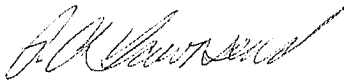


Environment & Sustainability Standing Committee
October 6, 2011

TO: Chair and Members of Environment & Sustainability Standing Committee

SUBMITTED BY: 

Phillip Townsend, Director, Infrastructure and Asset Management

DATE: September 23, 2011

SUBJECT: Pyritic Slate Process for HRM Property

INFORMATION REPORT

ORIGIN

March 3, 2011, Item 10.1, Councillor Sloane re: Request for Staff Report on Pyritic Slate Process

BACKGROUND

Over the past two years, HRM has developed three sites that “Acid Generating Rock” has been encountered. These sites are Washmill Court Bridge, Central Library and the Dartmouth Bridge Terminal. The attached map (Attachment 1) indicates that the risk of encountering “Acid Generating Rock” is high and predictable. Excavation of “Acid Generating Rock” is regulated to minimize the impacts to the environment that could result in the changing of the ph of the water and adversely affecting flora and fauna.

It is standard operating procedure, in the scoping of Projects, to engage Geotechnical Consultants to prepare a Geotechnical Report at the commencement of the Project to mitigate the risk of encountering “Acid Generating Rock”. Having identified the presence of “Acid Generating Rock”, a Slate Management Plan can be prepared and submitted to the Province of Nova Scotia for review and acceptance.

The presence of “Acid Generating Rock” increases the cost of developing the site to achieve regulatory compliance; the construction procedures to deal with the “Acid Generating Rock” are incorporated into the tender documents and are included in the contracts.

DISCUSSION

"Acid Generating Rock" is regulated in the Province of Nova Scotia by the Sulphide Bearing Materials Disposal Regulations, made under Section 66 of the Environment Act.

Process of Acid Generation:

When sulphide-bearing rock is exposed to oxygen and water, oxidation reactions produce sulphuric acid; non-sulphide forms of sulphur in rock do not contribute to acid generation. These oxidation reactions may occur continuously under natural conditions, but over the long-term, the reaction rates slow as all the sulphide sulphur is oxidized on exposed rock surfaces. However, any mechanism that disturbs the rock, such as fracturing by weathering processes, excavation, or blasting, may expose new sulphide and lead to renewed oxidation. This renewed acid generation may continue for many years until the available sulphide sulphur on exposed rock surfaces again becomes fully oxidized and stabilizes.

Construction activities often trigger new releases of acid from rock that has previously been relatively stable. The greater the degree of new and sudden disturbance, the greater and more prolonged will be the newly created release of acid.

Acid produced at rock surfaces leaches away, driven by gravity and infiltrating water flow. If the disturbed, acid producing rock is above natural ground level (e.g. grade or vertical cuts), the acid may enter the surface water flow regime directly and be transported rapidly to the nearest down-gradient water body. Alternatively, the acid may enter the groundwater flow regime and be transported more slowly. Environmental effects may occur consequently in two primary ways:

- (1) acidified groundwater is intercepted by and contaminates wells; and/or
- (2) acidified ground or surface water enters aquatic ecosystems causing fish kills and habitat destruction.

Bedrock Geology

The main documented sulphide-bearing geological formation within HRM that typically contributes to acid generation is the "Halifax Slate Formation". The attached Bedrock Geology Map shows the general areas of the formation. For this specific map, the slate formation is identified with white shading and designation Lp. As shown on the map, the Halifax Slate Formation is prevalent throughout peninsula Halifax and a zone through Dartmouth and beyond (see Attachment 1 for the full extent of the formation). It should be noted that the mapping provides only a guide and that acid generation, or lack thereof, can only be definitively assessed by testing.

Disposal of sulphide bearing materials is regulated under Section 66 of the Nova Scotia Environment Act (Attachment 2, complete regulations of the Act). Three key statements in the Act are:

- (1) "sulphide bearing material" means aggregate having a sulphide sulphur content equal to or greater than 0.4%;

- (2) No person shall dispose of a sulphide bearing material in the Province where the total volume excavated is greater than 500 m³ in situ or 1300 tonnes, unless the person responsible for the disposal holds a valid approval issued under these regulations; and
- (3) The regulations do not apply to an excavation site where less than 500 m³ or 1300 tonnes of aggregate is to be removed, unless the Administrator believes on reasonable and probable grounds that an adverse effect may be caused by the excavation.

