

# Modeling the Mining Process

Mining companies have much to consider when they are planning to open a new mine. The ultimate purpose of opening a mine is to make a profit. However, there are many costs that can quickly drain profit. Mining companies must be concerned with all the costs of preparation. Land must be explored and surveyed for potential ore sites. There are costs associated with obtaining the rights to mine the land, both from the landowners and the federal government. There are costs associated with drilling to determine the extent of buried ore. Once a mining company has selected and licensed a site for mining, there are costs associated with digging the ore out of the ground. Finally, mining companies are required by law to properly dispose of the waste rock from the mine and to reclaim the land (return the land to its original condition).

In this exploration lab, you will be modeling the entire process of mining, from planning to completion. Your teacher will lay out the lab room as a large piece of land for your lab team to explore. Clusters of packing pellets will be spread about the room to model ore deposits in the land. You will be staking claims to these ore deposits and mining them. But you have to watch your costs. If you are not careful, you could easily spend more money than you make. If your profit is small, you are literally “working for peanuts.” If you run out of money altogether, you will not be able to dispose of the waste rock and reclaim the land. This would be bad for the environment.

## OBJECTIVES

**Construct** a model of operating a mine from beginning to end, at a profit, and still be able to dispose of waste and reclaim the land.

**Compute** the costs and income of operating a mine.

## MATERIALS

- Felt-tip markers, various colors
- Graph paper (stock)
- Index cards, numbered 1–6 (6)
- Pencil, graphite
- Packing pellets (peanut-shaped)

## Procedure

### PART I—INCORPORATION PHASE

1. With your lab team, model the incorporation of your mining company by giving it a name.

COMPANY NAME \_\_\_\_\_

2. Model obtaining money from venture capital investors. Your company receives investments of \$1,000,000 to operate the mine. At no point can you spend more money than the amount of capital that you have remaining.

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3. To model structuring the company's operations, divide your lab team into four departments: the cartography (map-making) department, the survey department, the claim department, and the team treasurer, who will keep track of the money.

**PART II—EXPLORATION PHASE**

4. Your lab team will now model mapping the land area (room) where your company plans to conduct mining. Have the lab team member(s) in the cartography department enter the room and spend up to a maximum of 5 minutes preparing a base map of the room. The base map should show all major features like doors, windows, desks, tables, cabinets, etc. These model the terrain features of the land. Do not show the location of the packing pellets. The cost of exploration is \$15,000 per minute.

COST OF MAPPING: \_\_\_\_\_ Minutes  $\times$  \$15,000/Min = \$ \_\_\_\_\_

REMAINING CAPITAL = \$ \_\_\_\_\_

5. Your lab team will now model surveying the land for possible ore deposits (peanut clusters). Have the lab team member(s) in the survey department enter the room and spend up to 5 minutes marking the location of pellet clusters. When members of the survey department identify possible ore deposits, they can take core samples to determine the types and concentration of ore in the deposits. A core sample is taken by turning over one pellet without disturbing any others. Each core sample cost \$20,000. Identify the results of your core sampling on your map.

COST OF SURVEYING: \_\_\_\_\_ core samples  $\times$  \$20,000 = \$ \_\_\_\_\_

REMAINING CAPITAL = \$ \_\_\_\_\_

**PART III—CLAIM PHASE**

6. When the survey department lab team member(s) returns from conducting the survey, your lab team must now select one ore deposit site to claim. Identify the target site you wish to claim on your base map.
7. Your lab team will now model staking a claim on an ore deposit. Have the lab team member(s) in the claim department enter the room and use the base map to find the cluster of packing pellets on which to stake a claim. A claim is staked by placing piece of paper with your company name at a pellet cluster. Keep in mind, other lab teams may also stake a claim at the same pellet cluster.

**PART IV—BIDDING AND LICENSING PHASE**

8. Everyone may now enter the room.
9. Your lab team will now model purchasing a license to mine the ore deposit. If your lab team is the only one to place a flag on a particular pellet cluster, the cost of licensing for mining is \$20,000. If other lab teams placed a flag on the

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same pellet cluster, a competitive bid will take place. With the competing lab teams, shuffle the index cards, face down, and draw one. The order of bidding will progress in order of highest to lowest number. The opening bid starts at \$20,000 and must progress in increments of \$20,000.

