MINING IN MARYLAND
CURRICULUM UNIT

GRADE LEVEL: 5TH-8TH
SUBJECTS: Earth Science, Environmental Science, Social Studies (secondary)
TIME REQUIRED: Approximately two weeks (45-60 minute class periods)

OVERVIEW

In this project-based and inquiry-based unit, students will explore the economic and environmental issues associated with the mining industry in the State of Maryland. They will learn what resources are mined in Maryland and their importance to our society. They will also explore how mining impacts the environment, and solutions that are currently being used to address the environmental concerns. Students will develop an understanding and appreciation of the mine reclamation process, and how it benefits the natural environment. Finally, students will learn about the regulatory process and the various roles of the federal and state government.

Through demonstrations, hands-on activities, and inquiry-based research, this unit offers a combination of individual, and collaborative student group activities, as well as a variety of instructional strategies that will appeal to multiple learning styles.

OBJECTIVES

By the end of this unit, students will understand:

- what resources are mined in Maryland and where
- the economic benefits of mining
- how mining impacts the environment
- what solutions are currently being used to address environmental concerns
- roles of federal and state government in regulating the mining industry

---

MATERIALS

- Chart paper
- Markers
- Colored pencils

Hands-On Demonstration/ Experiments*	
Day 5	Day 6
o Steam table or large shallow pan o Sand o Gravel o Water	o Terrarium or large glass bowl o Sand o Rocks o Lumps of coal o Top soil o Plants (real or plastic) o Plastic spoon or other digging implement

* There are also two optional experiments on Day 5 that you may choose to do to reinforce understanding of solutions to some of the environmental problems associated with the mining industry (sediment runoff and acid mine drainage). These experiments may help different kinds of learners and lower performing students to better understand the concepts discovered in their research. Materials are listed separately in each optional experiment.

RESOURCES

- Computer connected to LCD projector; Internet access and PowerPoint
- Computers with Internet access (enough for student groups)
  Modification: If a computer lab or computers with Internet access are not available in the classroom, you may print Internet sites referenced in Student Research Guide.

Curriculum Resources

Teacher	Student Research Packet
• **Lesson Overview** (this document) • **Mining in Maryland Curriculum Standards** (mm-standards.doc) • **Lesson Details** (mm-lessondetails.doc) • **Mining in Maryland PowerPoint presentation** (mm-presentation.ppt) • **KWL Suggestions** (mm-KWL-suggestions.doc) • **Research Organizer Answer Key** (mm-researchanswerkey.doc) • **Unit Test** (mm-unittest.doc) • **Supplemental Resources-Extension Activities** folder	• **KWL Chart** (mm-kwl.doc) • **Vocabulary Sheet** (mm-vocabulary.doc) • **Research Organizer** (mm-researchorganizer.doc) • **Map of Maryland Counties** (mm-mapmarylandcounties.doc) • **Regulatory Timeline** (mm-regulatorytimeline.doc) • **Reclamation Case Study** (optional) (mm-reclamationcasestudy.doc) • **Gob Piles Article** (mm-baltsun-dec06-article.doc) • **Final Project Description** (mm-finalproject.doc) • **Final Project Rubric** (mm-finalprojectrubric.doc)

Print Resources (to order)

- Mining Poster (order from Interstate Mining Compact Commission/ 703-709-8654/ Email: bbotsis@imcc.isa.us; Website: http://www.imcc.isa.us. Ask for ***What Do All These Places have in Common?*** poster
- Mining in Maryland: Natural Aggregate – Building America's Future brochure. Free through USGS Map Distribution, Box 25286, Building 810, Denver Federal Center, Denver, CO, 80255. *Alternatively, you can use the PDF files included in the Student Research Packet (Student-Group → Natural Aggregate Brochure-PDF Files folder)*

- Mineral Information Institute Organization has some great free posters and supplemental teacher resources that you may fine useful. Many are geared towards elementary school, but may also be useful for middle grades. See http://www.mii.org/teacherhelpers.php
- ***What Everyone Should Know About Coal*** brochure; kid-friendly, easy to read brochure. Call 800-628-7733. Ask for Item #15438E-5-98

VOCABULARY

Day 1

- **Natural resources**: naturally occurring substances that are considered to be valuable
- **Mining**: the extraction of valuable minerals and natural resources from the earth
- **Non-fuel minerals:** a substance obtained by mining that is not fuel-based

Day 2

- **Aggregate**: Sand, gravel, crushed stone and quarried rock used for construction purposes.

