Scope of the Training Module Series

These modules are based on some of the booklets in the Best Practice Environmental Management in Mining Series. Topics covered in the booklets are listed below. All the booklets can be accessed at the Environment Australia website:
http://www.ea.gov.au/industry/sustainable/mining/bpem.html

Environmental management systems (EMS)
Using EMS as a tool to achieve environmental objectives and targets; how to develop, operate and implement an EMS in a company's operations from exploration to mine closure.

Environmental monitoring and performance
Objectives of monitoring programs; how to select performance indicators; measurement methods, collection and analysis of data; reporting.

Mine planning for environment protection
Planning to develop projects that meet community demands for environmental protection; includes air, water, noise, transport, biological resources, social and cultural considerations.

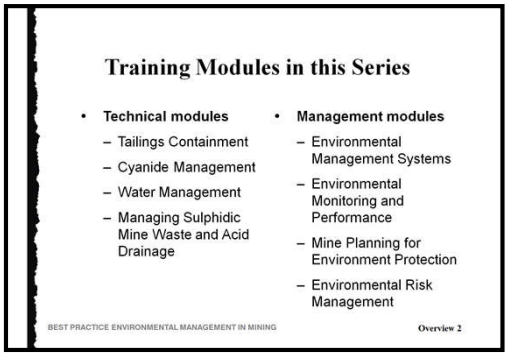
Environmental risk management (ERM)
Definition and scope of ERM; risk analysis, assessment and management; ERM and the mining cycle.

Tailings containment
Site selection, planning, designing, construction, operation and monitoring of tailings facilities.

Cyanide management
Cyanide management strategies, defining responsibilities, safe handling, training, waste management, emergency procedures and monitoring.

Water management
The hydrological cycle; minesite water management systems; water management plans; considerations during exploration, development, operation and decommissioning.

Managing sulphidic mine waste and acid drainage
What is acid drainage? How does it develop? Implications of acid drainage; prediction and identification; managing sulphide oxidation; treatment strategies.



TIPS

This module serves as an introduction to the series of BPEM Trainers' Modules. The first four modules (Volume 2) cover "management issues" and the other four (Volume 3) more technical topics. These modules are based on part of the booklets in the Best Practice Environmental Management in Mining series. Have the eight booklets in the series available for examination and reference during the presentation of this overview.

All the Booklets are available free of charge on the Environment Australia website.

Aims of the Overview Module

When participants have completed this module, they will be able to:

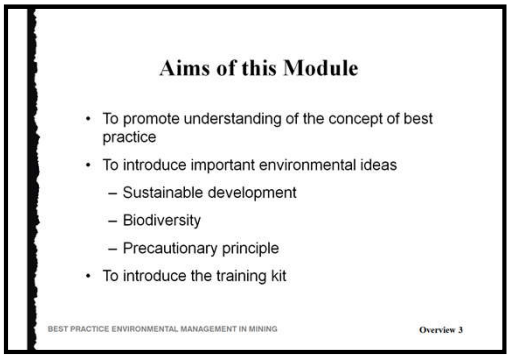
- Describe the concept of best practice;
- Apply the ideas of:
  - Sustainable development;
  - Environmental stewardship;
  - Biodiversity; and
  - The precautionary approach; and
- Assess the value of the topics covered in the training kit for their own work places.

This module can be used as a planning session, to develop a training plan for a minesite workforce.

This plan could include the following outcomes:

- Identifying which modules should be taught;
- Defining the target audiences;
- Setting a time table; and
- Finding strategies for developing acceptance of the training plan within the company.

Another booklet in the BPEM in Mining series which is relevant to this topic is *Planning a Workforce Environmental Awareness Training Program.*



TIPS

Many exercises in this module use group work to encourage participation. You will ask each small group of 4 to 6 people to report back on their discussions.

This will be most useful if the groups are given large sheets of paper and markers to record their responses. You can post these around the room and use the points on them to promote discussion. You may also want to refer back to the results of a discussion later in the training session.

