



Innovative Approaches to Mining Site Remediation and Reuse Workshop



ICCL
international
committee on
contaminated
land

Environmental Impact Assessment (EIA) as a tool for sustainable mining

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EIA process as a tool for sustainable mining

- ◆ The EIA process and key elements
- ◆ CAFTA-DR Regional EIA Technical Review Guidelines for Non-Metal and Metal Mining
- ◆ “Site Remediation and Reuse Plans” are built on information in and part of the EIA
 - closure and post closure activities
 - complete baseline information
 - reuse plans influence /integrate with site preparation, construction, operations and sequencing
 - Financial guarantees are needed UP-FRONT for closure and post-closure monitoring
 - Public participation process is essential for environmentally, socially and culturally acceptable reuse plans

Environmental Impact Assessment Definition

◆ Decision-making process

- | | |
|-----------------------------|--|
| ▪ Purpose: | <i>Integration of environmental, economic, and social concerns</i> |
| ▪ Decision-oriented: | <i>Requires a proposed action and practical alternatives</i> |
| ▪ Scope: | <i>Project, program, policy, plan</i> |

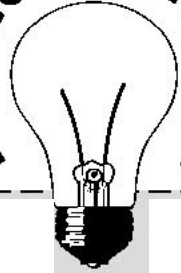
◆ Systematic, interdisciplinary, reproducible (objective) documented evaluation of potential impacts

