

REVIEW OF CANADIAN LEGISLATION RELEVANT TO DECOMMISSIONING ACID MINE DRAINAGE SITES¹

Ingrid Reichenbach²

Abstract: Regulatory strategies specifically geared towards decommissioning sites with acid mine drainage are in the development stage. In most jurisdictions, there are provisions for proposed mines to complete an environmental impact statement. The complexity of the statement varies depending on jurisdiction, discretion granted the Minister and size of the proposed mine. Several provinces have guidelines in place that require predictive testing to determine the acid generation potential of rock units. Nova Scotia has gone a step further and requires monitoring, and sometimes predictive testing, at any development on pyrite-rich shale of the Halifax Formation. In Canada, non-enforceable water quality guidelines are the norm. Site-specific enforceable parameters, based on water quality guidelines may be incorporated in mine operation permits. Provinces use the federal guidelines or develop their own approach and criteria. For example, with time, surface water bodies in Manitoba will be classified according to present and potential use and water quality criteria set accordingly. British Columbia sets water quality objectives on a site-specific basis, taking into account background water quality and water uses. This approach potentially has the flexibility to address the anomalous background water chemistry sometimes encountered at mine sites. With respect to effluent limitations, most provinces use the federal regulations, although some provinces have developed their own.

Introduction

The Mine Environment Neutral Drainage (MEND) program sponsored this review of Canadian legislation relevant to decommissioning acid mine drainage (AMD) sites. The MEND program is a co-operative program financed and administered by the Canadian mining industry, the Canadian government, and the governments of British Columbia, Saskatchewan, Manitoba, Ontario, Quebec and New Brunswick. The purpose of the review is to provide government agencies, industry representatives and other organizations and individuals with an overview of the existing Canadian regulatory framework relevant to decommissioning AMD sites, and to summarize the criteria used by Canadian regulatory agencies to assess the performance of decommissioning an AMD site. This paper is a summary document based on MEND Report 4.2.1: Review of Canadian and United States Legislation Relevant to Decommissioning Acid Mine Drainage Sites, 1993.

Canadian Federal Legislation

Federal jurisdiction over decommissioning tends to be more restricted than provincial jurisdiction. The Constitution Act of 1867 grants specific federal power over coastal and inland fisheries, navigable interprovincial rivers and migratory birds. However, recent federal environmental legislation such as the Canadian Environment Protection Act and the Canadian Environmental Assessment Act represents an increasing federal government role in the environmental regulatory field previously dominated by the provinces. Federal legislation and guidelines relevant to decommissioning AMD sites are discussed in the following paragraphs.

The intent of the Fisheries Act of 1985 is to protect fish, marine mammals, and their habitats. This responsibility is shared between the Ministers of Environment and Fisheries and Oceans. The Act prohibits the deposit of a "deleterious substance" directly into water frequented by fish or in a place where the substance may enter such water. Therefore, this Act would apply to most mining operations that discharge effluent into rivers,

¹Paper presented at the International Land Reclamation and Mine Drainage Conference and the Third International Conference on the Abatement of Acidic Drainage, Pittsburgh, PA, April 24-29, 1994.

²Ingrid Reichenbach, Hydrogeologist, Jacques Whitford Environment Limited, Ottawa, ON, Canada.

Proceedings America Society of Mining and Reclamation, 1994 pp 275-284

DOI: 10.21000/JASMR94040275

lakes or the ocean. The Act also prohibits any work that results in the harmful alteration or destruction of fish habitat. The Metal Mining Liquid Effluent Regulations and Guidelines (MMLER) of 1977, under authority of this Act, contain enforceable effluent regulations for new, expanded and reopened mines and non-enforceable effluent guidelines for existing mines (Table 1). The guidelines have the same numerical values as the regulations. The guidelines provide flexibility for mine operators and the Minister to negotiate a compliance schedule. Limits are "specified for those parameters which are known to occur commonly in base metal mining effluent in sufficient amounts to be deleterious to fish and for which demonstrated practicable technology exists to reduce these substances to low levels". The Arctic Waters Pollution Prevention Act regulates effluent disposal in arctic waters.

Table 1. Metal Mining Liquid Effluent Regulations (Environment Canada, 1977).