Defining Best Practice (i)

Environmental best practice in minerals and energy may seem difficult to define:

Many factors influence “best practice”. Some of these are listed below.

- Environmental and operating conditions vary between sites.
- In mining, best practice includes planning, management during operations and the outcomes on the site following closure and rehabilitation.
- Best practice is linked to continual improvement. What is defined as best practice at a particular time may not be best practice at a later time. Improvements in technology or in community or industry standards will demand further improvement.
- Companies must embrace continual improvement. It is difficult to ever reach best practice, but it should be seen as a goal.

TIPS

Reference

Brook et al in Mulligan (ed) (1996)

Exercise 1

Consider using a small group exercise here. Divide the participants into groups of 4 to 6 people.

Ask the groups to discuss the following questions:

- **What does “best practice “ mean to you?**
- **What examples of “best practice” have you seen?**
- **How can you apply the idea of “best practice” in your particular situation?**
- **What are the barriers to achieving “best practice”?**

Ask them to report back and encourage discussion of the results.

Refer to the *General Trainers’ Guide* **for hints on small group work.**

Defining Best Practice (ii)

The slide poses a key question: “Why strive for best practice?”

Ask participants to discuss this question in groups. When they report back, their responses will probably include some of the following:

- Improved environmental performance;
- To maintain competitiveness;
- To reduce waste;
- To improve profits; and
- To ensure legal compliance.

They will probably have a number of other responses.

If the dot points listed above are not included, add them to the list on the white board or large sheets of paper.

Encourage discussion of the responses.

Try to summarise the group conclusions on the whiteboard.

TIPS

Exercise 2

Brainstorm the reasons to strive for best practice.

Don’t be discouraged if some of the responses are negative. Use these responses to stimulate discussion. Other people in the group may be able to suggest solutions to problems that are raised.

The journey towards best practice will require changes to attitudes and the “culture” of an organisation. This training module forms the first step in the journey.

Use the Alcoa case study as an example to demonstrate that best practice can have positive business outcomes in addition to protecting the environment.

Defining Best Practice (iii)

The series of booklets "Best Practice Environmental Management in Mining" provides a useful tool for achieving best practice.

Some of the BPEM booklets have been used as the basis for developing these training kits in a project jointly sponsored by Environment Australia and the United Nations Environment Programme.

The aim of this kit is to make the information in the booklets more accessible through the provision of a training format.

Use of the kit will help mining companies to improve their environmental performance by working toward best practice environmental management, and assist regulators, consultants and concerned stakeholder groups to develop a deeper understanding of the concepts of and opportunities for best practice environmental management techniques in the mining industry.

All of the booklets can be downloaded from the World Wide Web. Titles in the series are listed below. Those marked with an asterisk have associated training materials.

*Overview of Best Practice Environmental Management in Mining **

*Mine Planning for Environmental Protection**
Community Consultation and Involvement
Environmental Impact Assessment
*Environmental Management Systems**
Planning A Workforce Environmental Awareness Training Program
*Environmental Monitoring and Performance**
*Tailings Containment**
Rehabilitation and Revegetation
Onshore Minerals and Petroleum Exploration
Environmental Auditing
Hazardous Materials Management, Storage and Disposal
*Managing Sulphidic Mine Wastes and Acid Drainage**
Noise, Vibration and Airblast Control
Landform Design for Rehabilitation
*Cyanide Management**
Dust Control
*Water Management**
*Environmental Risk Management**
Contaminated Sites
Cleaner Production

TIPS

Make a display of the other booklets in the series that you may use in a training program. Encourage participants to look at them during breaks. If you pass them around while you are trying to carry on with other activities, participants may become distracted.