◆ Involves all affected Stakeholders: public participation is key



THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

PROJECT INITIATION

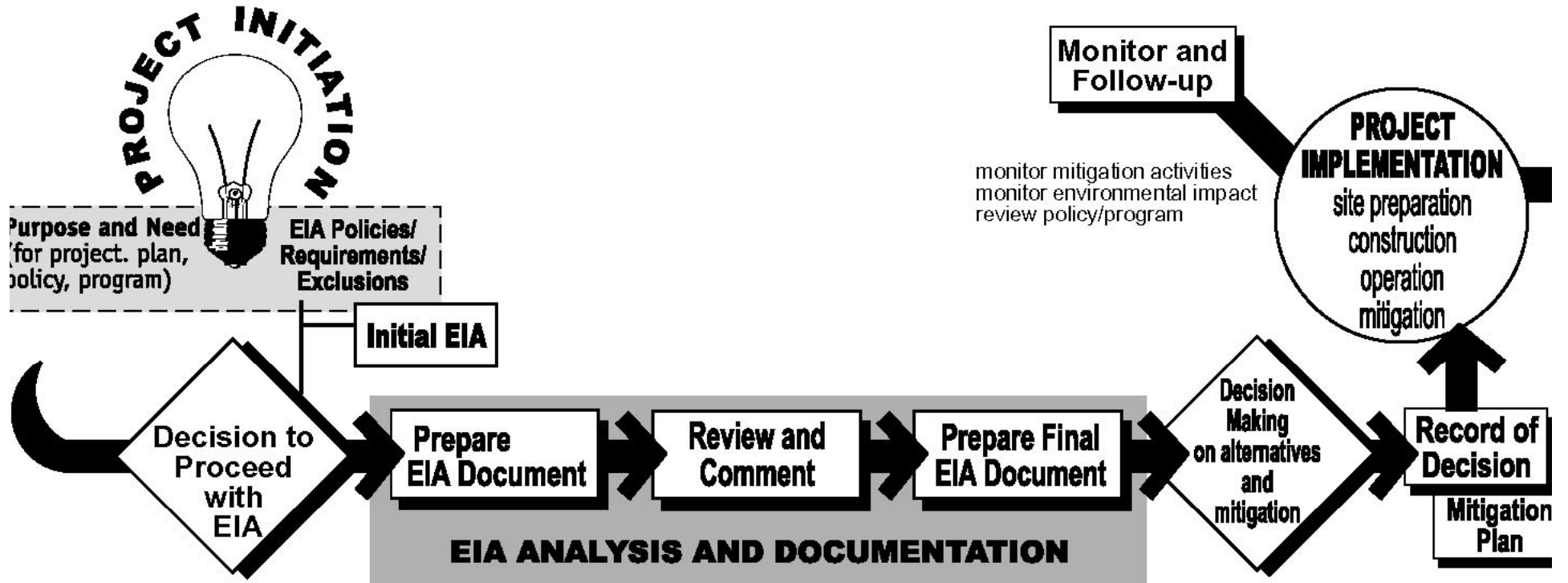


PROJECT IMPLEMENTATION

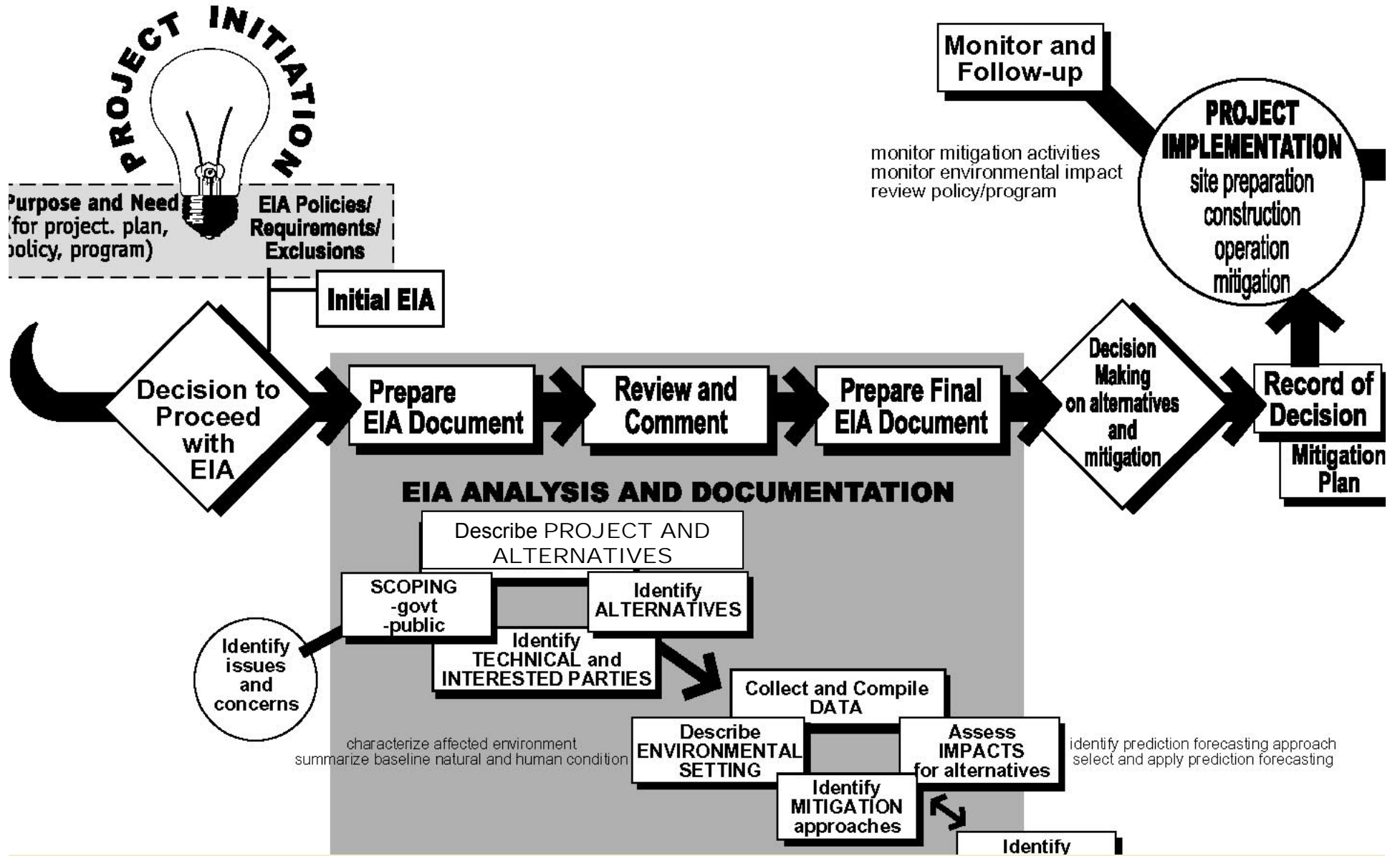
site preparation
construction
operation
mitigation