Parameters ¹	Maximum Monthly Arithmetic Mean Value	Maximum Value in a Composite Sample	Maximum Value in a Grab Sample
pH (unitless)	6.0	5.5	5.0
Total Suspended Matter	25.0	37.5	50.0
Arsenic	0.5	0.75	1.0
Copper	0.3	0.45	0.6
Lead	0.2	0.3	0.1
Nickel	0.5	0.75	1.0
Zinc	0.5	0.75	1.0
Radium 226 (pCi/L)	10.0	20.0	30.0

¹The concentrations are given as total values with the exception of Radium 226 which is a dissolved value after filtration of the sample through a 3 micron filter. All units are mg/l unless otherwise noted.

The Canadian Environmental Protection Act (CEPA) of 1988 is administered by the Department of Environment. The Minister of Health provides advice on human health aspects. CEPA is a prevention-oriented statute which outlines a comprehensive scheme for the control and regulation of toxic chemicals. Heavy metals found in AMD could potentially be regulated under CEPA. However, it is more probable that AMD will continue to be regulated under the Fisheries Act which has adequate legal authority. One aim of CEPA is to establish nationally consistent levels of environmental quality. CEPA provides that federal regulations with respect to toxic substances will not apply in provinces where equivalent provisions are already in force.

The Canadian Environmental Assessment Act of 1992 administered by Environment Canada, ensures that the environmental consequences of all federal projects and activities are assessed before final decisions are made. An Environmental Assessment (EA) is triggered when the Federal Government: is the proponent of a project, makes federal funds available for a project, makes federal lands available for a project, or evokes a statutory or regulatory provision that allows a project to proceed. When a federal authority is required to conduct an EA, screening is one of several procedural options to follow. Projects requiring a more intensive level of assessment will undergo a comprehensive study. The types of projects likely to require a comprehensive study based on their likelihood to cause significant adverse environmental effects are on the draft Comprehensive Study List of 1991. This list may be established by regulation at a later date by authority of the Act. Of interest to the issue of AMD is the inclusion on the list of "a metal mine with a mill capacity greater than 10,000 tonnes/day". This will cover most major ferrous metal and major new non-ferrous metal mines. The comprehensive study will be required to show that no significant adverse effects are expected, or that such effects can be mitigated, for the project to proceed. The question of how to handle small-scale, potentially high-impact mines (e.g. gold mines), and coal and industrial mineral mines, remains unresolved.

The Canadian Council of Ministers of the Environment (CCME) initiated the National Contaminated Sites Remediation Program for remediation of high priority contaminated sites in Canada. To promote consistency in the assessment and remediation of these sites, CCME adopted the Interim Canadian Environmental Quality Criteria for Contaminated Sites in 1991 from existing guidelines and criteria currently in use in various jurisdictions across Canada. Many of the criteria do not have a complete set of supporting rationale and, therefore, are considered "interim". Criteria are assessed and modified as required to reflect current knowledge of the environmental and human health effects of contaminants. The criteria do not constitute values for uniform environmental quality at all contaminated sites, and their use is site-specific. Although they are non-enforceable, they may serve as a basis for site-specific enforceable parameters incorporated in mine operation permits or licenses.

Territorial Legislation

The federal government owns and controls most of the lands and resources in the territories and, therefore, most mining activities require federal permits and licenses. The territorial governments have the authority to enact legislation; however, territorial legislation is subject to federal legislation and may be limited in scope where there is a contradiction. Territorial environmental legislation commonly mirrors federal legislation and may be based on federal environmental controls. The Territorial Lands Act (TLA), administered by the Department of Indian Affairs and Northern Development (DIAND), addresses concerns with respect to the abandonment and decommissioning of mines in the territories. The TLA is administered under two sets of regulations governing surface use: the Territorial Land Use Regulations (TLUR) and the Territorial Land Regulations (TLR). Typically, a prospective mining company will be issued a permit under the TLUR and will register a mining claim under the Canada Mining Regulations. The latter regulations grant authority to the Minister of DIAND to order the owner of a mining operation that is discharging a "harmful" substance to treat the substance prior to discharge, limit the discharge, or cease the operations causing the discharge. The relevant control mechanisms for abandonment and decommissioning of mines are the TLR and the leases issued pursuant to these regulations.

