

# MINE CLOSURE

Overview

Acts and Regulations

Environmental and Social Impacts

Community Employment and  
Other Economic Opportunities

Community Experiences





## 4.1 Overview

This section defines mine closure and describes the reasons why all mines eventually close. It also explains the necessary role of a mine closure and reclamation plan. The primary mine closure activities and players are identified, and so are opportunities for Aboriginal involvement, including in mine rehabilitation and monitoring.



### What Is Mine Closure?

Mine closure is the last phase of the mining cycle. Due to the nature of mineral deposits, they all have a finite life. While some deposits are very large and may generate a mine life of 50 years or more, other deposits may only produce a mine life of a few years. All mines have one thing in common – no matter how long they last, they all will close. Mining is a temporary land use.

Today, mine closure is defined as the orderly, safe and environmentally sound conversion of an operating mine to a closed state. Areas affected by mining activity should become viable and self-sustaining ecosystems that are compatible with a healthy environment and with human activities.

Mines close for different reasons, but the two most common are:

- 1) Running out of the ore resource; and
- 2) Low commodity or metal prices, which make the mine uneconomic to operate.

While closure is the last phase of the mining cycle, today planning for closure starts before the mine development phase. All governments in Canada have rules, legislation and regulations covering the closure process.

Mine closure is usually one of the most discussed issues with governments, companies and the public. Communities are concerned about what will be “left behind.” All stakeholders want to make sure that there are no contaminated sites now commonly referred to as “legacy issues.”

### *Time Frames*

The time frame needed for mine closure depends on many factors, including the size and complexity of the operation, the effects the mine has had on the environment, and the extent of regulatory review. Public input may also be a factor as some of the issues involved may raise public concerns that can take time to address.

Typically, it may take 2 to 10 years to shut down a mine. If long-term monitoring or

treatment is required, it may take decades before closure is considered complete.

### What Is a Mine Closure and Reclamation Plan?

Planning for mine closure starts during mine planning. The public usually reviews proposals for closure during the public consultations that occur as part of a project's environmental assessment. Under existing legislation, mine owners must submit a mine closure and reclamation plan to the provincial/territorial and/or federal government. Mining companies usually make great efforts to ensure that public views and concerns are heard and addressed during this consultation process.

The government must approve the initial closure and reclamation plans before any mine development work can begin. However, the development of final plans may take years of study and detailed engineering before being completed. The company must also put up money (e.g., a deposit or bond) to make sure that it can complete the reclamation, including shut-down, closure and post-closure. The financial assurance may be a few million dollars for a small mine or over \$100 million for a large mine. The deposit makes sure that the government will not be left with the responsibility of paying for a mine closure as has happened in the past

because abandoned mines become property of the governments.

A mine closure and reclamation plan for any mine is site-specific. It details how the mining company will close the mine site and return the surrounding land, as closely as possible, to its pre-mining state. Mine closure and reclamation activities include decisions on what to do with every component of the mine that was planned and put in place at the development stage, including, but not limited to:

- Buildings and other structures;
- Roads and airstrips;
- Tailings disposal facilities;
- Waste rock management, quarries and open pits;
- Petroleum and chemical storage areas and facilities;
- Pipelines and electrical transmission lines;
- Sewage and waste disposal areas and facilities;
- Mine and site drainage systems;
- Mine workings;
- Mine shaft, adit (passage ways), and decline openings;

#### Facts & Figures

*When a mine has exhausted its mineral supply, the disturbed area must be cleaned up and restored according to a mine closure and reclamation plan.*



- Site water quality, including water flows leaving the site;
- Recycling of materials; and
- Revegetation of the site.

A mine closure and reclamation plan should also:

- Indicate how progressive reclamation of the site will occur during the life of the operation;
- Provide cost estimates to close and reclaim the mine;
- Prepare a plan for temporary closure of the mine;
- Develop a plan for post-closure monitoring of the site; and
- Make sure that the site is left in a condition that will require little or no long-term care and maintenance.