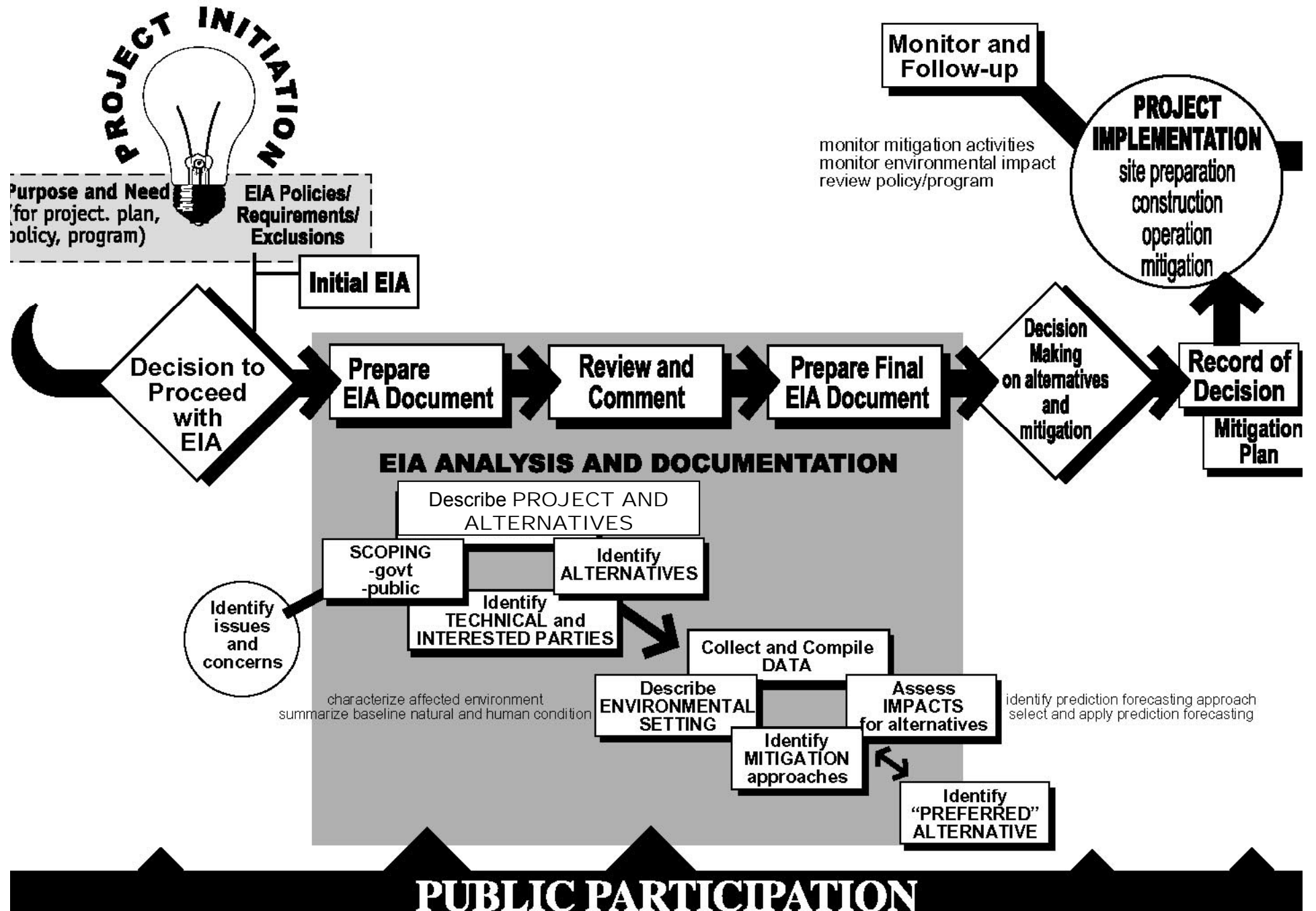
THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS



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THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS



EIA addresses all phases/activities

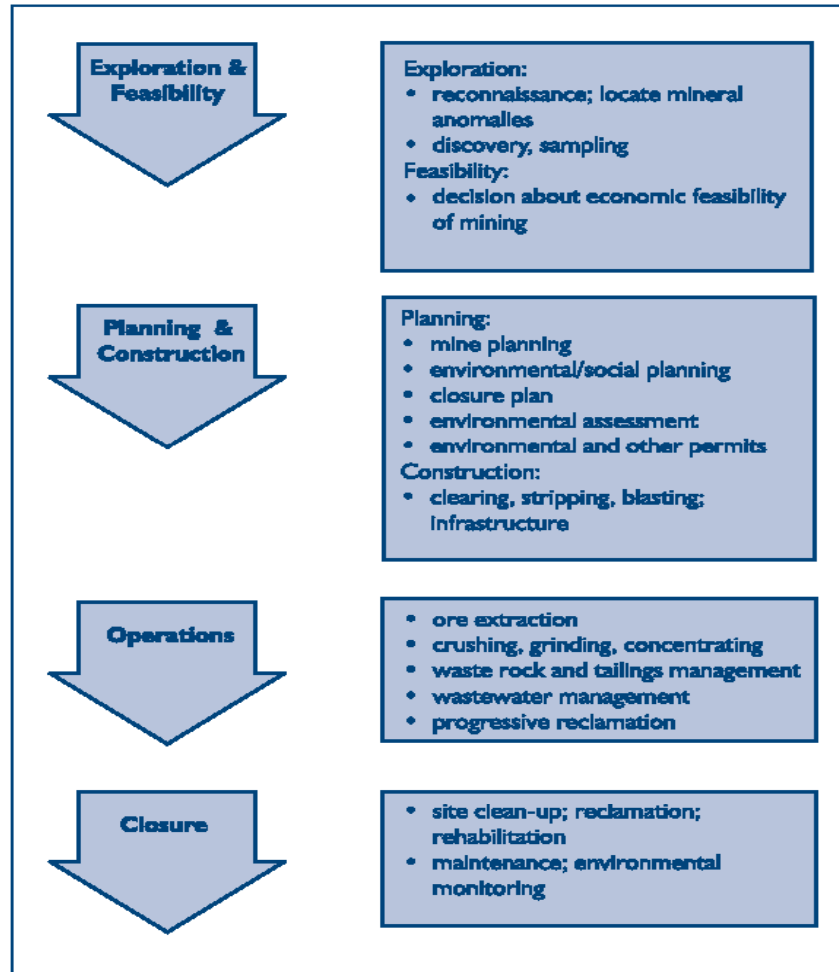


Figure E-1: The Mining Cycle (Env. Canada, 2009)

- ✓ Project/Engineering design
- ✓ Project facilities
- ✓ Construction sequencing
- ✓ Project operations
- ✓ Closure and restoration
- ✓ Post-closure activities, if needed

The ICMM (2006) considers two types of integration for post-closure planning:

- The integration of social and environmental considerations into the closure approach
- The integration of closure considerations into an operation's life cycle planning and engineering processes

CAFTA-DR EIA Guidelines for Mining



Volume I: Guidelines

- A. Introduction
- B. EIA Process and Public Participation
- C. Project and Alternatives Description
- D. Environmental Setting
- E. Anticipated Impacts
- F. Assessing Impacts: Predictive Tools
- G. Mitigation and Monitoring Measures
- H. Environmental Management Plan
- I. Glossary and References
- J. Example Terms of Reference (see Volume 1 Part 2)

Volume I Part 2 Example TORs

Separate for Non-Metal and Metal Mining:

- A. Overview
- B. Exploration
- C. Exploitation

Volume II: Appendices

- A. What is Mining
- B. Mining in CAFTA DR Countries
- C. Regulations and Standards
- D. Erosion and Sedimentation Control
- E. GARD: Acid Rock Drainage Guide
- F. Sampling and Analysis Plan
- G. International Cyanide Code
- H. Financial Surety Guidelines