The federal Northern Inland Waters Act has recently been replaced by the Northwest Territories (NWT) Waters Act and the Yukon Waters Act, both promulgated in 1993. The NWT Waters Act, administered by the NWT Water Board and DIAND, regulates the use of water and the disposal of waste into waters of the NWT. A mining company that wishes to operate a mine must first obtain a water license by satisfying the following conditions: any waste produced by the mining operation will be treated and disposed of in the appropriate manner under prescribed effluent standards, and the financial responsibility of the applicant is adequate for completion of the undertaking as well as any required mitigation, maintenance or restoration. If present restoration technology will not satisfactorily prevent long term degradation of the environment, a water license may not be issued. The Water Board may require an applicant to furnish and maintain a security with the Minister to compensate users who are entitled to compensation or to recover the Crown's costs incurred in counteracting, mitigating or remedying adverse effects. Industrial licences generally contain conditions requiring abandonment and restoration plans and their implementation. If the approved abandonment and restoration plan is not satisfactorily implemented, the security deposit or a portion of it may be withheld by the Water Board. In 1990, the NWT Water Board published: Guidelines for Abandonment and Restoration Planning for Mines in the NWT. The guidelines include a discussion of design features (e.g. tailings and containment structures, cover treatments, waste rock piles), plan development (e.g. abandonment scenarios) and monitoring. The maximum acceptable concentrations for selected substances in discharges from abandoned tailings areas are from the MMLER, but lower values may be considered for environmentally sensitive areas.

The Water Resources Division of Northern Affairs administers and enforces the Yukon Waters Act, and is responsible for licensing. The Water Board processes and issues the licenses. The Act is similar to the NWT Waters Act. A mining company needs a license to operate. Conditions included in the license include provisions for monitoring, collection and treatment and closure. The Minister has the authority to take the necessary action to mitigate or remedy adverse effects caused by the operation and a security deposit to cover this eventuality is incorporated into the license.

Northwest Territories

The mineral industry in the NWT accounts for a major portion of the territorial economy. Almost one-quarter of Canada's lead and zinc production originates in the NWT, which also produces gold, cadmium and silver. There is no legislation in the NWT directly affecting prospecting, exploration and mining. Environmental legislation includes the territorial Environmental Protection Act and the Environmental Rights Act, both administered by the NWT Department of Renewable Resources. The former provides general protection from contamination by hazardous substances. For example, it prohibits the discharge of contaminants to the environment and holds the party responsible for a spill liable for clean-up and damages. The latter is primarily concerned with the release of contaminants and gives residents of the NWT the right to take certain actions to protect the environment. The NWT Department of Energy, Mines and Petroleum Resources has prepared and keeps updated A Guide to Legislation Affecting Exploration and Mining in the NWT.

Yukon

The Yukon mining industry comprises mineral exploration, hardrock mining and placer mining. Zinc, lead and gold are the most important minerals. Mining in the Yukon is regulated under the Yukon Quartz Mining Act of 1924. The Act does not have any specific regulations governing land use activities on mining claims. An amended Act and regulations have been proposed by the Yukon Mining Advisory Committee, which includes representatives from government and industry. It is expected to encompass exploration, development, production, mine closure, financial security and penalties. A production license will be required for any producing mine. The license application would trigger review under the Canadian Environmental Assessment Act.

Provincial Legislation

Most of the legislative power relating to decommissioning AMD sites falls within provincial jurisdiction because the provinces exercise proprietary rights over vast areas of Crown land and minerals; have legislative authority for the development, conservation and management of mineral resources; and have powers over property and civil rights that provide a basis for the regulation of land use and mining activities, including reclamation work. Provincial jurisdiction in these areas is expressed in provincial legislation related to environmental assessment and licensing, land-use planning, water rights and mineral tenure and mining, all which directly affect decommissioning activities. Provincial legislation and guidelines relevant to decommissioning AMD sites are discussed in the following sections.