The booklets are available free of charge from the Environment Australia website at:

http://www.ea.gov.au/industry/sustainable/mining/

The BPEM series will continue to be developed. Some titles will be revised and updated. The most recently published titles include: *Mine Decommissioning* **and** *Energy Efficiency***.**

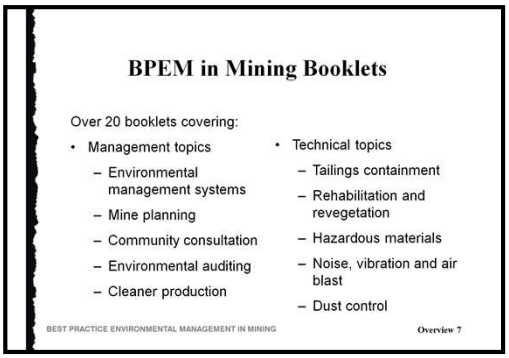
Defining Best Practice (iv)

Using the strategies outlined in the BPEM booklets helps to contribute to sustainable development.

Note that use of the the term “ecologically sustainable development (ESD)” as found in the booklet is restricted to Australasia. “Sustainable development” or “sustainability” includes social and economic issues as well as ecological impacts.

Sustainable development was defined in the Brundtland Report (World Commission on Environment and Development, 1987) as “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

This statement contains two key concepts, the concept of ‘needs’, in particular the essential needs of the world’s poor, to which overriding priority should be given, and the idea of limitations imposed by the state of technology and social organisation on the environment's ability to meet present and future needs.



TIPS

Discussion on sustainable development in the mining industry may raise issues such as leaving open voids, resource use and recycling of metals.

Exercise 3

Encourage participants to explore what sustainability means in the mining industry.

Record their responses on a white board or large sheets of paper. Compare them with the definitions on the next slide.

You could use a group exercise to find out what the participants think about the meaning of sustainable development in the mining context.

Remember that when brainstorming you should record responses exactly as they are given and avoid making judgements about the “correctness” of the ideas.

When the responses are recorded on the white board, show the next overhead transparency.

Sustainable Development (i)

Many of the ideas shown on the overhead will be on the list of ideas contributed by the participants.

Participants may have contributed even better ideas than those listed on the overhead. You may be able to develop a constructive discussion of these ideas.

You may like to explore just what it is that we need to sustain. Some important concepts are:

- Best practice in mining;
- Biodiversity: the variety of species, populations, habitats and ecosystems. This concept is discussed in more detail in the notes for Slides 15 and 16;
- Ecological integrity: the general health and resilience of natural life-support systems. This includes the ability of ecosystems to survive stresses such as climate change. It also includes the ability to maintain basic "ecosystem services" such as the water cycle;
- Natural capital: our stock of productive soil, fresh water, mineral resources, forests, the marine environment. We need to protect and maintain our renewable resources; and
- Social capital: sustainability includes social and cultural systems as well as the natural environment.

Towards Ecological Sustainability, the final chapter of *Australia State of the Environment Report 1996* provides a good discussion of this topic. It is available on-line at:

http://www.ea.gov.au/soe

TIPS

The Brundtland Report is named after Gro Harlem Brundtland who was appointed chair of the United Nations' World Commission on Environment and Development in 1983. The report of the Commission is entitled *Our Common Future* **and was first published in 1987.**

The second description on the slide comes from the *National Strategy for Ecologically Sustainable Development* **published by the Council of Australian Governments in 1992.**

These definitions are somewhat awkward. The diagram on the next slide shows a model developed in Southern Africa. It may help to clarify the concept.

Sustainable Development (ii)

This model of sustainable development was developed by the regional Mining Minerals and Sustainable Development group in Southern Africa.

Try to develop a similar diagram based on input from your group.

The fact that mining traditionally deals with a commodity that is a reducing asset makes sustainable development even more difficult.