Project and Alternatives Description in the EIA

◆ Purpose and need

◆ Project Details

◆ Alternatives

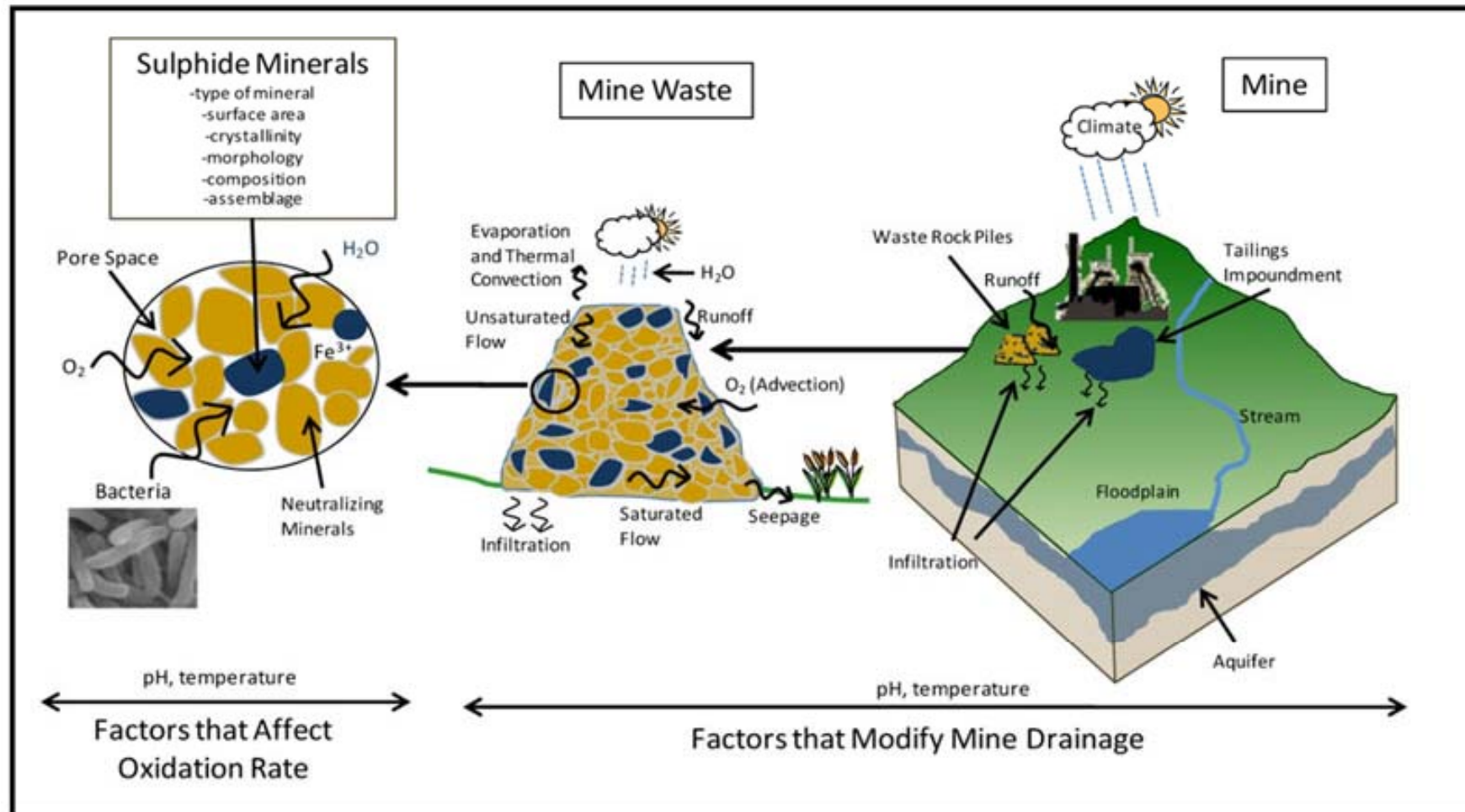
◆ *The project description shall include a Restoration and Closure Plan with a description of restoration measures including the size of the area to be restored as well as concurrent, temporary and final restoration measures to be used and their schedule. Restoration and closure measures shall include, but not be limited to, the following types of structures:*

- ☑ Pits and quarries
- ☑ Underground workings
- ☑ Waste rock dumps
- ☑ Final disposal of hazardous and radioactive wastes
- ☑ Stockpiles
- ☑ Solid waste disposal facilities
- ☑ Facilities
- ☑ Roads
- ☑ Electrical structures
- ☑ Water conveyance and treatment structures.