British Columbia

Mineral products constitute over one-fifth of the province's total exports. Coal and copper are British Columbia's most important minerals, followed by zinc, gold and silver. The Mine Development Assessment Act of 1990 provides the legal framework for comprehensive environmental assessments of proposed mine developments. It is intended to dovetail with the Canadian Environmental Assessment Act. Mine developments subject to the Act are termed "reviewable" and include new coal or mineral mines capable of producing 10,000 tonnes per year, or other mines designated by the Chief Inspector of Mines where potential impacts warrant an integrated review. An application for a mine development certificate must contain an environmental protection plan approved by the Minister of Energy, Mines and Petroleum Resources with the concurrence of the Minister of the Environment. A certificate must be obtained before a reviewable mine development can be constructed. As part of the approval process, the government requires testing to identify potentially acid producing materials and assurance that all sources of potential acid generation have been identified and that prevention and control measures have been incorporated into the plan, if appropriate. The Ministers may refer the application to an assessment panel or accept, modify or reject an application. The assessment panel may recommend amendments to the certificate, which can overrule existing permits, even if those permits were obtained in compliance with applicable legislation.

The Mines Act of 1989 governs all mining activities including exploratory drilling, excavation, processing, concentrating, waste disposal and site reclamation. Before commencing work on a mine, proponents are required to outline the proposed work plan and a program for the protection and reclamation of the land and watercourses affected by a mine, and to obtain a Reclamation Permit. Disturbed land and water resources must be reclaimed to a level of productivity not less than that which existed previously, and water released from the minesite must meet long term water quality standards. A reclamation security deposit may be required. The inspectors appointed under the Act may do work around a closed or abandoned mine to abate pollution and a charge may be registered against the mineral title.

In 1992, the Mines Act also established the Health, Safety and Reclamation Code for Mines in British Columbia. The code is subject to an annual review. Compliance with the code includes worker health and safety, mechanical/electrical and reclamation requirements. Proposed mines must submit reclamation plans if a surface disturbance is likely to result. The Chief Inspector of Mines decides when exploration work is likely to cause a significant surface disturbance and can exercise broad discretion with respect to requiring and approving reclamation programs. Reclamation plans should include: 1) location and extent of the mine, 2) present land uses, 3) nature of the mine, with special reference to "prediction of acid generation for all strata and deposits, including static and, if necessary, kinetic tests", 4) reclamation plan for construction and operational phases of mining operation, and 5) final reclamation plan. Mine reclamation standards are also specified in the code and include returning the land and watercourses to a productive land use, ensuring that impoundment structures and waste rock dumps are stable over the long-term, and ensuring that water quality released from a mine site is of an acceptable standard. With respect to acid generating material, the mine reclamation standards specify that "all potential acid generating material shall be placed in a manner which minimizes the production and release of AMD to a level that assures protection of environmental quality".

The Pollution Control Objectives for the Mining, Smelting and Related Industries, developed by BC Environment in 1979 for discharges to air, water and land, provide for a wide range of discharge concentrations depending on the needs of particular receiving environments. The more stringent values apply to sensitive environmental situations, the less stringent where it can be shown that unacceptably deleterious changes will not follow. The objectives are intended to apply province-wide, but in special circumstances the Director of Pollution Control may apply more or less stringent requirements.

British Columbia does not have any province-wide water quality objectives. BC Environment develops objectives on a site-specific basis using scientific guidelines or criteria. For example, if an area has very high copper, objectives for copper would be set for this area. Each objective and criteria is published in a separate report. There are presently reports on 33 objectives and 15 criteria. Objectives may serve as a guide for mine permitting and may help to assess the Ministry's performance in protecting water uses. Neither criteria nor objectives are based on any legislation, so they are non-enforceable. However, these guidelines are used in the review of a mine development certificate and failure to comply may result in significant delays. Furthermore, each mine site has site specific parameter concentrations specified in their waste management permits.

The Victoria-based Reclamation Advisory Committee has developed a series of working policies and technical initiatives to deal with AMD. These have recently been released as an "Interim Policy" for public comment. The interim policy reflects the committee's current philosophy of preventing AMD generation through prediction and design, wherever possible avoiding long-term treatment. The policy contains sections dealing with prediction, prevention, collection and treatment, reclamation permitting, bonding, monitoring, historic sites, existing mines, commercial leaching and exploration. Many of these issues are discussed in detail in: Draft Acid Rock Drainage Technical Guide, developed by BC AMD Task Force in 1989, that provides guidance and recommendations in the application of state-of-the-art technology in prediction, control and monitoring of AMD.