Mine closure plans should be flexible and adaptable to new techniques and methods for protecting the environment and reducing environmental risks while ensuring liabilities are met. Good communications and consultation between governments, companies, and communities of interest will lead to the best solutions.

## What Are the Mine Closure Activities?

### *Shut-Down*

When all production has stopped, employees are progressively laid off leading up to the shut-down. A small labour force is kept on to permanently shut down equipment. The mine closure plan will indicate what types of skills are needed to shut down and demobilize equipment.

Before shut-down, the mine owner must notify various stakeholders, including employees, and employee representatives if any, various levels of government (municipal, provincial and federal), media, mining associations, and any other interested party.

The mine owner will carry out a final review of the mine closure plan and submit any changes needed to the government regulators for approval.

### *Decommissioning*

Decommissioning follows mine shut-down. Small crews decommission (take apart) mining and processing facilities and equipment. A contractor can do this work. Decommissioning includes:

- Draining hydraulic fluids and oils from mobile equipment;

- Draining pipelines;
- Removal and recovery of saleable equipment and parts;
- Clean-up and salvage of buildings;
- Recovery of warehouse materials, tools and consumables (i.e., oils, grease, etc.); and
- Disposing properly of all waste.



### Reclamation

Reclamation is the process of restoring disturbed land as closely as possible to its original condition when mining is finished. The process of reclamation can occur either during the life of the mine (progressive

reclamation) or after the mine has closed (reclamation).

All mine sites must be reclaimed according to applicable governmental regulations. This typically involves a number of activities including: re-shaping the land, restoring topsoil, and planting native grasses, trees or ground cover. Reclamation is done according to the approved closure and reclamation plan, which must be continuously updated by the mining

company and approved by the responsible government agency.

### Post-Closure

Environmental activities continue long after a company has finished mining an area. The owner is obligated under permit or licence conditions to reclaim the affected land and to monitor the success of the reclamation activities. The period of post-closure activity and monitoring varies and depends on the results.



Before



After

*The abandoned Coldstream mine site (Ontario) before and after rehabilitation.*

*(Source: Natural Resources Canada)*





Some mines may require long-term care and maintenance after closure. Examples include sites where:

- Mine discharge waters need to be treated;
- Tailings containment structures require periodic monitoring and maintenance; and
- Remediation technologies need to be monitored.

### Who Are the Main Players in Mine Closure?



#### *Mining Companies*

The mining company is responsible for full and proper environmental closure and reclamation of the mine operation once mining stops. The company must put the closure plan into action, implement decommissioning activities, and monitor the effectiveness of the closure activities. As reclamation is completed, funds from the initial deposit are released back to the company.



#### *Governments*

Government regulators and agencies enforce mining law and the terms of mining-related permits. Their acts, regulations, policies, and programs help ensure that the mining company establishes site-specific closure goals and objectives.

Regulatory agencies or boards then assess closure plans and make suggestions as required. If the company cannot close the mine properly, the government will use the deposit or bond provided by the company before the mine started to operate.



#### *Communities*

Because communities are involved throughout the mining cycle, they should be familiar and comfortable with the mine closure and reclamation plan. Community members affected by the closure include the employees, their families, suppliers, and business owners.

Industry and governments are expected to maintain and promote open and transparent discussions with the various community, public and special interest stakeholders. Throughout the closure process, the industry is accountable to, and required to consult with, those affected by closure activities.



#### *Others*

Consulting firms, service providers and non-governmental organizations (NGOs) may also play a role in mine closure.

## How Can Aboriginal Communities Get Involved in Mine Closure?

Mine closure is a natural part of the mining cycle. Even though it is inevitable, mine closure can still be an emotional and difficult time for communities located near a mine site that is closing.



Communities can manage the impacts of mine closure by planning well in advance, communicating with the mining company and government, understanding the process, and providing input. The goal is to develop strategies to lessen the negative impacts of the closure, obtain financial assistance, if available, and identify employment opportunities. Even during the mine closure phase, the mine can still create some value for the community in the form of jobs in reclamation and long-term maintenance and environmental monitoring. Alternative job creation and economic activities following closure can also be identified. For instance, the community may be able to attract other industries because of its trained work force.