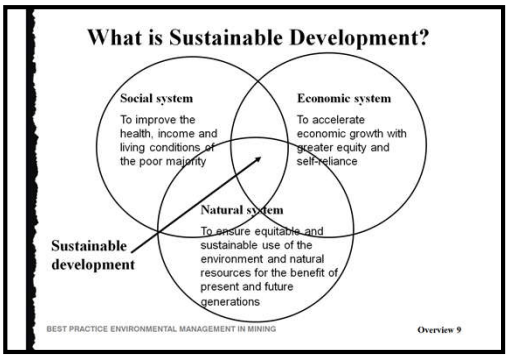
The question “Is sustainable development possible in mining?” could be a useful topic for discussion.

One possible definition is “Sustainable development, broadly defined, reflects the desire of people to act in ways that simultaneously sustain or even improve:

- The natural environment, including both:
  - environmental quality; and
  - the stock of natural resources;
- Economic well-being; and
- Social justice.”

Elliot Dwyer (2001) writes in *Environment South Australia,* “A sustainable minerals industry… is one that:

- Recognises its community obligations;
- Is socially and environmentally aware and is prepared to protect and enhance both social and biological ecosystems;
- Recognises that its “stakeholders” are more than shareholders; and
- Is ready to inform and communicate with its stakeholders.”



TIPS

Mining Minerals and Sustainable Development (MMSD) is an independent two-year project of participatory analysis seeking to understand how the mining and minerals sector can best contribute to the global transition to sustainable development. The Project began in April 2000 and is designed both to produce concrete results — a Final Report and a series of working papers — and to create a dialogue process capable of being carried forward into the future.

MMSD is managed by the International Institute for Environmental Development (IIED) in London, UK under contract to the World Business Council for Sustainable development (WBCSD). The project was initiated by WBCSD and is supported by the Global Mining Initiative (GMI).

Information about these organisations can be found at:

IIED http://www.iied.org/mmsd/index.html

WBCSD http://www.wbcsd.org

GMI http://www.globalmining.com/index.asp

MMSD is made up of four major partners based in South America, Australia, Southern Africa and North America. Links to these regional programs can be found in the IIED website.

Sustainable Development (iii)

The objectives of sustainable development are underpinned by a number of guiding principles:

- The precautionary approach (see next slide);
- The global dimensions of environmental and social impacts of actions and policies should be recognised and considered;
- The need to develop a strong, growing and diversified economy, that can enhance the capacity for environmental protection, should be recognised;
- The need to maintain and enhance international competitiveness in an environmentally sound way should be recognised;
- Cost effective and flexible policy instruments should be adopted such as improved valuation, pricing and incentive mechanisms; and
- Decisions and actions should provide for broad community involvement on issues that affect them.

(source: Council of Australian Governments, 1992)

Discuss with the group objectives of sustainable development in the light of the guiding principles listed above.

If these principles are to be have a positive effect, should some of the words such as “recognise” and “consider” be made stronger? How could the impacts of these guiding principles be strengthened?

TIPS

Invite any further questions or comments.

Precautionary Approach (i)

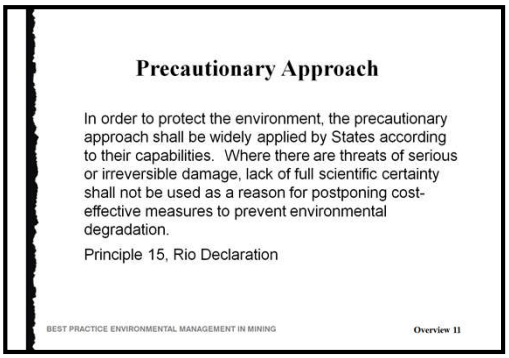
The idea of the Precautionary Approach (or Principle) emerged from issues of marine pollution, international law and 'cleaner production' in Europe in the 1970s.

The slide uses the definition of the Precautionary approach stated in the Rio Declaration.

In Australia the Precautionary Approach has been adopted through the *Intergovernmental Agreement on the Environment* (1992) which states that "In the application of the precautionary [approach], public and private decisions should be guided by:

(i) Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and

(ii) An assessment of the risk-weighted consequences of various options."