Of the 16 metal mines currently operating in BC, six are presently producing AMD and several more have the potential to do so. These six mines are currently collecting and treating all acidic drainage. Of the eight

operating coal mines, none are presently generating AMD. Although one coal mine has acid generating potential, it has been designed to prevent AMD. For proposed new mines, Ministry of Energy, Mines and Petroleum Resources policy is to approve only those mines that develop plans to prevent or control AMD. Existing mines with AMD that commenced operation prior to present legislation are required to submit detailed closure plans. For example, the Equity Silver Mine in the central interior of British Columbia has scheduled closure and developed detailed closure plans. At this time, the water quality objectives are not yet available. British Columbia also has at least six historic mine sites with AMD and new policies pertaining to them are currently under development. One such site is the Mt. Washington Mine on Vancouver Island, which is undergoing reclamation. However, water quality objectives are in the early draft stage and not yet available.

Manitoba

Next to agriculture, mining is the leading primary resource industry in Manitoba. Nickel, copper and zinc are the major metallic minerals produced. There are some serious AMD sites in Manitoba, but not many compared to other provinces participating in MEND. There are no readily available case studies of AMD sites that have been decommissioned. Manitoba passed a new Mines and Minerals Act in 1991, which contains two sections relevant to decommissioning AMD sites: (1) new and existing mining operations must file closure plans that address the "protection of the environment during the life of the project" and rehabilitation of the site upon mine closure; and (2) mining operations must put up security for performance of rehabilitation work. However, the practical details of the closure and rehabilitation requirements are still to be worked out and developed into regulations.

Prior to commencing operation of a mine, an environmental impact statement must be completed to comply with the Environment Act. In Manitoba, the Clean Environment Commission (CEC) holds hearings and gathers evidence from any "concerned individuals" including the public, the government Environmental Department, and the proponent. Following this, the CEC issues a report with recommendations, which the Director of the Environment Department uses in setting terms and conditions of an Environmental License. The Director is not bound by the CEC recommendations, but must indicate why any such recommendations are rejected. Any issued License is subject to an appeal process. The mine license includes limitations on effluent. Federal effluent limitations are sometimes used, but in general, criteria are set on a site-specific basis using the following approach.

Surface waters in Manitoba are classified from 1 to 6. Manitoba Environment assesses the potential impact area of the proposed mine and, if the surface waters in the vicinity have not been previously classified, makes an assumption as to water classification. As can be expected, the class of surface waters for the entire province has not been determined yet. Public hearings are required to set the classification, therefore, during mine licensing only an initial assumption is made. Manitoba Environment then selects the most stringent surface water quality objectives applicable, based on the assumed classification, and sets effluent limitations such that the loading to the surface water can be accommodated without exceeding the water quality objectives. At times, this approach results in criteria more stringent than the federal mine effluent limitations. Details on surface water classification and water quality objectives are contained in the following three Department of Environment documents: Surface Water Quality Objectives, The Development and Use of Water Quality Objectives and Watershed Classifications. Groundwater standards are still in the development stage.

New Brunswick

Mining is New Brunswick's second-largest industry. The most valuable minerals are zinc, potash, lead, silver, coal, antimony and peat, with zinc accounting for over 50 percent of the total value of production. AMD is an overwhelming problem in New Brunswick, but very few (if any) AMD sites have been decommissioned at this time. The Mining Act of 1985 provides the authority for the imposition of reclamation requirements on mining operations. As part of the mine approval process, an application must be made to the Minister of Natural Resources and Energy. Requirements for closure and reclamation are regulated under the General Regulation of

1986, which specifies that a reclamation program for the protection, reclamation and rehabilitation of the environment be submitted as part of the application for a mining lease. In addition, mining lease applicants are required to provide security for the costs of reclamation work conducted both during and after mining operations. A mining lease will not be granted until the Minister has approved the reclamation program.

The approvals process for a new mine may commence with an environmental impact assessment (EIA) if, in the Minister's opinion, the proposed mining operation will result in a significant environmental impact. New Brunswick has a standing committee consisting of members from the Department of Natural Resources and Ministry of the Environment who oversee the EIA process by authority of the 1987 Environmental Impact Assessment Regulation. This regulation does not specifically deal with mine decommissioning, but the feasibility of mine reclamation would likely be addressed in the EIA.