## 4.2 Acts and Regulations

This section identifies the jurisdictions, responsibilities and liability issues associated with mine closure. It also outlines the conditions of licences and permits that apply during mine closure.

### Who Governs Mine Closure?

#### *Liability*

The licensed mine owner is responsible for mine closure and reclamation. During project evaluation and mine planning, the owner must submit an Environmental Impact Assessment. This report describes the initial closure plan and the costs to close the mine.

Federal or provincial governments make sure that mining companies give adequate financial assurance to guarantee the costs of reclamation (including shut-down, closure and post-closure). This means that the costs of reclamation are covered by the mine operator and not the government.

#### *Provincial/Territorial Government*

In the provinces and the Yukon, provincial/territorial governments regulate minerals and metals activity. These jurisdictions have enacted mining-related acts and regulations for the administration of mining activities,

### Facts & Figures

*Elliot Lake, Ontario, is an excellent example of alternative job creation and alternative land use. In 1996, the last of its 12 uranium mines shut down and 4500 jobs were lost. Using imagination and innovation, this former mining town recreated itself as a retirement haven. In addition, the city has now entered into a joint venture with Serpent River First Nation to establish a school of fine arts. There is even a field station focusing on mine reclamation and environmental research operating in the city.*

*This type of option will not be available to all communities, but it shows that with creative thinking and imagination, communities can create positive opportunities out of mine closure.*



including mine reclamation. The policy issues and priorities parallel those of the federal government.

### *Federal Government*

The Government of Canada is responsible for mine reclamation and closure in Nunavut, the Northwest Territories, and on Indian Reserves. In addition to the federal acts and regulations, much of the responsibility in the two territories now rests with local co-management boards.

Important federal environmental acts related to mine closure include the:

- *Canadian Environmental Protection Act (CEPA);*
- *Fisheries Act (FA);*
- *Canadian Environmental Assessment Act (CEAA);*
- Waters Acts of the Northwest Territories and Nunavut; and
- mine-site reclamation policies of Nunavut and the Northwest Territories.

## What Are the Conditions of Licences and Permits?

When a mine is nearing the end of production, the most recently approved mine closure plan is used as the basis for final decommissioning. It is common for government agencies to issue a new permit on shut-down of an operation to cover closure and develop a reclamation permit.

The reclamation permit governs all activities relating to decommissioning and reclamation. This permit may outline additional site-specific conditions and methods for reclamation of open pits, underground openings, tailings, and waste rock. This permit will include an Environmental Effects Monitoring Plan, an assessment of stability of embankments, a site characterization plan, and financial assurance. Site-specific air and sewage permits may be required for certain jurisdictions.

The government body regulating the site will also need to approve the owner's monitoring plan. Where joint jurisdictions occur, an oversight committee made up of federal-provincial environment and mining agencies, as well as public representation, may be developed.

### **Facts & Figures**

*In British Columbia, Boliden Westmin Resources operates a copper-lead-zinc mine that is surrounded by a Class A Park. All mining activities and the eventual reclamation and rehabilitation of the site fall under a park use permit. Constant environmental and safety monitoring is an integral part of the mine operation. Not only is recreation not affected, but mine tours have become an important attraction for park visitors.*

*(Source: [www.em.gov.bc.ca/mining/geosurv/Publications/InfoCirc/IC1995-07/mine.html](http://www.em.gov.bc.ca/mining/geosurv/Publications/InfoCirc/IC1995-07/mine.html))*

As reclamation work is successfully completed and environmental liability is reduced, the amount of financial assurance required will be reduced and any surplus will be refunded. An amount of financial assurance may be held back to cover future requirements for the site. In such cases, the mining company will be responsible for the care and maintenance of the site.

When the responsible government is satisfied that the operator has met the requirements for decommissioning and the objectives of the closure plan have been fully met, it will provide the mining company with a written acknowledgement of release and the site will be considered closed.

