwim River. There is a large airstrip at Donlin Creek and a 15-mile winter trail to the village of Crooked Creek. There is no road to connect Crooked Creek with any larger cities. The Calista Corporation owns the subsurface rights and Kuskokwim, Inc. (a village corporation) owns the surface rights to Donlin Creek. The corporations have leased the property to two mining companies that are working in partnership to develop the mine: Barrick, Inc.(formerly Placer Dome) , and Novagold Resources. Currently, over $30 million is being spent on a Feasibility Study to make a decision by November 2007 about whether to construct a mine.

Donlin Creek will be a large open pit mine similar to the existing Fort Knox gold mine near Fairbanks. The mine will include waste rock dumps, an ore processing mill, and a tailings impoundment, roads, maintenance shops, living quarters, drinking water supply and domestic sewage disposal. Supplying affordable electricity is one of the project's biggest challenges because of its remote location. If the huge amounts of electricity needed were to be produced using traditional diesel generators, it is estimated that it would take 200 barges per year to provide the necessary 30 to 40 million gallons of fuel.1 The Kuskokwim River is free of ice and navigable by barges for only about 120 days a year.

The mining company has studied a variety of possible power sources including long-distance power lines from the Anchorage/Fairbanks area coal or natural gas power plants, coal-powered generators in the region, biomass, propane, and natural gas. They are now hoping that about 40% of the power can be provided by wind turbines in combination with diesel fueled power.

Some suggested questions to research:

- What are the pros and cons of using diesel, coal, biomass, propane, natural gas, and wind? How do they compare in cost?
- Are there other energy sources that could be considered?
- How is electricity provided now to Crooked Creek and other villages in the region? How would development of a new power source help the region?
- How are other large, remote mines powered (in Alaska or in other parts of the world)?

1. Iverson, Shane, "Donlin Creek Permitting May Begin This Summer", Bethel Delta Discovery , March 14, 2006