The 1982 Water Quality Regulation, by authority of the Clean Environment Act, prohibits anyone, without approval, from permitting a source to discharge a contaminant such that it may cause water pollution. The Clean Water Act of 1989 gives authority to the Minister of Health and Community Services to prescribe the maximum concentration of any contaminant or waste that is permissible in potable water and to the Minister of the Environment for water that is not potable. However, there are no compliance numbers in either the Clean Environment Act or its regulations, or in the Clean Water Act. Criteria for water quality and effluent are usually taken from federal sources such as the MMLER or the interim criteria adopted by the CCME, but criteria are negotiable and site-specific.

Newfoundland

Iron ore accounts for over 80 percent of the provincial mineral industry; the other two leading minerals are zinc and asbestos. Newfoundland does not have a significant AMD problem. The Environmental Assessment Act of 1980 governs the approval of new mines in Newfoundland and provides the authority to impose reclamation conditions on these operations. It does not apply to mines already in operation when the Act was passed. Mining operations are regulated under The Department of Mines and Energy Act of 1989. In addition, the Environment and Lands Act specifies that any building or construction requires a discharge permit from the Minister of Environment. The Minister issues a discharge permit to mines before they can start and effluent limits are set at this point. Newfoundland utilizes the federal MMLER and the interim criteria adopted by the CCME, and any other regulations or criteria on a site-specific basis. In addition, the pH of any effluent can be set under the Water and Sewage Regulations.

There are no regulations or policies specific to AMD in Newfoundland. The Newfoundland Department of Mines and Energy deals with AMD problems at the point when the mining company wants to terminate its lease and return the land back to the province. The mining company must show that the mine site will not pose any environmental liability. Site-specific effluent data is reviewed by relevant provincial and federal agencies and a decision is made on whether the mine poses a problem or not. One mine returned to the province does have an AMD problem. As part of the remedial assessment, the province is reviewing stream geochemical data collected previously by the Newfoundland Geological Survey for prospecting purposes. The province plans to utilize the data to establish background concentrations of parameters of concern.

Nova Scotia

Coal and industrial minerals constitute the bulk of mining in Nova Scotia. Coal is Nova Scotia's most important mineral resource, followed by gypsum. Canadian primary tin production came from one open-pit mine in East Kemptville until 1991. Nova Scotia has a significant AMD problem due to the fact that pyrite-rich Halifax Formation slate underlies many areas of the province. Many aspects of mining operations are regulated under the new Mineral Resources Act of 1991, administered by the Nova Scotia Department of Natural Resources. It deals

primarily with land management issues such as mining leases, mining permits, reclamation and bonding. The department is currently developing guidelines for reclamation.

Mining operations are also affected by the Environmental Protection Act of 1973, which requires industry to apply for an industrial discharge permit at the commencement of operations. Effluent criteria are determined on a case-by-case basis as part of the permitting. As a result, the Department of Natural Resources, who have jurisdiction over permitting, works closely with the Department of Environment, who has jurisdiction over effluent quality. Nova Scotia does not have their own water quality objectives or effluent guidelines. They use objectives from other jurisdictions including the federal Metal Mining Effluent Regulations. The Environmental Protection Act also requires industry to propose close-out plans and put-up security at the same time. The close-out plans tend to be very general, for example: "a reclamation plan will be available one year prior to closure".

Mine decommissioning may be influenced in some cases by the Environmental Assessment Act of 1988. This Act requires proponents to register proposed mining activities with the Minister of the Environment. The Minister then decides if the activity has the potential to have a significant environmental impact, in which case an environmental assessment report would be required. Based on the report and input from government agencies and the public, the Minister has the authority to grant approval for the proposed operation and to place conditions on the approval. Specific authority is provided in the Act for conditions requiring reclamation research and rehabilitation to a level acceptable to the Minister. The Act also requires that owners register abandonment of particular operations. Decisions on whether a complete environmental assessment is required are based on input from government agencies and the public.

