Topic 1: Impact of mining on the Environment

Learning Outcomes

Upon successful completion of this topic you will be able to:

• Identify the difference between mining and mineral exploration
• Define the economic importance of the Australian Mineral Industry
• Discuss the impact mining has on the environment
• Discuss the formation of Acid Mine Drainage and its associated impact
• Discuss the methods to lessen the environmental impact of mining operations/processes
• List and detail remediation strategies in the mining industry
• Discuss the use of biological remediation of mine sites, such as wetlands or phytoremediation
• Research and evaluate the general impacts of mining, the use of biological remediation, the impacts and remediation strategies of acid mine drainage and/or the process and impacts of copper extraction

Introduction to the Topic

Mining and its subsequent activities are carried out under the provisions of the Mineral Resources Development Act 1990 and undertaken in accordance to a work authority granted by the Department of Primary Industries. The Australian minerals industry is one of the top five producers of the world’s mineral commodities and injected around $91 billion into the Australian economy in 2006-07.

In this topic you will understand the different types of mining, how mining impacts the economy, the impacts on the soil and water environments and look at attempts that have been tried to
lessen this impact. You will also look at the way Acid Mine Drainage is formed, the conditions necessary for its formation and attempt to treat the problem. Remediation strategies (including wetlands and phytoremediation) for treating mining contamination of land and water will be discussed.

**Background Skills and Knowledge**

Basic knowledge of science  
Ability to use the computer

**Session 1.1 The Mining Industry**

In this session, you are given a variety of references to understand the basics of the mineral industry. The references detail the difference between mining and mineral exploration, the different types of mining processes and the activities and processes for assessing mining proposals, previous and current statistics related to the Australian mineral industry.

**Learning Outcomes**

Upon successful completion of this session, you will be able to:

- Identify the difference between mining and mineral exploration
- Define the economic importance of the Australian Mineral Industry
Activity 1A

The Mining Industry

Read
to obtain an overview of the mining industry.

View
Diagrams 15, and 17-19, in the “Mining and its impact on the environment” resource material collected from the course coordinator, to see a schematic diagram of the typical processes in mining operations and the major components of minerals, respectively.

Read

Complete
Self Assessment Quiz: Mining (multiple choice questions), located in the online learning hub under the Course Documents button in the Mining and the Environment folder.

Optional
Watch
A 3 minute video on a geologist discussing the difference between mining and mineral exploration that also shows the typical equipment used for underground mining and mineral exploration at the following link:
http://www.youtube.com/watch?v=J0iLuDJfhHU&feature=related

Session 1.2 Impact of Mining

The impacts of mining on the environment can be substantial and varied. In this session we focus on impacts on the soil and water environments and look at attempts that have been tried to lessen this impact.

Learning Outcomes

Upon successful completion of this session, you will be able to:

- Discuss the impact mining has on the environment
- Discuss the methods to lessen the environmental impact of mining operations/processes

Activity 1 B

Impact of Mining

Read
Power point presentation: Environmental Impact of Mining located in the online learning hub under the Course Documents in the Mining and the Environment folder

Read
Pages 20-21 of the “Mining and the Environment” handout collected from the course coordinator, for a summary of the possible impacts of mining, including physical, ecological,
land use, social, infrastructure and heritage aspects

View
Diagrams 1, 2, 4 and 6 - 9 in the “Mining and its impact on the environment” resource material handout collected from the course coordinator, to see the basic water use flow sheet for metal extraction mines and concentrations of heavy metal and other parameters in mine effluent, water use by mineral exploration and mines, concentrations of cations and anions in river water and a guide to the toxic thresholds for freshwater.

Complete
Self Assessment Quiz: Impact of Mining (multiple choice questions), located in the online learning hub under the Course Documents button in the Mining and the Environment folder

Session 1.3 Acid Mine Drainage

Acid Mine Drainage (AMD) is probably the most serious and widespread impact that mining has on water and soil. It occurs whenever sulphide minerals are mined for metals such as gold, copper, lead and silver. We look at the way AMD is formed, the conditions necessary for its formation and attempt to treat the problem.

Learning Outcomes
Upon successful completion of this session, you will be able to:

- Discuss the formation of Acid Mine Drainage and its associated impact
- Discuss the methods to lessen the environmental impact of mining operations/processes
Activity 1 C  
Acid Mine Drainage  

Read  
Power point presentation: Acid Mine Drainage located in the online learning hub under the Course Documents in the Mining and the Environment folder to obtain an overview of Acid Mine Drainage.

View  
Diagrams 3 and 5 in the “Mining and its impact on the environment” resource material handout collected from the course coordinator, to see the US EPA classification of acid mine drainage and the concentration of various parameters from a range of mine effluent/discharge.

Read  
The section “About this document” at the following link http://www.environment.gov.au/ssd/publications/ssr/125.html to appreciate the extent and potential future liability of acid mine drainage in Australia. Click on the link “discussion and recommendations” to further investigate technologies for managing wastes, transfer and awareness, climatic affects and groundwater, and comparisons with other mines and environmental costs.

Complete  
Self Assessment Quiz: Acid Mine Drainage (multiple choice questions), located in the online learning hub under the Course Documents button in the Mining and the Environment folder

Optional  
Read  
The executive summary of “Remediation options to reduce
acid drainage from historical mining operations at Mount Lyell, Western Tasmania” at the following link: http://www.environment.gov.au/ssd/publications/ssr/108.html

that discusses using a conventional neutralization water treatment plant by Solvent Extraction/Electro winning (sx/ew), for another remediation strategy of acid mine drainage.

