

## Activity 4: Uranium Mining Methods

### Objectives:

Students will:

- Hypothesize and list the benefits and impacts of mining methods.
- Consider whether they would be for or against a particular mining method being used in their community.

### Next Generation Science Standards

The concepts in this activity can be used to support the following science standard:

- ESS3. Earth and Human Activity.

### Materials and Resources

- *Uranium: Teacher Background Information.*
- *Vocabulary Materials.*
- *Uranium Mining Methods Worksheet* (one per student, pair or group) and *Uranium Mining Methods Teacher Answer Key.*

### Time

You may choose to have students complete the entire activity within one or two class periods. If time or computer access is limited, the activity can be introduced, completed outside of the class and concluded in another class period.

### Vocabulary

- Ionizing radiation
- Radiation
- Radioactive atom
- Radium
- Radon
- Uranium
- Uranium mining
- Uranium milling

## Directions

1. Start with a vocabulary activity if students are not familiar with uranium and the vocabulary used in this activity.
2. Explain that the U.S. uranium mining boom started in the mid-1940s. Once the U.S. built a stockpile of uranium in the 1970s, the mining industry slowed. Uranium mining is still in operation, but on a much smaller scale. The U.S. mining industry uses two distinct methods to extract uranium ore: physically removing the ore-bearing rock from the soil for processing or chemically dissolving uranium from the ore at the site.
3. Provide students with a *Uranium Mining Methods Worksheet* and review the directions. Students can form hypotheses based on their present knowledge or allow them to access any available resources, such as the Internet, library or school books or individuals who may have insight on mining and environmental issues.
4. Conclude by having students share their responses. You can reference the *Uranium Mining Methods Teacher Answer Key*. Compile the “for” and “against” votes to see which method the class would be in most favor of, or if they would not want to allow mining in their community.
5. Optional activities or extensions: Have students:
  - Debate the pros and cons of the different mining methods.
  - Develop models or drawings that show the mining process and impacts on the earth, people and our environment.

# Uranium Mining Methods Worksheet

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Imagine that a company wants to mine uranium in your area. The company is trying to determine which of the three mining methods it wants to use based on considerations like:

- Other radioactive materials like radium and radon gas that can contaminate the environment and cause health concerns.
- Safe disposal or storage of the mining waste.
- The protection of the health of the workers, nearby community members and the environment.

For each mining method:

- Hypothesize and list the benefits and impacts each mining method may have on the local society, the economy and the environment.
- Check whether you might be for or against allowing the mining method in your area.



**Underground mining** involves digging and removing rock through a tunnel or opening the side of a hill or mountain. Miners must work underground in tunnels.

Benefits:

Impacts:

For  Against



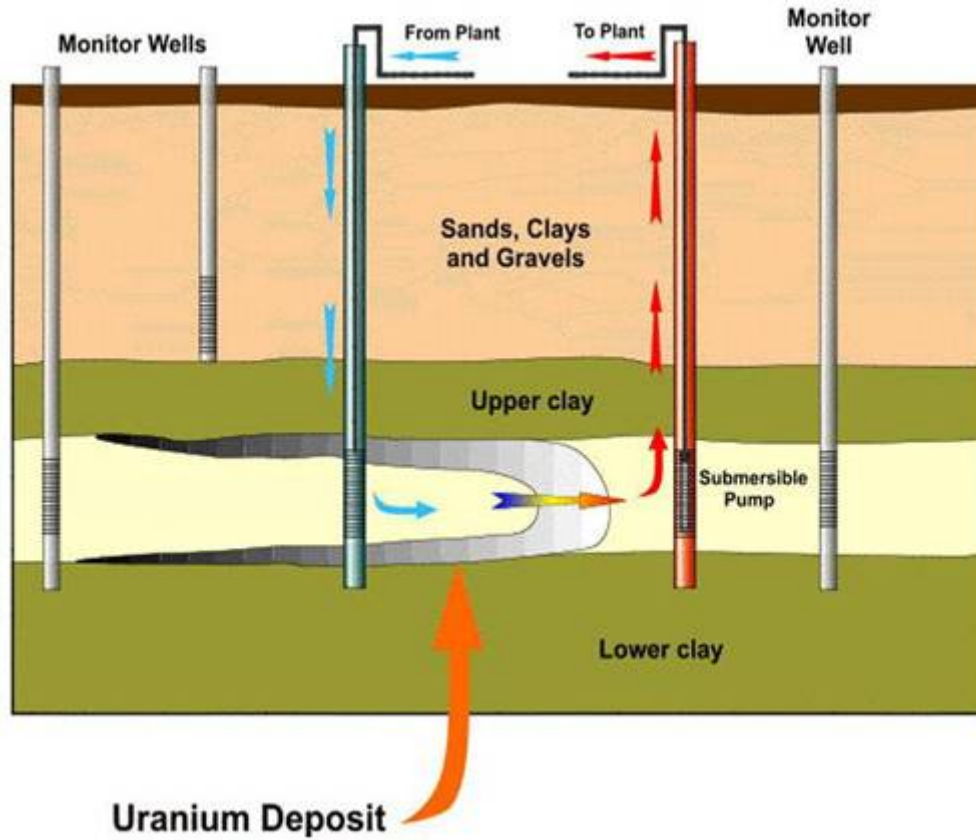
**Open-pit mining** involves stripping away or excavating the topsoil and rock that lie above the uranium ore

Benefits:

Impacts:

For  Against

**In-situ leaching** involves treating ore deep underground with chemicals to dissolve the uranium and then pumping the liquid to the surface. This method is feasible in deposits that are saturated and have high permeability. This method is the most common method used in the U.S. through wells.



Source: World Nuclear Association

Benefits:

Impacts:

For  Against

# Uranium Mining Methods Teacher Answer Key

| <b>Mining Method</b> | <b>Benefits</b>   | <b>Impacts</b>  |
|----------------------|---|---|
| Underground mining   | <ul style="list-style-type: none"> <li>• Provides jobs</li> <li>• Brings money to the local economy and may lead to improved local facilities and services</li> <li>• Permits mining operations to be largely out of sight</li> <li>• Allows for production in all kinds of weather conditions</li> </ul>   | <ul style="list-style-type: none"> <li>• Produces safety and health hazards if unauthorized persons enter mines or fall in openings</li> <li>• Presents numerous safety and health risks for workers working underground</li> <li>• Releases radon and radioactive dust into the environment</li> <li>• Produces contaminated soil, water and tailings that can impact the surrounding soil, air and water if not managed properly</li> </ul>                                   |
| Open-pit mining      | <ul style="list-style-type: none"> <li>• Provides jobs</li> <li>• Brings money to the local economy and may lead to improved local facilities and services</li> <li>• Allows for high production of uranium that brings money to the company</li> </ul>   | <ul style="list-style-type: none"> <li>• Produces safety and health hazards if unauthorized persons enter or fall in pits</li> <li>• Releases radon into the environment</li> <li>• Produces tailings/radioactive waste that can contaminate the soil, air and water</li> </ul>   |
| In-situ leaching     | <ul style="list-style-type: none"> <li>• Provides jobs</li> <li>• Brings money to the local economy and may lead to improved local facilities and services</li> <li>• Reduces risk of employee accidents and exposure to radiation</li> <li>• Costs less than other mining methods</li> <li>• Eliminates the concerns of open pits, radioactive dust and uranium mill tailings</li> </ul> | <ul style="list-style-type: none"> <li>• Risk of spills, leaks and contamination of groundwater and potential drinking water</li> <li>• Releases radon into the environment</li> <li>• Produces waste slurries and waste water that could contaminate the environment if not managed properly</li> <li>• Leaching chemicals may impact or contaminate groundwater, soil and rocks</li> <li>• Only feasible in deposits that are saturated and have high permeability</li> </ul> |