Of relevance to more than just the mining industry are the Guidelines for Development on Slates in Nova Scotia, jointly prepared by the Nova Scotia Department of Environment and Environment Canada in 1990. The objective of the guidelines is to protect aquatic habitat and water resources from acid runoff from disturbed Halifax Formation slate. The guidelines apply to all developments on, or disposal of, mineralized slates where a total volume greater than 1000 m³ is to be disturbed. The guidelines require monitoring effluents and groundwater at all development sites for pH, arsenic, iron, sulphate, copper, aluminum, total acidity, alkalinity and conductivity. No compliance criteria are given; they are determined on a site-specific basis. The guidelines also include protocols for the sampling and evaluation of bedrock and overburden with respect to acid generation potential.

Recently, Nova Scotia initiated a review and overhaul of the province's environmental laws. The process will culminate in a consolidation of 16 pieces of environmental legislation into a single act, titled the Nova Scotia Environment Act. Among legislation included in the review will be the Environmental Protection and Environmental Assessment Acts.

Ontario

Ontario accounts for one-third of total Canadian mineral production: two-thirds of Canada's nickel and salt, almost half its gold, a third of its sand and gravel, cement, copper and uranium, and over a quarter of its silver and zinc. Four minerals: gold, nickel, copper and uranium, constitute over half the value of Ontario's production. Activities specific to mining operations are regulated by authority of the Mining Act which was amended in 1991 to include Part VII. Part VII and its accompanying Regulation 114/91 addresses mine closure and rehabilitation. Any mining company that plans advanced exploration, mine production, expansion or alteration of a project, or temporary suspension or closing out of a project must follow the rehabilitation requirements outlined in an accepted closure plan or the rehabilitation standards set out in the Regulation. Part VII also gives the Director of Mines Rehabilitation the ability to demand closure plans for properties already abandoned when the Act came into force, if the owner can be found.

To assist proponents in dealing with the requirements of Part VII pertaining to closure, the Ontario Ministry of Northern Development and Mines issued: Rehabilitation of Mines - Guidelines for Proponents, that include

details on: closure plans, the Regulations, closure technology, closure components, monitoring, costing and financial assurance. For example, the closure plans should provide data on ore mineralogy and on the acid generating potential of the ore and host rock. Data should also be provided to allow the Ministry to assess potential water quality impacts adjacent to and downstream from the site. Predicted downstream water quality should be compared with Provincial Water Quality Objectives. The closure plan should also provide details on the chemical monitoring program to be carried out during closure including the location of the monitoring points, the parameters to be measured and sampling frequency. Parameters to be measured will be determined on a site-specific basis and will depend on the mineralogy of the particular site, results of the predicted downstream water quality, and relevant provincial and/or federal effluent and water quality criteria.

Policies and implementation procedures regarding the management of surface and groundwater quality and quantity are contained in Water Management - Goals, Objectives, Policies and Implementation Procedures of the Ministry of the Environment (MOE). The document sets Provincial Water Quality Objectives, which represent a desirable level of water quality that the MOE strives to maintain in Ontario's surface waters (Table 4). The document also contains objectives for groundwater quality including Ontario's Drinking Water Objectives and water quality criteria for agricultural use.

Ontario is currently in the midst of implementing the Municipal Industrial Strategy for Abatement (MISA) which is a regulatory program initiated by the MOE to tighten standards that must be met by mines and other industries that discharge an effluent into surface waters. Initially, each of nine major industrial sectors have been subject to a monitoring regulation that requires them to identify, measure and report concentrations of toxic chemicals in the effluents that they discharge into surface waters. After one year of monitoring, the MOE reviews the results and develops regulations that specify the concentrations of toxic pollutants permitted in the effluent of each operation. Effluent limits will generally be established on a sector-by-sector basis, but more stringent limits may be set for a particular operation in order to protect sensitive waterbodies. MOEE will set effluent limits that are attainable by using the "best available technology economically achievable". The draft regulations for the metal mining sector were recently released for public review.

MISA's legislative authority is based on the Environmental Protection Act (EPA) of 1980. The purpose of the Act is to protect and conserve the air, land and water of Ontario. It prohibits discharges that contaminate the environment, and enables the MOE to require that certain discharges be stopped or controlled, preventive measures taken and damage repaired. The Ontario Water Resources Act (OWRA) of 1980 also prohibits discharges of materials that may impair water quality, and enables the MOE to require measures to be taken to prevent or reduce water quality impairment. The general purpose of the OWRA is to protect and conserve the lakes, rivers, streams and groundwater of Ontario. There is some overlap between the EPA and OWRA, but the Acts complement each other and are both administered by the MOE.