TIPS

The Rio Declaration on Environment and Development can be found at:

http://www.unep.org/unep/rio.htm

Deville and Harding (1997) *Applying the Precautionary Principle* **provides step-by-step guidance for application of the precautionary principle and gives number examples from a range of resource management issues.**

Examples

- **The Australian Fisheries Management Authority limits access to new areas for fishing and to development of new fisheries, *pending scientific assessment* of the long-term sustainability of the resources in question.**
- **A decision of the Land and Environment Court in the State of New South Wales denied planning permission for a new road through native forest because destroying habitat *might* have brought an endangered species closer to extinction.**

Precautionary Approach (ii)

Valuing environmental assets is an important rule that has often been overlooked. We often take for granted services that are provided by the environment. We do not pay for them, so we do not realise that they have a value.

The New York City watershed provides a good example.

New York City has traditionally been known for its clean water. The water comes from a watershed in the Catskill Mountains. Recently the natural ecological purification system provided by the mountains was overwhelmed by agricultural runoff and sewage. The water quality dropped below the standards set by the U.S. EPA.

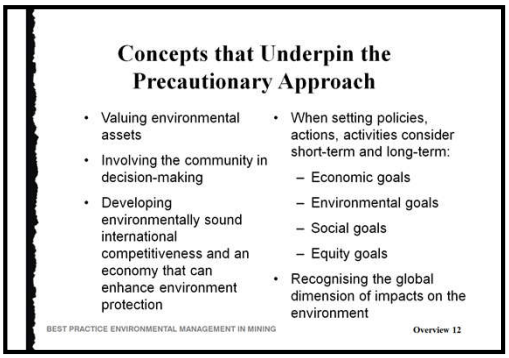
The New York City administration investigated the cost of replacing the natural system with an artificial water treatment plant. The estimated price of the filtration plant was $(US) 6-8 billion in capital costs and an annual operating cost of $(US) 300 million.

This would be a high cost to pay for something that was once obtained for free!

Further investigation found that restoring the integrity of the watershed would cost about $(US) 2 billion. This strategy was adopted, and the watershed is being restored and the water quality is improving.

The value of this environmental asset was demonstrated to be in the range $(US) 4-6 billion capital costs plus substantial annual operating savings.

Recent reports have indicated that the strategy is successful and that the quality of water harvested from the Catskill Mountains is improving.



TIPS

Ask the group to suggest other examples of environmental assets.

One example is the use of bacteria in mining to remove economic traces of minerals from ores.

The group should be able to nominate other environmental assets such as water supply from ground water, visual and noise buffering by woodland belts, natural attenuation of contaminants in wetlands, etc.

Precautionary Approach (iii)

Some possible strategies for applying the precautionary principle in mining are listed below.

1. Existing operations and activities

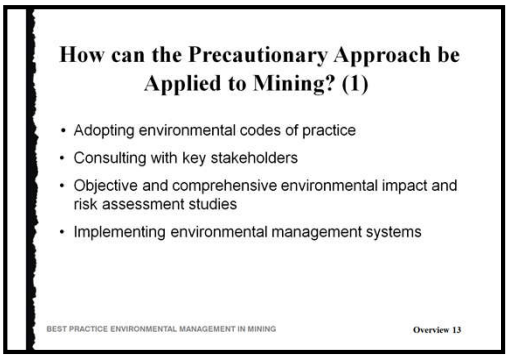
Education: Make sure operators are educated about relevant regulations, codes of practice standards and BPEM in mining strategies.

Monitoring: Establish formal monitoring programs incorporating the lowest possible detection limits and use the data that is collected to identify low-order impacts and to quantify risk. Encourage operators to report operational and ecological information to senior management. Monitoring should include a range of biological techniques which can detect changes at the ecosystem and individual level that can provide early warnings of damage to the environment.

