

## **Lignite Energy Council Teacher's Seminar Classroom Exercise**

(grade school version)

To demonstrate the process of surface coal mining and land reclamation, set up a cake pan layered with coal at the bottom, then a thick layer of overburden (gray or brown dirt), then a thinner layer of topsoil (or potting soil). The object is to remove the coal and return the land to as good a condition as existed prior to mining. The cake pan represents the mining permit area. No disturbance or spillage is allowed outside the cake pan, or permit area.

Give students their "mining equipment" (spoons and spatulas). They must strip off the topsoil carefully, making sure they do not contaminate topsoil. Then the overburden is moved, then the coal is removed. Be careful not to mix dirt with the coal! After the coal is removed the overburden is replaced and smoothed out. This represents regrading the spoil. Then topsoil must be spread back over the top.

You can discuss the following

- How topsoil must be saved carefully;
- How you must carefully plan each operation to make sure you have room for topsoil stockpiling and overburden placement;
- The difficulties involved with staying within the permit area, and how great care must be taken to avoid spillage (or unnecessary land disturbance);
- How this exercise relates to real-life mining conditions, including environmental protection and land reclamation requirements;
- The importance of leaving the land as good or better than before mining occurred

## **Lignite Energy Council Teachers' Seminar Classroom Exercise**

(high school version)

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.

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.

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 charge they'll have to pay.

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.

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.

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.

Start the timer, but immediately let each team know they must complete a mining permit application first, before they are allowed to mine coal. The form is attached. 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.

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

Failure to follow any of these rules can result in a violation notice from an inspector (the 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.

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.

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.

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 include the importance of:

- 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

Start-up money: \$ 1,000,000

## SUBTRACT THE FOLLOWING:

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 \$ \_\_\_\_\_

Hiring employees (include yourself!)

\$50,000 per employee \$ \_\_\_\_\_

Submit surface mining bond to state (will be returned at end if your reclamation is complete) \$ \$300,000

Finance charges: \$10,000/minute x \_\_\_\_\_ minutes \$ \_\_\_\_\_

Royalties, taxes and government fees  
\$1.50/ton x \_\_\_\_\_ tons mined \$ \_\_\_\_\_

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) \$ \_\_\_\_\_**

*OFFICIAL*

Regulatory

Notice

of

Violation

**\$50,000 penalty**

**OFFICIAL**

**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:

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I certify the information on this permit is correct:

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(name and signature of applicant)

Approved for mining:

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(signed by regulatory agency)

# Mining and Reclamation Word Search

B	S	P	N	D	R	A	G	L	I	N	E	O	W	T
U	G	E	E	O	N	L	K	R	A	G	M	V	I	L
P	Z	R	E	C	L	A	M	A	T	I	O	N	N	H
D	F	M	Y	R	A	N	G	E	L	A	N	D	J	S
I	A	I	K	X	L	I	N	T	E	R	I	O	R	L
R	P	T	K	Z	S	R	B	L	A	S	T	I	N	G
E	F	F	L	U	E	N	T	C	U	B	O	Y	W	O
C	V	G	R	A	D	I	N	G	R	U	R	G	M	R
T	N	E	J	D	I	B	A	S	E	L	I	N	E	P
E	P	P	S	M	M	O	N	U	M	E	N	T	S	H
S	C	R	A	P	E	R	S	F	Y	D	G	Z	P	A
W	E	T	L	A	N	D	S	U	B	S	O	I	L	N
Z	U	C	O	N	T	R	O	L	E	A	S	E	S	Q
T	U	N	T	N	X	W	W	M	P	G	S	V	R	G
C	O	N	T	O	U	R	N	C	N	G	S	O	N	N

- The acronym 'SMCRA' refers to the Surface Mining \_\_\_\_\_ and Reclamation Act.
- SMCRA is administered by the US Department of \_\_\_\_\_.
- The \_\_\_\_\_ Division of the ND Public Service Commission regulates surface coal mining in North Dakota.
- Information collected for mining permit applications is referred to as \_\_\_\_\_ data.
- In the mine pit, coal is loosened or fractured by means of ripping or \_\_\_\_\_.
- Mined lands are regraded to 'approximate original \_\_\_\_\_'.
- The activity of spreading soil immediately after stripping is referred to as \_\_\_\_\_ respread.
- The \_\_\_\_\_ is the primary machine used to remove overburden.
- Collected runoff from disturbed mine areas can be discharged when it meets State \_\_\_\_\_ standards.
- Early reclamation rules only required the \_\_\_\_\_ of spoil peaks.
- Surface and coal \_\_\_\_\_ are secured from property owners prior to mining.
- Ground water information is collected from \_\_\_\_\_ wells.
- Small islands of soil left to indicate the depth of topsoil and subsoil removal are referred to as \_\_\_\_\_.
- Unreclaimed ridges of dirt remaining from pre-law surface mining are called \_\_\_\_\_ spoils.
- Baseline data, lease information, mining plans, and reclamation plans are compiled into a mining \_\_\_\_\_ application.
- The majority of lands disturbed by coal mining in North Dakota are reclaimed as cropland and \_\_\_\_\_.
- Topsoil, and in many cases subsoil, is handled by mobile equipment known as tractor-\_\_\_\_\_.
- The initial earthwork activity in the mining process is to construct \_\_\_\_\_ ponds.
- The second layer of earth removed by mining operations is referred to as \_\_\_\_\_.
- Unique reclamation features include shelterbelts, native tree and shrub plantings, stockponds, and \_\_\_\_\_.

# Mining and Reclamation Word Search



- (Control) The acronym 'SMCRA' refers to the Surface Mining \_\_\_\_\_ and Reclamation Act.
- (Interior) SMCRA is administered by the US Department of \_\_\_\_\_.
- (Reclamation) The \_\_\_\_\_ Division of the ND Public Service Commission regulates surface coal mining in North Dakota.
- (baseline) Information collected for mining permit applications is referred to as \_\_\_\_\_ data.
- (blasting) In the mine pit, coal is loosened or fractured by means of ripping or \_\_\_\_\_.
- (contour) Mined lands are regraded to 'approximate original \_\_\_\_\_'.
- (direct) The activity of spreading soil immediately after stripping is referred to as \_\_\_\_\_ respread.
- (dragline) The \_\_\_\_\_ is the primary machine used to remove overburden.
- (effluent) Collected runoff from disturbed mine areas can be discharged when it meets State \_\_\_\_\_ standards.
- (grading) Early reclamation rules only required the \_\_\_\_\_ of spoil peaks.
- (leases) Surface and coal \_\_\_\_\_ are secured from property owners prior to mining.
- (monitoring) Ground water information is collected from \_\_\_\_\_ wells.
- (monuments) Small islands of soil left to indicate the depth of topsoil and subsoil removal are referred to as \_\_\_\_\_.
- (orphan) Unreclaimed ridges of dirt remaining from pre-law surface mining are called \_\_\_\_\_ spoils.
- (permit) Baseline data, lease information, mining plans, and reclamation plans are compiled into a mining \_\_\_\_\_ application.
- (rangeland) The majority of lands disturbed by coal mining in North Dakota are reclaimed as cropland and \_\_\_\_\_.
- (scrapers) Topsoil, and in many cases subsoil, is handled by mobile equipment known as tractor-\_\_\_\_\_.
- (sediment) The initial earthwork activity in the mining process is to construct \_\_\_\_\_ ponds.
- (subsoil) The second layer of earth removed by mining operations is referred to as \_\_\_\_\_.
- (wetlands) Unique reclamation features include shelterbelts, native tree and shrub plantings, stockponds, and \_\_\_\_\_.