### 4.3 Environmental and Social Impacts

This section identifies the potential environmental and social impacts a community may experience during mine closure. Ideas for environmental monitoring, mitigation, and community input and response are included.

#### What Are the Potential Environmental Impacts?

Mine operators try to limit negative environmental impacts throughout mine operation and mine closure. As well, significant advances

in mining methods and technology for mine reclamation have minimized many negative impacts. Mining companies and governments are cooperating to develop cost-effective long-term closure strategies.

The main potential environmental impacts during mine closure are:

| Environmental Impacts |   |   |
|-----------------------|---|---|
| Type                  | Condition   | Mitigation  |
| Land use              | Long-term stability of waste rock piles and mining slopes | Need annual inspections until permanent stability is demonstrated |
|                       | Tailings containment structures                           | Periodic monitoring and maintenance                               |
| Water quality         | Acid mine drainage or metal leaching                      | Water treatment   |

#### What Environmental Monitoring Is Required?

##### *Monitoring Plans*

A monitoring program is used to assess the effectiveness of reclamation and mitigation measures after site shut-down and to identify corrective actions where needed. The mining company, together with governments (i.e., provincial/territorial, federal and municipal), will develop an environmental monitoring program to comply with metal mining effluent regulations and conditions of regulatory



approval. At some sites, a committee, including governments, the mining company and local communities, will be created to monitor progress. This monitoring program applies to all aspects of the mine life. During mine development and mine operation, the company monitors the impacts on water, wildlife and air, and provides this information to the regulators.

Monitoring programs, during the mine life and post-closure, assess:

- The accuracy of the environmental assessment;
- Any unforeseen environmental impacts; and
- The effectiveness of the mitigation measures.

Also, they guide changes to the environmental management program to address unpredicted changes and impacts.

The length of the monitoring phase is reviewed and confirmed when the mine closes and depends on the potential impacts and risks to the environment. If the site needs long-term care and maintenance, the mining company remains responsible for the

site, including remediation of any additional environmental issues arising after closure. The monitoring period may be extended to make sure remedial objectives are met.

### *Environmental Audits/Standard Practice*

The mine operator or an independent contractor will usually conduct inspections and compliance audits of contractor activities during shut-down, decommissioning and reclamation. Government regulators will do audits to validate the site inspection program and conformity to the closure plan.

Best practices for both regulatory and voluntary/non-regulatory efforts include policies, programs, technologies, reclamation research, and other measures that have been found to be cost-effective and environmentally

appropriate for the site. Best practices encompass and build on measures embodied within local, national and international initiatives.

### **What Are Orphaned/Abandoned Mines?**

The owner of a mine is responsible for reclamation of the mine site. If the owner of a mine cannot be found, or cannot

### **Facts & Figures**

*The Fort McKay First Nation participated in a research project in Alberta with Syncrude Ltd. on the potential to convert reclaimed oil sands to grassland and manage a wood bison population.*

*(Source: [www.syncrude.ca](http://www.syncrude.ca))*

afford to do the reclamation, the mine is called “orphaned” or “abandoned.” The federal and provincial governments are liable for orphaned/abandoned mines. Over history, mines have been abandoned in all mining jurisdictions in Canada. Fortunately, this is no longer occurring as current regulations ensure that mine owners are responsible for reclamation.

The assessment and remediation of orphaned and abandoned mine sites in Canada have received increased attention since the year 2000. With the establishment of the National Orphaned/Abandoned Mines Initiative (NOAMI) in 2002, the Canadian government signalled its commitment to address this serious environmental issue. NOAMI is a cooperative Canadian program that is guided by a committee consisting of the mining industry, federal/provincial/territorial governments, NGOs and Aboriginal Canadians. As part of the initiative, guiding principles were developed for meaningful community involvement in planning for and rehabilitating orphaned and abandoned mines and published in the pamphlet “Best Practices in Community Involvement” ([www.abandoned-mines.org](http://www.abandoned-mines.org)).

