Cake Mining Activity

Unit 2: North Dakota Geology, Mining & Reclamation

High School Version

Materials:

- Cake pan (1 per group)
- Spoons (large and small)
- Spatulas
- Lignite coal

- Gray or brown dirt
- Potting soil
- Scale
- Timer

Overview:

This exercise reflects real-life challenges and opportunities faced by mining companies. Good business decisions must be made. Environmental laws and regulations must be followed. Speed is an important factor. Time is money.

Procedure:

1. Set up a cake pan layered with a known weight of coal, then overburden (gray or brown dirt can be used) and topsoil (or potting soil) on top. The object of the exercise is to "mine" as much coal as possible within a set time frame (10-20 minutes is suggested), while adhering strictly to environmental laws and regulations. Land must be reclaimed at the end of the exercise.

2. Prior to starting, assume each team has enough money to pay start-up expenses. In real life this money often must be borrowed, so they are charged $10,000/minute in finance charges. The faster they work, the less finance charges they'll have to pay.

3. Prior to starting, each team must buy equipment. They can buy large expensive equipment or small inexpensive equipment. A good business decision must be made to buy enough equipment to move a lot of dirt and coal as quickly as possible without spending too much money.

4. Also prior to starting, each team must decide how many employees will actually be operating equipment. The more employees the team has, the faster they can mine. However, each employee will cost an additional $50,000, so another business decision must be made.

5. Each team will have to put up a $300,000 surface mining bond before starting. They get this bond money back from the state at the end of the mining only if all their land is reclaimed in the opinion of the inspector (the teacher). Some of the bond money may be retained by the state if the team does a poor job reclaiming their mined land. This can be very expensive.

6. Start the timer, but immediately let each team know they must complete a mining permit application before they are allowed to mine coal. The form is found at the end of this document. Again, time is money. Time spent getting regulatory approval to mine coal is time lost from actual coal mining. The regulatory agency (the teacher) needs to be encouraged to make a fast review and give approval quickly so mining can begin.

7. Once permit approval is received, mining can begin. Topsoil must be stripped off and stockpiled, then overburden moved, and then coal can be removed. Coal will be loaded into a container and later weighed. Remember:
   - No spillage outside the "permit area;" everything must stay inside the permit area
   - No mixing of topsoil and overburden

8. Failure to follow any of these rules can result in a violation notice from an inspector (teacher). And you will be inspected! Each violation notice costs the team $50,000. A pattern of violations (three violations) demonstrates willful negligence and the mine will be shut down, and the team's entire bond will be forfeited. They can keep any money from the coal that's already been mined. The inspector (the teacher) can hand out a notice of violation and charge the company at any time.

9. Also, be aware that getting a violation notice can significantly slow down the mining operation through time spent dealing with the regulatory agency. Remember that time is money. To keep from being slowed down by a regulatory agency it's very important to strictly follow all rules and regulations. This makes good business sense.

10. To assure that a high quality coal product is delivered to the customer, great care must be taken to avoid contaminating the coal with dirt. Coal contaminated with large amounts of dirt is too poor to burn and cannot be sold. This can be a significant loss, so it's important to mine coal as cleanly as possible.

11. After the end of the mining period the mined coal is weighed. Income is calculated. The regulatory agency inspects the quality of reclamation and determines how much of the team's bond money they can get back. The total expenses are subtracted from the total income to see if the team has made a profit.

Discussion Items:

- Making sound business decisions regarding equipment, employees and how one operates a mine
- The economics of mining and reclamation
- How failure to follow environmental laws and regulations can have a large financial impact on mining companies
- How time is money

Worksheet to Determine Expenses and Profit for the Mining Company

1. Start-up money: $<u>1,000,000</u>

SUBTRACT THE FOLLOWING:

2. Purchase of equipment (miner's option):

        $300,000 for each large spatula bought $_____

        $200,000 for each large spoon bought $_____

        $100,000 for each small spoon bought $_____

3. Hiring employees (include yourself!)

        $50,000 per employee $_____

4. Submit surface mining bond to state (will be returned at end if your reclamation is complete) $<u> 300,000 </u>

5. Finance charges: $10,000/minute **x**_____ minutes $_____

6. Royalties, taxes and government fees
    $1.50/ton **x**_____tons mined $_____

7. Number of violations **x** $50,000/violation $_____

TOTAL EXPENSES $_____

INCOME:

Payment received for coal sold:

         _____ tons **x** $10/ton $_____

Amount of bond money returned $_____

TOTAL INCOME $_____

NET REVENUE (TOTAL INCOME-TOTAL EXPENSES) $ _____

Regulatory Notice of Violation

$50,000 penalty

OFFICIAL MINING PERMIT APPLICATION

(must be approved before mining begins)

Name of mining company: _____

Address of mining company: _____

Location of permit area: _____

Size of permit area: _____

Describe how you will mine the coal and reclaim the land:

_____

_____

_____

I certify the information on this permit is correct:

_____

(*name and signature of applicant*)

Approved for mining:

_____

(*signed by regulatory agency*)