Learning Objectives of the Module

- To identify a range of environmental issues that are relevant to the planning of a modern mine
- To demonstrate how mine planning, at all stages of a mine's development, can contribute to environmentally sound mining practices

What are the Environmental Issues

?

Environmental Issues

- Air quality
- Noise & vibration
- Water management
- Water quality
- Soil conservation
- Flora & fauna
- Archaeology & heritage protection
- Transport
- Subsidence
- Rehabilitation
- Visual impacts
- Hazard & risk assessment
- Waste management
- Socio-economic issues
- Nuisance

Air Quality

- Dust impacts
  - Health hazard
  - Loss of environmental amenity
  - Aesthetic impact
- Planning solutions
  - Minimise area of pre-stripping
  - Rehabilitate mined areas as soon as possible
  - Water haul road surfaces
  - Consider using binders on haul roads

Noise & Vibration

- Noise and vibration impacts
  - Disturbance of nearby residents and land holders
  - Potential injury to human health
  - Possible structural damage
- Planning solutions
  - Control noise sources
  - Use good blast design
  - Bunds and screens
  - Develop operational plans
  - Consider land use zoning

Water Management

- Flood impacts
  - Worker safety
  - Damage to equipment
  - Inundation of surface workings
- Drought impacts
  - Disruption of processing
  - Conflict with other water users

- Planning solutions
  - Design appropriate flood diversion works such as levees

- Planning solutions
  - Model water balances
  - Build retention ponds/dams
  - Harvesting water

Water Quality

- Impacts
  - Groundwater & surface water contamination
  - Increased sediment in runoff
  - Acid or saline waters
  - Impacts on aquatic flora and fauna
- Planning solutions
  - Use sedimentation ponds
  - Install grit & oil arresters in association with oil separators around workshops, vehicle wash-down pads and process plants
  - Develop a water management strategy

Soil Conservation

- Impacts
  - Erosion
  - Affects success of rehabilitation and revegetation programs
- Planning solutions
  - Develop a topsoil management plan
  - Reuse topsoil in rehabilitation programs

Flora and Fauna

- Impacts
  - Displacement of animals
  - Habitat reduction
  - Loss of plants and animals
  - Damage to the ecological integrity of the area
- Planning solutions
  - Survey pre-mining flora and fauna and identify rare and endangered species
  - Develop a rehabilitation strategy
  - Minimise mine impacts on flora and fauna through layout and design

Archaeology & Heritage Protection

- Issues
  - Potential damage to artefacts or sites of historical and heritage value
  - Sites may be of scientific or spiritual significance
- Planning solutions
  - Consult the local community for help in identifying these sites
  - Carry out site surveys
  - Plan to minimise disturbance & conserve archaeological & heritage sites

Transport

- Transport impacts
  - Traffic noise
  - Traffic congestion
  - Potential reduction in road safety
  - Increased road wear and tear
- Planning solutions
  - Upgrade and use existing roads
  - Construct new facilities dedicated to the mine
  - Stagger shift times with surrounding industries to reduce road congestion

Subsidence

- Subsidence impacts
  - Surface damage (ground movement and slope change)
  - Waterlogging soils or making land more flood prone
  - Potential damage to buildings or infrastructure
- Planning solutions
  - Modify extraction methods
  - Modify buildings or other surface structures before mining so they can better withstand subsidence

Rehabilitation

- A key goal of mine planning is ensure the rehabilitation of disturbed lands to a stable and productive post-mining land use which is acceptable to the community
  - Design and create appropriate landforms for the minesite
  - Establish appropriate and sustainable ecosystems

Visual Impacts

- Visual impacts
  - Removal of vegetation
  - Modification of landforms
  - Create colour contrasts
  - Impose structures into a natural landscape
- Planning solutions
  - Consider location of viewing points, quality of the visual resource
  - Tree plantings
  - Suitable colour choice for buildings and equipment
  - Perimeter screening (bunds & vegetation)

Hazard & Risk Assessment

- Hazard issues
  - Natural disasters
  - Operational hazards
  - Site accidents
  - Blasting
  - Spills
- Planning solutions
  - Planning can assess and minimise hazards and risks to the environment, personnel & the community
  - Training, emergency procedures, careful blast design, traffic rules, EMS, appropriate environment performance targets

Waste Management

- Waste issues
  - Overburden
  - Slimes, muds and tailings from ore concentrators and processing plants
  - Maintenance wastes (oils and lubricants)
  - Staff waste (sewage, wash water)
- Planning solutions
  - In-pit disposal
  - Mechanical de-watering
  - Incineration (possible electricity generation)
  - Effluent land irrigation systems

Socio-Economic Issues

- Issues
  - Local and regional economic issues
  - Community attitudes and concerns
  - Impacts on neighbours
- Planning solutions
  - Understand and accommodate the concerns and needs of the local people
  - Effective community consultation

Mine Planning Stages

1. Mine location
2. Pre-mining investigations
3. Construction
4. Pollution prevention
5. Biophysical impacts
6. Socio-economic issues
7. Environmental monitoring
8. Mine closure

Mine Location: Issues to Consider (1)

- Location in drainage basin
- Surrounding land use
- Location of waste dumps
- Location of hazardous materials stores

Mine Location: Issues to Consider (2)

- Proximity to utility infrastructure
- Surrounding land use
- Labour market
- Visual exposure
- Cumulative impacts

Pre-Mining Investigations

- Baseline investigation is required to:
  - Enable mine planners and environmental scientists to understand the environmental and social issues that need to be addressed
  - Ensure the financial viability of the mining operation
  - Gather sufficient information about flora, fauna, landscape, soil types and drainage system to provide a sound basis for planning rehabilitation

Construction

- Worker housing
- Transport issues (construction materials and bulk samples/trial shipments)
- Community concerns
- Environmental safeguards during construction

Pollution Prevention and Controls (1)

- Incorporate pollution controls into the design phase of operations
- Control and contain contaminants on site
- Train mine employees in environmental awareness and responsibilities

Pollution Prevention and Controls (2)

- Containment of contaminants
- Air quality
- Noise
- Water pollution

Biophysical Impacts

- Design safeguards can minimise biophysical impacts
- For example, soil erosion can be minimised by:
  - Understanding soil structure
  - Landform design
  - Drainage networks
  - Incorporating runoff silt traps and dry detention ponds in the rehabilitated landform

Socio-Economic Issues

- Promote the positive aspects of mining while recognising and addressing adverse effects.
- Consider:
  - Community infrastructure
  - Employment
  - Archaeological and heritage issues
  - Land use planning

Environmental Monitoring

- Ongoing environmental monitoring provides information to:
  - Test environmental performance
  - Demonstrate compliance with environmental legislation
  - Refine operational practices
  - Safeguard the interests of both the mining company and the community

Mine Closure

- Ideally mine closure should be planned at the commencement of operations
- Issues to consider:
  - Long term water management
  - Post-mining land use
  - Final rehabilitation
  - Safety of mining voids
  - Sustainability

Conclusion

- Environmental considerations should be firmly integrated into the planning of each stage of a mining project