Environmental Setting Section of the EIA

Physical	Biological	Socio-economic-Cultural
<p>Geology and Soils</p> <ul style="list-style-type: none"> • Soils & Geotechnical Stability • Geology & Geochemistry <ul style="list-style-type: none"> ○ Waste Rock ○ Wall Rock ○ Ore <p>Air and Climate</p> <ul style="list-style-type: none"> • Climate & Change • Air quality <p>Water Resources</p> <ul style="list-style-type: none"> • Surface Water • Ground Water <p>Noise & Vibration</p> <p>Aesthetics and Vistas</p>	<p>Vegetation/Flora</p> <p>Fish and Wildlife/Fauna</p> <p>Ecosystems</p> <p>Endangered or threatened species and habitat</p> <p>Protected Areas</p>	<p>Socioeconomic Conditions / Resources</p> <ul style="list-style-type: none"> • Population Statistics/Housing • Community Services • Economic Activity/Employment • Health and Safety • Vulnerable Populations <p>Infrastructure</p> <ul style="list-style-type: none"> • Transportation/Infrastructure • Public Health Infrastructure • Communications • Energy <p>Cultural or Historical Resources</p> <p>Land Use</p>

Potential for Acid Rock Drainage is based on both Physical and Biological factors



Potential Environmental Impacts During Reclamation/Closure

- ◆ Subsidence of underground workings
- ◆ Long-term stability of waste rock piles and mining slopes
- ◆ Erosion and sedimentation
- ◆ Interim and final pit lake water quality, effects on wildlife (e.g. poisoning) and on groundwater or surface water from flow-through pit waste
- ◆ Trace metals
- ◆ Acidic and neutral rock drainage potential (metal and coal mines)
- ◆ Containment failures
- ◆ Disposal/discharge of heap leach and tailings drain down solutions
- ◆ Degradation of surface water and groundwater (ARD and trace metals)
- ◆ Long-term changes to groundwater balance (loss through pit lake evaporation)
- ◆ Failure of vegetation to properly reestablish
- ◆ Failure to meet final land use requirements
- ◆ Emissions from vehicles and machinery
- ◆ Fugitive dust
- ◆ Odors
- ◆ Noise from reclamation activities

Mitigation and Monitoring Measures in the EIA for Reclamation and Closure Plans

- ◆ **Reclamation and Closure is one part** of continuous mitigation of impacts at a mine
- ◆ **Before mining begins**, the mine owner should first prepare a detailed Project Description of the proposed mine
- ◆ **This Project Description should be based** on detailed engineering evaluations, geological coring programs, and preliminary determination of how to manage environmental impacts
- ◆ **The proposed mine Project Description is used** by the mining company to seek financing as well as a way to determine if the proposed design will meet government standards
- ◆ **Each Project Description should** include a proposed reclamation and Closure Plan
- ◆ **The Reclamation and Closure Plan should** assume that a independent third party will conduct these activities
- ◆ **The Reclamation and Closure Plan should** be updated on a 3-4 years basis throughout the life of the mine

Reclamation and Closure Plan Content

- ✓ Size of the area to be restored?
- ✓ Post-mining land uses for restored mine lands
- ✓ If and How re-contoured mine lands will be re-vegetated
- ✓ The timing of reclamation – at what interval it should occur after ore removal
- ✓ Timing of reclamation and whether it is concurrent with operations
- ✓ Whether open pits should be backfilled with waste rock
- ✓ Amount of financial guarantee set aside to ensure reclamation can be accomplished by a third party if the mine company cannot complete the job and form of financial surety required for this guarantee
- ✓ Acceptable slopes for re-contouring the land to prevent erosion and mudslides
- ✓ Acceptable vegetation, the number, types (species) and density of plants; how they will be maintained and a determination of whether this effort has been successful or needs to be repeated or revised
- ✓ How the mining company will mitigate all of the environmental concerns and impacts noted in the EIA

Post-Closure Concerns

- ◆ Long-term maintenance of water treatment facilities
- ◆ Long term actions to address the potential for facilities to contaminate surface water and groundwater with ARD, suspended solids, trace metals, and other contaminants
- ◆ Long-term maintenance of slopes, drainage control and vegetation
- ◆ Long term environmental monitoring
- ◆ Steps to be taken to address environmental contamination indicated by monitoring
- ◆ If a **post-mining pit lake** may form, an **ecological risk assessment** should be conducted for the EIA to predict impacts to aquatic resources and wildlife. Where **wall rock** could generate contaminated leachate, companies should assess whether backfilling the mine pit with waste rock would minimize the likelihood and environmental impact of contaminated leachate.
- ◆ Assess and mitigate danger of **land subsidence** associated with underground mining. Subsidence due to the collapse of abandoned mine workings can cause significant long-term environmental damage by allowing water to flow unimpeded into mine workings, leaching contaminants as water travels through the mine site.

