

## “DRIFT AWAY”

### An Underground Mining Exercise

#### STANDARDS

See summary of National Science Education Standards.

Original: <http://books.nap.edu/readingroom/books/nses/>

Standard Concept	General standard	Specific standard	General standard	Specific standard	General standard	Specific standard
Grade Level		K-4		5-8		9-12
Science as inquiry (A)	Abilities ... to do ... inquiry	A.1.4.1	Abilities ... to do ... inquiry	A.1.8.4	Abilities ... to do ... inquiry	
	Understandings about ... inquiry	A.2.4.2	Understandings about ... inquiry	A.2.8.5	Understandings about ... inquiry	
Physical Science (B)	Properties of ... materials	B.1.4.1	Properties ..of matter	B.1.8.1		
		B.1.4.2				
Earth Science (D)	Properties of Earth Materials	D.1.4.1	Structure of Earth system	D.1.8.4		
					Geochemical cycles	D.2.12.1
						D.2.12.2
Science and Technology (E)	Abilities of tech design	E.1.4.4	Abilities of tech design	E.1.8.4		
	Understanding about science and technology	E.2.4.2	Understanding about science and technology	E.2.8.4		
		E.2.4.3		E.2.8.5		
	Distinguish ...natural and man-made	E.3.4.2				



Social Perspective (F)	Personal Health	F.1.4.1	Personal Health	F.1.8.2	Personal and community health	F.1.12.1
	Types of resources	F.3.4.1			Natural Resources	F.3.12.1
		F.3.4.2				
		F.3.4.3				
			Risks and Benefits	F.4.8.1		
History and Nature of Science (G)	Science as Human Endeavor	G.1.4.1				



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### An Underground Mining Exercise

**OBJECT:** To introduce students to the basic concepts of underground mining, the safety procedures taken and terminology used.

#### **MATERIALS REQUIRED:**

- Paper Towels, waxed paper or butcher paper
- One loaf of sliced bread for each four or five students. (Wheat works best)
- Whipped Cream Cheese for each group – Shotcrete
- Pretzel sticks for each group – Roof Bolts
- Long handled plastic spoons (Dairy Queen or similar ones)
- Plastic knives – try to find the long ones or use small spatulas.
- Template for entrance. Cut out one for each table in heavy cardboard.

#### **INSTRUCTIONS:** (for the student)

1. The group will determine who will take the specific jobs: Tunneling, Mucker, Roof Bolter, Shotcreter and Holder. The Roof Bolter or Shotcreter can also act as the mucker, who will remove all the loose muck that drops to the sill.
2. Place the paper on the table and put the loaf of bread on it.
  - a. The Holder will sit on the opposite side of the table from the others and place both hands on unwrapped loaf of bread to stabilize the loaf as the work is being done.
3. Place the template on the heel of the loaf and using the knife, begin opening the portal.
4. Once the portal is done and stabilized sufficiently with bolts, the tunneling will continue with the spoon, a couple of slices at a time.
  - a. The mucker will then clean out the muck in the drift.
  - b. The bolter will then place the roof bolts as progress warrants (follow the tunneling→mucking→ bolting cycle).
  - c. It is recommended that you tunnel and bolt as far through the loaf as possible before beginning to add the Shotcrete from end of drift back to front. The object is to go through the loaf of bread, keeping the drift as even as possible, without going through the sill and maintaining enough on the back to prevent a collapse.

#### **TERMINOLOGY USED:**

- PORTAL – Main opening drive in.
- COLLAR – Top of shaft opening
- RIB – Side Wall
- SILL – Floor
- BACK – Roof Overhead



- DRIFT – Horizontal mine passage
- FACE – Part of drift you are drilling for next round

**EVALUATIONS:** What safety measures were used before and during the process? Summarize the steps involved in underground mining, including the safety procedures. Did the roof bolting methods you used work properly or could another method have worked better?

**OTHER OPTIONS:**

- 1) Weigh the bread before beginning, and then weigh the amount mined to determine the efficiencies of each team's mining.
- 2) Use a marbled loaf and when mining try to mine only the marbled core. After mining, separate dark from light and determine the percentage of dilution (i.e., how much unwanted waste relative to marbled core was mined).
- 3) Place cardboard platform over mined loaf and begin adding weight, until it starts to collapse, to determine which team had the sturdiest or safest drift.
- 4) Use Raisin bread and count the raisins mined as ore. (Note: Raisin bread comes in smaller loaves so will be harder to get hands in).

**TEACHER TIPS:**

Compare each group's drift to the size of the opening in the template and explain the importance of keeping the drift the right size. Underground mining is costly. Keeping waste to a minimum is important. If your drift is driven to follow an ore zone and is engineered to a certain size, it is important to maintain that size to prevent dilution of the ore you are removing. Generally, the material on either side of the ore zone is waste (has little or no value). Also, it costs more in time, fuel consumption, and equipment use to "muck" out the excess rock material.