Ontario also has an Environmental Assessment Act. Proposed mining operations in Ontario have generally not been subject to the Environmental Assessment process, although MOE is considering requiring that all proposed private sector mining undertakings undergo some form of environmental assessment and approval process.

Quebec

Over half the value of Quebec's mineral production is derived from gold, iron ore, asbestos and copper. Mining has traditionally been a major source of employment in the northeastern, north-central and Gaspé regions of the province. Quebec has a significant AMD problem. The Mining Act of 1992 sets out requirements for exploration licenses and for operators involved in mining activities and, due to recent amendments, ensures the rehabilitation and restoration of land affected by mining activities. The Ministry of Energy and Resources is responsible for developing mineral resources in the public domain and has control over the restoration of mining sites. Mine operators are required to submit a rehabilitation and restoration plan for approval before exploration

or mining activities begin (for new mines), or within a set period of time (for existing mines), meet the requirements of the plan and furnish a financial guarantee. The content of restoration plans will be site-specific. Acid generation tests can be requested to determine if there is a danger of AMD, and restoration plans will be stricter when acid tailings are present. Rehabilitation and restoration plans are subject to consultation with the Ministry of the Environment. In cases of non-compliance, the Minister has authority to order the work done at the operator's expense. The amendments also give the Minister authority to order an operator that has ceased mining to perform rehabilitation and restoration work due to the presence of tailings, even if the operation predates the amendments.

Mining activities are subject to the Environmental Quality Act of 1977, which requires that certificates of authorization be obtained from the Ministry of the Environment prior to the commencement of any mining activity which may change the environment. A certificate is also necessary for any modifications. Procedures and requirements for obtaining the certificate of authorization are outlined in Directive 019, a guidance document developed by the Ministry of the Environment in 1989, which addresses aspects of the Environmental Quality Act applicable to the mining industry. For example, it contains criteria for final effluent from mines, derived largely from the federal MMLER. The directive applies to both new and existing mines.

The Drinking Water Regulation contains enforceable drinking water quality criteria. Quebec does not have any regulations containing surface water quality criteria.

Saskatchewan

About 40 percent of world exports of potash are produced in Saskatchewan. The province also contains some of the highest-grade reserves of uranium known in the western world. Other metals and minerals produced in Saskatchewan include coal, sodium sulphate, special clays, copper, zinc, gold, silver, cadmium, selenium and tellurium. Newer uranium ore bodies, which are located in the sulphide-bearing Athabasca Sandstone, tend to have a greater AMD problem than older ones located in sulphide-poor basement rocks. Saskatchewan has a fairly arid climate and AMD can take a while to manifest itself. Prior to licensing, new mines in Saskatchewan must go through the Environmental Impact Assessment (EIA) process by authority of the Environmental Assessment Act of 1979. Once the Minister of the Environment is satisfied that the proponent has met the requirements of the Act, he will decide whether to approve the development. The Minister may impose any terms and conditions on the approval that he considers necessary or advisable. For example, in the case of major coal mine operations, conditions have been placed on the approvals requiring compliance with the reclamation program described in the Environmental Impact Statement (part of the EIA process) or with area specific reclamation guidelines.

The Mines Pollution Control Branch of the Department of Environment is responsible for licensing mines by authority of the Environmental Management and Protection Act of 1983, which the Branch administers. The Branch provides input during the EIA process, but its primary role lies in approving and ensuring compliance with the site specific reclamation plans required as part of the EIA process. Security deposits are generally not required. Abandonment of a mine site requires approval by the Minister.

Effluent criteria for mines are site-specific. Some criteria are contained in the Mineral Industry Environmental Protection Regulations of 1991, but these are very broad-based and apply to all types of mining. Effluent criteria are generally determined by considering the Surface Water Quality Objectives of 1988, which are incorporated into the EIA prior to approval.

In 1992, Saskatchewan Environment and Public Safety, with input from a committee of industry and regulatory representatives, published: Mine Rock Guidelines - Design and Control of Drainage Water Quality. The guidelines are to provide a summary of the processes which control effluent quality and to provide guidance and recommendations for the state of the art in prediction, control and monitoring of AMD and metal leaching for the uranium mining industry in Saskatchewan, in particular.