Financial Assurance: Basics

- ◆ **A financial guarantee is a critical** component of the reclamation and post-closure process because it can be used to cover the costs of closure should the mine operator be unable to do so
- ◆ **Because closing a mine can typically** cost tens of millions of dollars, regulators need a dependable source of funds to pay for the physical reclamation of the mine site as well as the necessary oversight by government officials
- ◆ **Long-term trust funds should be considered** if post-closure monitoring, operations and maintenance are needed over the long term or in perpetuity
- ◆ **Long term financial guarantees are separate** mechanisms from reclamation bonds
- ◆ **Governments have employed a number of financial vehicles** to meet surety requirements. These vehicles generally take two forms: independently guaranteed sureties and sureties guaranteed by mining companies
- ◆ **The EIA should include how the mining company will** establish financial assurance in the full amount that covers the projected reclamation and closure costs (assuming a third party conducts reclamation and closure)

Reclamation Example Auditable Commitment Language

- ◆ **Stabiliization of surface areas:** All exposed surface areas will be protected and stabilized to effectively control erosion and air pollution attendant to erosion.
- ◆ **Rills and gullies, which form in areas that have been regraded and topsoiled** and which either (1) disrupt the approved post-mining land use or the reestablishment of the vegetative cover, or (2) cause or contribute to a violation of water quality standards for receiving streams will be filled, regraded, or otherwise stabilized; topsoil will be replaced; and the areas will be reseeded or replanted.
- ◆ **Landslides and other damage:** An undisturbed natural barrier will be provided beginning at the elevation of the lowest bench to be mined and extending from the outslope for [X distance - determined by the Ministry] to assure stability. The barrier will be retained in place to prevent slides and erosion.
- ◆ **At any time a slide occurs which may have a potential adverse affect on public property**, health, safety, or the environment, the person who conducts the surface mining activities will notify the Ministry by the fastest available means and comply with any remedial measures required by the Ministry.
- ◆ **Contemporaneous reclamation:** reclamation efforts, including but not limited to backfilling, grading, topsoil replacement, and revegetation, on all land that is disturbed by surface mining activities shall occur as contemporaneously as practicable with mining operations
- ◆ **Backfilling and grading: timing:** Rough backfilling and grading for surface mining activities should be completed within [X period of time] after the ore has been removed from the pit.
- **Disturbed areas will be backfilled and graded to:** (a) Achieve the approximate original contour; (b) Eliminate depressions except if they are needed to retain moisture, minimize erosion, create and enhance wildlife habitat, or assist revegetation in small depressions or (previously mined highwalls) of this section; (c) Achieve a post-mining slope to prevent slides; (d) Minimize erosion and water pollution both on and off the site; and (e) Support the approved post-mining land use.

Revegetation part of Reclamation Example

Auditable Language

- ◆ Following backfilling and regrading, the slopes shall be prepared for an appropriate seed mixture designed for the mine site and final land use.
- ◆ The seed mixture if possible shall consist of native species without noxious weeds. Weed-free straw or other type of mulching material shall be placed over seeded areas to retain moisture and reduce erosion, if appropriate. Seeding shall be done at the appropriate time of time of year to ensure rapid growth.
- ◆ Long-term revegetation monitoring of reclaimed areas will be done annually over the life of the project and up to **[five years]** after closure to ensure revegetation meets project specific performance standards. Long-term revegetation monitoring will consist of the following: collecting annual data over the life of the project and for **[five years after closure]** on existing and newly restored areas; documenting trends in vegetation parameters over time; identifying areas where revegetation may be failing; and providing recommendations for maintaining revegetated areas. Monitoring reports will contain:
 - ◆ Monitoring locations and justification
 - ◆ Area-wide monitoring and cover sampling data will be recorded on field forms
 - ◆ Cover sampling method using either the Point-Quadrat Method, 35mm Slide Method,
 - ◆ Bitterlich's Variable Radius Method, or other method approved by the Ministry. Each method will use transects that will be established in reclaimed and undisturbed areas. In restored areas, sample transects and sample locations will be located to represent a one-dimensional "square grid" pattern
 - ◆ Quality assurance and control measures including field duplicates, error limits, and statistical validity
 - ◆ Measures to be taken if results do not meet expectations