Technology: Try to use best available technologies or techniques for:

- Identifying which modules should be taught;
- Reducing environmental effects;
- Waste management;
- Pollution prevention and control; and
- Environmental rehabilitation.

Risk management: Identifying and assessing existing hazards allows the most serious risks to be addressed in a systematic fashion.



TIPS

Refer to *Environmental Risk Management* **and** *Environmental Management Systems* **booklets. These are important tools for applying the precautionary principle in mining.**

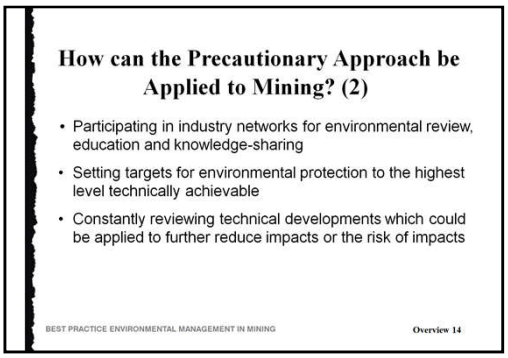
Precautionary Approach (iv)

2. Planning projects and activities

The precautionary principle is an important tool in reducing the environmental impact of new projects. Some aspects to consider are listed below:

- Site selection to avoid sensitive environments;
- Public involvement to identify threats and gain information on community attitudes;
- Consider options including approaches for preventing and managing waste, resource and energy sources and the project itself;
- Consider natural conditions and cycles, appropriate technology targets and indicators and project management including BPEM;
- Identify and predict impacts to reduce uncertainty. This should include identifying the baseline ecology and the impact of the project;
- Tools may include environmental impact assessment including cumulative impact, land capability and social impact;
- Consider how to avoid, reduce and rehabilitate impacts; and
- Use risk assessment and management techniques at the planning stage.

From Deville and Harding (1997).



TIPS

Exercise 4 (Lead in to Next Topic)

An important component of sustainable development and environmental management is the maintenance of biological diversity.

Ask how many have heard the term biological diversity (or biodiversity). Ask the groups to address the following questions:

- **What is biological diversity?**
- **Why is biological diversity important?**

Invite feedback, and record their answers before you show the following overheads.

Biological Diversity (i)

Biodiversity is the variety of all life forms. It is usually considered at three levels. **Species diversity** is the number of species and their relative abundance in an area. Some species may become extinct even before they are identified and named. **Genetic diversity** includes the variety of all the genes (DNA) contained in all the species in a given area. Genetic diversity provides the basis for continuing evolution and the adaptability and survival of species. **Ecosystem diversity** refers to the range of ecosystems in an area.

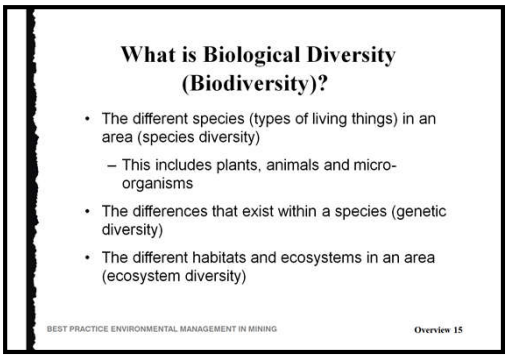
Biodiversity is threatened by many factors. Including loss or fragmentation of habitat, urban development, over-exploitation, agriculture, pollution and mining.

Mining can affect biodiversity by removing vegetation and topsoil, by polluting air or water and by producing mine overburden. Acid mine drainage can pollute rivers and kill aquatic life. Poor handling of tailings dams can lead to damage that reduces biodiversity.

Effective mine planning and management of acid mine drainage and tailings containment can contribute to maintaining biodiversity. These topics are covered in more detail in other modules in this series.

Careful planning and wise management can clearly help minimise the adverse effects of mining or drilling operations.