Session 1.4 Remediation at a Glance

This session introduces the remediation generally and looks at the various options for treating mining contamination of land and water.

Learning Outcomes

Upon successful completion of this session, you will be able to:

- Discuss the methods to lessen the environmental impact of mining operations/processes
- List and detail remediation strategies in the mining industry

Activity 1 D

Remediation at a Glance

Read

Pages 26-28 of the “Mining and the Environment” handout collected from the course coordinator, for the major factors and stages in rehabilitation programs.

Read

Pages 30-31 of the “Mining and the Environment” handout collected from the course coordinator, for a summary of the environmental issues, proposed management and the
anticipated outcomes of the management strategies.

View
Diagrams 10, 14 and 24 of the “Mining and its impact on the environment” resource material handout collected from the course coordinator, to see the advantages and disadvantages of tailings dams, treatment of cyanide waste and treatment methods for sulphidic waste.

Complete
Self Assessment Quiz: Remediation Strategies (multiple choice questions), located in the online learning hub under the Course Documents button in the Mining and the Environment folder

Session 1.5 Biological Remediation

Biological remediation is a fairly new approach to mine site remediation but offers many advantages. The use of wetlands and phyto-remediation are gaining increased popularity as they do not involve major additions of chemicals or removal and treatment of large quantities of soil.

Learning Outcomes
Upon successful completion of this session, you will be able to:

- Discuss the use of biological remediation of mine sites, such as wetlands or phytoremediation
**Activity 1E**

**Biological Remediation**

Read
The document “Constructed wetlands” at the following link: [http://www.frtr.gov(matrix2/section4/4-43.html](http://www.frtr.gov(matrix2/section4/4-43.html)

to get an overview of a typical wetland system, applicability and limitations.

Read
The article “Phytoremediation” at the following link: [http://www.ars.usda.gov/is/AR/archive/jun00/soil0600.pdf](http://www.ars.usda.gov/is/AR/archive/jun00/soil0600.pdf)

to get an overview of how plants clean up soil and their applicability to mine sites.

Complete
Self Assessment Quiz: Biological Remediation (multiple choice questions), located in the online learning hub under the Course Documents button in the Mining and the Environment folder.

Optional
Read

to obtain an overview of using wetlands as remedial strategies discussed at a variety of contaminated sites and a phytoremediation strategy.
Session 1.6 Essay on the Impact of Mining on the Environment

In this session, you are required to select two of the questions from the assignment sheet and research them. Either write about general impacts of mining, the use of biological remediation, the impacts and remediation strategies of acid mine drainage and/or the process and impacts of copper extraction.

Then you are required to discuss your topic in detail to form a coherent, linear argument. Your discussion should give a balanced overview of the topic (looking at all sides) and utilise a number of references.

Start with working out the focus and tasks required to answer the questions. It is a good idea to start reading general texts to gain an overview of the topic and look for potential ways to structure your essay. Write down the main points/arguments of the topic and then find further information on these points/arguments.

Take the time to work through the activities and examples in the essay writing tutorial it will help you structure, plan and order your essays in a logical and coherent manner.

To make writing more efficient, you shouldn’t worry about spelling, grammar, sentence structure or finding the ‘right’ word until you have finalised the content of the essay. It may also be easier to concentrate on the body of the essay first, and then the conclusion followed by the introduction.

Learning Outcomes

Upon successful completion of this session, you will be able to:

- Research and evaluate the general impacts of mining, the use of biological remediation, the impacts and remediation strategies of acid mine drainage and/or the process and impacts of copper extraction
- Discuss the impact mining has on the environment
- Discuss the methods to lessen the environmental impact of mining operations/processes
Activity 1F
Essay on the Impact of Mining on the Environment

Research
Choose two of the four questions listed in the assignment sheet that relate to the impact mining has on the environment. To answer the copper question (d) relevant references are in first session of the next topic ‘Mining Operations and their Management’

Complete
A 30min to 1 hour essay tutorial located in the online Learning Lab at the following link
http://www.dlsweb.rmit.edu.au/lsu/content/2_AssessmentTasks/01essays.htm

to gain knowledge on how to write an essay. Take the time to work through the activities and examples to aide learning.

Complete
Write an essay on your chosen questions and submit to course coordinator by Friday end of week 7.

Complete
Self Assessment Quiz: “Essay on an environmental problem” located in the online Learning Hub under the Course Documents section in the Hazardous Waste and Contaminated Sites folder.
Summary and Outcome Checklist

Over the past six weeks the way the mining and processing of minerals can have an impact on the environment has been discussed. In particular, Acid Mine Drainage – its causes and potential treatments – has been examined. We have looked at biological methods used to remediate mine sites such as wetlands and phytoremediation.

You may not be able to tick all the statements because they relate to every question in each assessment. In assessment 1 you only answer two of the questions as part of your assessment, therefore you may have some boxes unchecked.

Tick the box for each statement with which you agree:

I can now...

- Identify the difference between mining and mineral exploration
- Define the economic importance of the Australian Mineral Industry
- Discuss the impact mining has on the environment
- Discuss the formation of Acid Mine Drainage and its associated impact
- Discuss the methods to lessen the environmental impact of mining operations/processes
- List and detail remediation strategies in the mining industry
- Discuss the use of biological remediation of mine sites, such as wetlands or phytoremediation
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Assessment

This topic will be assessed as part of the Major Assessment task: 1 (see: Assessment for more detail). This aims to ensure understanding of key concepts of the impacts of mining on the environment.