Day 5

- **Erosion:** the process by which the surface of the earth is worn away by the action of water, glaciers, winds, waves, etc.
    - "geologic" erosion naturally produces about 30 percent of the total sediment in the United States
    - "accelerated" soil erosion from man's use of land accounts for the remaining 70 percent. Surface mining, forestry, agriculture and construction are the major activities that can cause accelerated erosion
- **Acid Drainage:** acidic water formed from a chemical reaction between water, oxygen and rocks containing sulfur-bearing minerals. Source is usually an abandoned coal mine, however, other areas where the earth has been disturbed (e.g. construction sites, subdivisions, transportation corridors, etc.) may also contribute acid rock drainage to the environment
- **Runoff:** water from rain, snowmelt or irrigation that flows over the land surface and is not absorbed into the ground, instead flowing into streams or other surface waters
    - In the mining industry, runoff usually contains either sediment or acid

Day 6

- **Mine or Land reclamation:** process of protecting, restoring, and possibly even improving the land before, during, and after mining. Result: land is preserved, nature has been protected, water and soil are conserved, and the land can be turned into productive farmland, forests, lakes, etc.
- **Surface Mining :** Surface mining is used when coal or other mined materials are found close to the surface or on hillsides. It involves removing the topsoil and subsoil and setting them aside while the materials are removed.

ASSESSMENTS

(1) At your discretion, grade for accuracy and/or completion (√+ √ √-) the following worksheets:

- Student K-W-L Chart
- Production Map
- Optional activities (hands-on experiments, Mine Reclamation Case Study)

(2) Student Research Packet (recommended): 50 Points

• Research (Chart and Questions from Days 2-4)	20
• Erosion Demonstration	5
• Cause and Effect Trees (5 each)	10
• Mine Reclamation Questions	5
• Laws and Regulations	5
• Gob Piles Article Questions	5

Summative Assessments include:

• Mining in Maryland Final Project: (see rubric mm-finalprojectrubric.doc)	30
• Mining in Maryland Unit Test (mm-unittest.doc)	100

PREREQUISITES

- Students should be familiar with appropriate safety and lab procedures for hands-on lab experiments

- Students should know how to conduct basic web research

EXTENSION ACTIVITIES

Content/ Cross-Curricular

The websites listed below contain a variety of classroom activities that allow students to explore deeper much of the content covered in this unit.

Bureau of Land Management / Mine Reclamation Hands-On Activities
http://www.blm.gov/education/LearningLandscapes/teachers.html

American Coal Foundation
http://www.teachcoal.org/
Site includes excellent online resources including lesson plans, student activities and materials for the classroom, to deepen students' understanding of coal mining

Mineral Information Institute offers free teacher and classroom resources
http://www.mii.org

Cement and Concrete Basics
Lesson Plans and Activities for middle and high school students designed to help students understand the large role that cement and concrete products play in their everyday lives
http://www.cement.org/basics/concretebasics_classroom.asp

Hands-on Activities about rocks and minerals
http://www.womeninmining.org/activity.htm

Mathematics
There are limitless possibilities to integrate more mathematics into this unit:

- How are numbers for the MII Baby calculated? (http://www.mii.org/pdfs/2005_mii_Baby_Announce.pdf)
- What is the history of annual Per Capita Minerals Consumption in the US? http://www.mii.org/pdfs/mii_Baby_History.pdf)
- Simple calculations for how much energy it takes to light your school (see coalmat.pdf from MII in Extension folder)

Community and Field-based Connections

- Invite an official from the Maryland Department of the Environment in to speak with the class about the mining industry
- Arrange to visit a local mining site

CREDITS

Maryland Department of the Environment Mining in Maryland
http://www.mde.state.md.us/Programs/WaterPrograms/MiningInMaryland/index.asp

Mineral Information Institute
http://mii.org/
Extension Activities include PDF files from this site.

Day 6 Activity has been adapted from
http://www.teachcoal.org/lessonplans/reclamation.html