Source: Stone et al. (1997) *Biodiversity and Business--A guide for the private sector* available from: World Business Council for Sustainable Development
http://www.wbcsd.org/newscenter/reports/1997/Business%20&%20Biodiversity.pdf



TIPS

Ask for examples illustrating where mining activities have affected biodiversity. Remind participants that biodiversity is not limited to large animals and plants. Micro-organisms, insects and other macro-invertebrates are as important as the more obvious large trees and vertebrates.

MMSD in cooperation with Conservation International and IUCN is carrying out a project to review the impact of mining on biodiversity, the scope and effectiveness of impact management and the potential for proactive minerals industry practices to protect and enhance biodiversity. See http://www.poptel.org.uk/iied/mmsd/activities/biodiversity.html

Case Study

In cases where great physical disruption is required in order to reach certain metals or minerals, site rehabilitation should become a priority. This can take many forms. For example, coastal dune sand mining in South Africa had caused a temporary change in the local environment. But, by removing the vegetation and topsoil ahead of the mining operation, Rio Tinto's planners in South Africa were able to replace them over the mined sand, effectively speeding up the rate of settlement and recolonization of the various ecological processes. Before the mining began, 243 plant species had been identified in the region. After 12 years, this diversity of species had returned, demonstrating a restoration of biodiversity. This type of restoration indicates the kinds of actions which mining industries can now take to counter claims that their activities are incompatible with environmental protection.

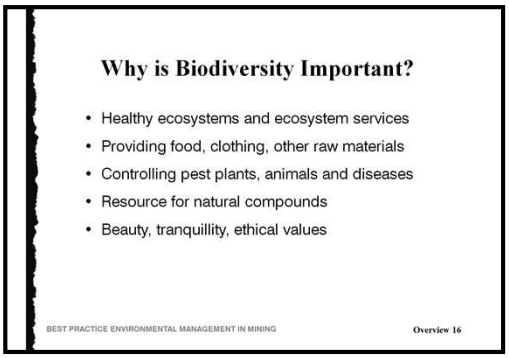
Biological Diversity (ii)

An ecosystem is a dynamic complex of plants, animals and micro-organism communities and their non-living surroundings interacting as a functional unit. "Ecosystem services" is the term used to describe the role played by organisms in creating a healthy environment for human beings, from production of oxygen to soil formation and maintenance of water quality.

Many of our systems for producing food and other raw materials use only a few strains of crops. Large areas planted to a single crop are called monocultures. These are vulnerable to plant diseases. Commercially grown soybeans have a very narrow genetic base. There are many wild species in the same genus that are an important resource for the improvement of the commercial varieties.

Plants and other organisms produce a wide range of chemical compounds. Some of these are useful in medicine or technology.

Biodiversity provides a vast library of genetic material for use now and in the future, for a variety of industries including agriculture, medicine and gene technology. A loss in genetic diversity would result in a loss of potential for these industries (*State of the Environment Report,* 1996, Commonwealth of Australia).



TIPS

There are four reasons for conserving and maintaining biodiversity. These are:

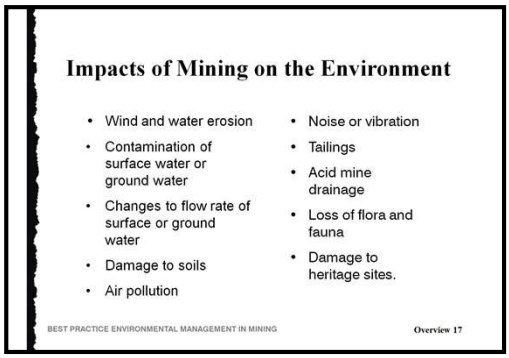
- **Life support systems (ecosystem services);**
- **Economic returns;**
- **Aesthetics and culture; and**
- **Future generations.**

Source: Milburn-Clark, K. (2001) *Business and Biodiversity.*

Available from Earthwatch Australia at:
http://www.earthwatch.org/australia/pubs.html

Impacts of Mining

Mining has many environmental impacts. You may be able to expand on the impacts listed on the slide in the context of your specific operation.