## What Are the Potential Social Impacts?

Mine closure has a potential long-lasting impact on a community. The immediate impact is the loss of jobs at the mine and income used to support the growth of a community. It also has a direct and indirect impact on local employment, businesses, and the sale of goods and services. These economic impacts can have major social impacts.

Careful planning from the start of the operations will help prepare communities for closure. From the day the mine opens, communities have to plan for closure, not only in a physical sense, but also in a socio-economic sense. Some of the main impacts and how they are minimized are shown in the table below.

| Social Impacts |                                |                                      |  |
|----------------|--------------------------------|--------------------------------------|--|
| Type           |                                | Positive and Negative Effects        | Community Response                                     |
| Social         | Decrease in community capacity | Loss of social services              | Need to acquire new sources for resources and capacity |
| Economic       | Loss of employment             | Reduction in income<br>Unused skills | Assist with development of new economic opportunities  |
| Cultural       | End of employment phase        | Return to traditional skills         | Teach skills, mainly through elders                    |

## Facts & Figures

*Aboriginal people could be involved in a variety of areas in mine rehabilitation, monitoring, and management. The proper closure and rehabilitation of a site may involve ongoing treatment and maintenance. As such, site monitoring and assessment are needed to minimize risks to the community and environment. As the community members are sometimes located near a site, they are often in a better position to monitor, manage and assess it.*



Communities can work with the company to reduce the negative impacts of mine closure by:

- Building community capacity to manage opportunities and impacts;
- Providing training and competency development; and
- Developing alternative and secondary industries (e.g., Aboriginal suppliers).

This may be part of any Impact and Benefits Agreements (IBAs).

This planning process should start during the mine development phase of the mining cycle.

### Facts & Figures

*Industry and governments have worked together to develop programs to provide retraining skills and opportunities for laid-off employees. The skills that an employee gains while working for a mining company may allow him/her to advance into other areas like trades, construction, medical technology, and administration.*

## 4.4 Community Employment and Other Economic Opportunities

This section identifies the employment and economic opportunities that exist for Aboriginal communities during mine closure. It also includes information on retraining opportunities.

### What Are the Employment Opportunities?

Only a small number of jobs are usually available during mine closure. The work involved in mine closure provides specialized business and employment opportunities that can often be applied to other mine sites. The main jobs available are for:

- Trades personnel – to dismantle equipment;
- Equipment operators and mechanics – to complete the earth-moving work necessary for reclamation;
- Inspectors – to inspect, sample and audit the closure activities as part of the safety and environmental plan; and
- Security and first aid personnel – in accordance with applicable laws and management plans.

Contractors are the main employers for these activities. Typically, arrangements are made to hire local qualified personnel for decommissioning and reclamation activities. A small number of employees may be kept on to supervise these activities.

Environmental monitoring training can be provided to enable Aboriginal people to be involved in site assessment and reporting.

Training can also be provided in the areas of community engagement and social capacity to make sure that rehabilitation plans and activities are in line with the values and interests of community members.



### What Are the Other Economic Opportunities?

The economic opportunities generated during mine closure are smaller than those associated with the mine development and mine operation phases. At the same time, by the time closure occurs, community businesses will be well experienced in providing services. Communities need to use innovation and creativity in order to capture the limited economic opportunities of closure.

Business opportunities related to closure activities include:

- Reclamation of the site;
- Planting trees;
- Establishing drainage systems;

- Water sampling and analysis;
- Possible ongoing water treatment;
- Dismantling transmission lines; and
- Ongoing site security.

The skills required for this work are largely gained during mine development and mine operation.

It is vital that the community look beyond the closing of the mine as a source of economic growth. Mine closure can usually be predicted, so communities can **diversify** the economy and begin to develop new economic activities years before the mine closes. Whether the future economic base will be tourism, manufacturing, agriculture, or any other activity, sound planning and use of the community's skill base will be essential.

Many communities have gone through the closure process and there are great examples (Port Hardy [British Columbia], Elliot Lake [Ontario], Kimberley [British Columbia]) on how to diversify a mining-based community economy. Mine closure could represent an opportunity to use the skills and capacity gained from participating in the mining cycle for new beginnings.