The winner of the bid will license the mine at a cost equal to the amount of the winning bid. The loser(s) must select an unclaimed cluster of packing pellets.

COST OF LICENSING = \$ \_\_\_\_\_

REMAINING CAPITAL = \$ \_\_\_\_\_

**PART V—DRILLING PHASE**

- 10.** Your lab team will now model drilling the ore deposit (turning over unmarked pellets) to see if there is valuable, buried ore. Your lab team can turn over up to six pellets in the pellet cluster. The cost of drilling is \$30,000 per pellet that is turned over.

COST OF DRILLING: \_\_\_\_\_ turned over pellets  $\times$  \$30,000 = \$ \_\_\_\_\_

REMAINING CAPITAL = \$ \_\_\_\_\_

- 11.** If your lab team decides at this point that it has not claimed a valuable ore deposit, you can go to another unclaimed site. If you do this, you will have to pay again for mine licensing and drilling. Once drilling is complete, you can select the claim that you think will be the most valuable.

COST OF LICENSING SECOND SITE = \$ \_\_\_\_\_

COST OF DRILLING: \_\_\_\_\_ turned over peanuts  $\times$  \$30,000 = \$ \_\_\_\_\_

REMAINING CAPITAL = \$ \_\_\_\_\_

**PART VI—MINING PHASE**

- 12.** Your lab team will now model mining the ore deposit (turning over pellets) of the claim you have selected for mining. At this point you may exceed your remaining capital money, if you desire. Take one pellet at a time, marked or unmarked, from the pellet cluster. Use the information in Analysis steps 1 and 2 to find out how much that ore is worth (a color-marked ore pellet) or how much it will cost you to dispose of it (an unmarked waste rock pellet). You can stop mining (taking pellets) at any time, based on how your profits and losses are progressing. If you do this, you are risking your potential for future profit. You may continue mining, even if you are not coming up with good results. But you are taking a risk if you do this, because the objective of the mining operation is to still have a profit after all waste rock has been disposed and land reclaimed. The cost of mining the pellets is \$5,000 per pellet.

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TOTAL # OF MINED PELLETS: \_\_\_\_\_

COST OF MINING ONE SITE: \_\_\_\_\_ Pellets  $\times$  \$5,000 = \$ \_\_\_\_\_

REMAINING CAPITAL = \$ \_\_\_\_\_ (could be a negative number)

**Analysis**

- 1. Organizing Data** Calculate the value of each group of colored pellets. Add up the values to get your total income and calculate your net loss or profit.

INCOME GOLD: \$400,000  $\times$  \_\_\_\_\_ = \$ \_\_\_\_\_INCOME SILVER: \$50,000  $\times$  \_\_\_\_\_ = \$ \_\_\_\_\_INCOME COPPER: \$20,000  $\times$  \_\_\_\_\_ = \$ \_\_\_\_\_INCOME COAL: \$10,000  $\times$  \_\_\_\_\_ = \$ \_\_\_\_\_INCOME IRON: \$5,000  $\times$  \_\_\_\_\_ = \$ \_\_\_\_\_

TOTAL INCOME: \$ \_\_\_\_\_

REMAINING CAPITAL (Procedure step 12): \$ \_\_\_\_\_

NET PROFIT OR LOSS: \$ \_\_\_\_\_

- 2. Organizing Data** Calculate the cost of disposing of waste rock and reclaiming the land. The cost of disposal is \$5,000 per unmarked pellet. The cost of land reclamation is 10% of the total income determined in Analysis question 1.

COST OF WASTE DISPOSAL: \$5,000  $\times$  \_\_\_\_\_ = \$ \_\_\_\_\_COST OF LAND RECLAMATION:  $0.1 \times$  \$ \_\_\_\_\_ = \$ \_\_\_\_\_

TOTAL COST OF ENVIRONMENTAL CLEANUP: \$ \_\_\_\_\_

- 3. Analyzing Results** Compare the net profit or loss of question 1 with the total cost of environmental cleanup of question 2. Did you achieve the objective to make a profit, dispose of the waste, and reclaim the land?
- \_\_\_\_\_

**Conclusions**

- 4. Evaluating Models** Assess the validity of this model of land mining. Do you think this model is representative of what happens in the real world?
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