TIPS

Recent tailings dam accidents provide ample illustrations of the severe environmental impacts that can result from mining activities.

The Baia Mare tailings dam failure is an example of the wide ranging damage that can occur. An account of this incident can be found at:

http://www.antenna.nl /wise/uranium

Click on Tailings Dam Failures.

Small groups may be useful here.

- **Before you show the slide, ask the participants to think about the impacts of their mining operation on the environment.**
- **Remind them that there may be positive impacts as well as negative impacts. They should consider both positives and negatives.**
- **Ask the groups to list their impacts on the environment.**
- **Report back.**
- **Write their responses on the white board or post the large sheets of paper with their responses around the room.**
- **Show the overhead, and compare the list shown there with their responses.**
- **Encourage discussion on the impacts on the overhead and on their lists.**

Achieving Best Practice (i)

Refer booklet: Sections 4.2, 5

"Best Practice" may seem difficult to define. It can be defined at a particular time by the practices of the leaders in the industry. These practices are identified by "benchmarking". However, these practices change over time, so "best practice" is a moving target. Improvements in technology and management practices will affect what can be regarded as best practice.

Legal compliance is a first step towards best practice. However legal compliance alone does not constitute best practice. International standards such as the ISO 14000 series, require commitment to continual improvement, and while their application reduces the risk of environmental harm, in themselves they do not guarantee environmental outcomes.

BPEM in mining should be regarded as a process rather than a destination. Once an organisation starts on the journey to best practice, it should continue along this road for the duration of its operation.

Tools that can be used on the road that leads to best practice include the BPEM in Mining series of booklets, these training modules, the strategies of cleaner production, environmental management systems and industry codes of practice.

One such code of practice is the Australian Minerals Industry *Code for Environmental Management* which is an initiative of the Minerals Council of Australia.

TIPS

The *Environmental Management Systems* **booklet is a useful tool for working toward best practice environmental management.**

The Minerals Council of Australia *Code for Environmental Management* **provides another tool for improving the management of environmental impacts. The Code is based on four principles:**.

- **Accepting environmental responsibility for all our actions;**
- **Strengthening our relationships with the community;**
- **Integrating environmental management into the way we work; and**
- **Minimising the environmental impacts of our activities.**

The Code can be found at the Minerals Council of Australia website:

http://www.minerals.org.au

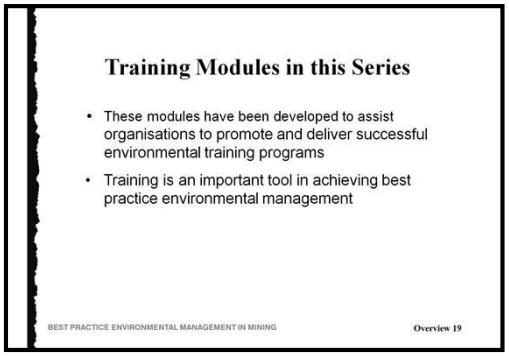
Achieving Best Practice (ii)

Training for best practice environmental management in mining can take many forms. These include:

- Environmental awareness for all staff;
- Legal responsibilities and obligations;
- Cultural sensitivity;
- Induction training of new operational staff; and
- Follow up technical training.

Outcomes of a successful training program include:

- All workers knowing that their jobs have environmental consequences, and being willing to take responsibility for them;
- A corporate culture that promotes best practice rather than mere compliance with regulatory requirements;
- Adherence to a true environmental ethos; and
- The urge to continually improve environmental management systems.



TIPS

If you are using this *Overview* **module to develop a training program, you could refer back to Slide 1, and ask the groups to identify the modules to be included in the program. Other issues that could be addressed include who should be trained, the training schedule and strategies to gain support for the training plan.**

The booklet *Planning a Workforce Environmental Awareness Training Program* **provides guidance.**