### Facts & Figures

*Through training and experience, the skills acquired in the mining industry can be transferable to other economic activities, often within the same community.*

*(Source: Natural Resources Canada)*



## 4.5 Community Experiences: Polaris Mine Closure

*The rich red buildings with a monster-sized Canadian flag on the roof contrasted against a carpet of snow served as a symbol of the modern age of Canadian mining for over 20 years. The Polaris mine was an example of vision, innovation and success in Canada's North. While the discovery, construction and operation of the mine is an amazing story, its closure and reclamation demonstrate excellent use of community input through consultation, water board processes, monitoring, and on-site work experience.*

### Background

The Polaris mine was an underground zinc-lead mine located on Little Cornwallis Island in Nunavut in the Canadian High Arctic. Polaris was the world's most northerly base-metal mine situated at about latitude 75° north and longitude 97° west, approximately 1400 kilometres from the North Pole. Resolute Bay is the nearest community – about 100 kilometres to the southeast.

After 21 years of operation, Polaris stopped production in September 2002, as forecast, due to depletion of the orebody. A two-year, \$53 million decommissioning and reclamation program was completed in September 2004.

Polaris was one of the most compact operations in Canada. Total land use was about 170 hectares. Surface facilities included a barge housing the concentrator, powerhouse, maintenance services, dryroom, warehouse and operating offices; a concentrate storage building for

11 months' production; and an accommodation complex with housing for up to 220 personnel. Other facilities included a conveyer ship loader system and an airstrip.

### Mine Closure and Reclamation

After stopping commercial production in 2002, a major project was started to decommission the mine and reclaim the site. The goal was to complete the program by October 2004. A detailed closure plan was developed based on environmental site assessment work done in 1999 and 2000. After extensive regulatory and public consultations, Nunavut and federal authorities gave all approvals.

In September 2002, an on-site work force began demolishing buildings. In April 2003, remediation of metals and hydrocarbon-contaminated sites began. Materials from the demolition were placed in a surface rock quarry and capped. Most of the remaining equipment and materials were removed in September 2004.

A small camp, several sea containers of supplies, and some heavy equipment remain on site for touch-up work and to support ongoing monitoring programs. Water quality monitoring in Garrow Lake, where the tailings were deposited, will continue until 2011.

SNC-Lavalin was the general contractor for the demolition of the structures and the clearing of the site. Gartner Lee Limited provided technical resources to assist

the company in securing its closure approvals and to supervise the environmental remediation of the site.

### Aboriginal Participation

The company actively sought the participation of the Nunavut community in the closure activities. Aboriginal engagement in the closure process consisted initially of consultation with communities that were affected by the process, specifically Resolute Bay and Grise Fiord.

Representatives traveled to the communities to present the drafts of the closure plans and to seek input and provide explanations of the process and procedures. The input on historical and future land use by the local residents was used to develop site-specific soil quality remediation objectives for the site. Local residents were invited to visit the site. The Nunavut Water Board also assigned a coordinator who spent time in the community while the plans were being developed and then made a number of trips to the site during its implementation while the demolition and reclamation work was being carried out in order to keep residents informed of the activities on site.

### Aboriginal Economic, Employment and Business Opportunities

The tenders for contracts for work at the site had to include a northern content component, thereby assuring that some of the economic benefits for the contracts went to northern residents.

Qikiqtaaluk Corporation, an Inuit-owned firm, was retained as a subcontractor of SNC Lavalin to provide equipment operators, mechanics, and general labourers.

Local residents were also hired and trained to assist with the environmental site assessment and to assist Gartner Lee Limited in guiding and assessing the effectiveness of the reclamation work in 2003.

Post-closure, local residents have assisted with the environmental monitoring of the site. They have also been retained by other mining companies as equipment operators and mechanics, and to monitor and guide environmental remediation activities.

For more information, contact Teck Cominco Ltd. at [www.teckcominco.com](http://www.teckcominco.com).

Mine Operation



Post-Closure