Practise indicates that the sulphide sulphur content of the Halifax Slate Formation is almost always above 0.4%. Further, as noted in the third statement, even if less than 500 m³ of material is excavated, the regulation may still apply if there is potential for adverse effects caused by the excavation. Therefore, this regulation often applies for any excavation work where the slate bedrock will be exposed and/or disturbed.

A geotechnical investigation completed on a site, during the planning and design stage of a project, would normally identify if a site contains Halifax Formation Slate. Slate bedrock samples recovered from boreholes/test pits put down for geotechnical investigation, are typically submitted to the Dalhousie University Minerals Engineering Laboratory for testing of sulphide sulphur concentration. Caution should be taken when interpreting test results within the Halifax Slate Formation when the results are below the 0.4% sulphide sulphur regulation. The main reason for this is that a sample is typically a very small representation of the larger rock formation. The prudent approach for excavation work in the Halifax Slate Formation is to assume the rock is acid generating, unless extensive testing at the time of construction is able to demonstrate otherwise.

The most common disposal facility that accepts clean sulphide bearing materials around HRM is the Bedford Waterfront Site, operated by Waterfront Development Corporation Limited. In general, the material has to be free of Total Petroleum Hydrocarbons (TPH) and Polynuclear Aromatic Hydrocarbons (PAHs).

Current costs for disposal at the Bedford site is \$15/cubic yard and they generally need one week of notice to prep a delivery contract, etc. Their recent contracts for disposal have led them to use estimates of 15.5 tonnes of material in a tandem and 24 tonnes in a trailer. This would mean (using a conversion factor of 1.292 cubic yards/tonne) that if they are load counting, that they would use the following figures: 12 cubic yards/tandem and 19 cubic yards/trailer. Our experience is that the in situ rock volume will swell about 50% (+/-) from blasting/breaking so that will have to be calculated into the disposal volume. From haulers they require:

- (2) An environmental approval from NS Environment, certifying that the acid bearing slate is not contaminated. This may require testing from an independent lab, depending on the site; and
- (2) Proof of insurance for the hauling and work on the site. With these documents in hand, they can draft a contract outlining the provision of slate placement.

NSE, under certain circumstances, will also accept on-site management of materials such as encapsulation in an engineered containment cell.

Current practise in the scoping of construction projects is to have prepared a Geotechnical and

Environmental Report, which is incorporated into the contract documents for tendering and the permitting regulations with the Province of Nova Scotia.

BUDGET IMPLICATIONS

There are no Budget Implications from this Report

FINANCIAL MANAGEMENT POLICIES / BUSINESS PLAN

This report complies with the Municipality's Multi-Year Financial Strategy, the approved Operating, Project and Reserve budgets, policies and procedures regarding withdrawals from the utilization of Project and Operating reserves, as well as any relevant legislation.

COMMUNITY ENGAGEMENT

None required for this report

ATTACHMENTS

- 1) Bedrock Geology Map
- 2) Nova Scotia Environment Act Regulations

A copy of this report can be obtained online at <http://www.halifax.ca/commcoun/cc.html> then choose the appropriate Community Council and meeting date, or by contacting the Office of the Municipal Clerk at 490-4210, or Fax 490-4208.

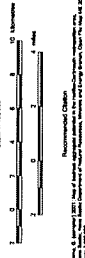
Report Prepared by: Terry Gallagher, Manager Facility Development, Ph. 476-4067

Nova Scotia Department of Natural Resources
 Minerals and Energy Branch
 Open File Map ME 2001-1

**Map of Bedrock Aggregate Potential in the
 Halifax-Dartmouth
 Metropolitan Area
 Nova Scotia**

Compiled by G. Payne

Scale: 1:100,000



NOVASCOTIA
 Nova Scotia
 2001

Map Name

Project Number: 0707, Project Name: Nova Scotia Department of Natural Resources, Minerals and Energy Branch, Open File Map ME 2001-1

Author: G. Payne

Editor: G. Payne

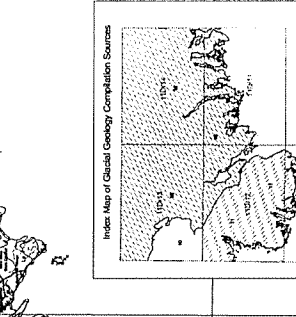
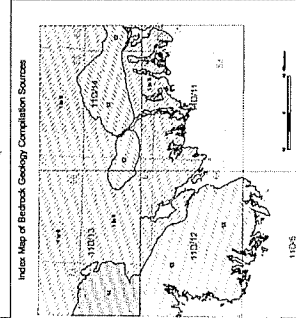
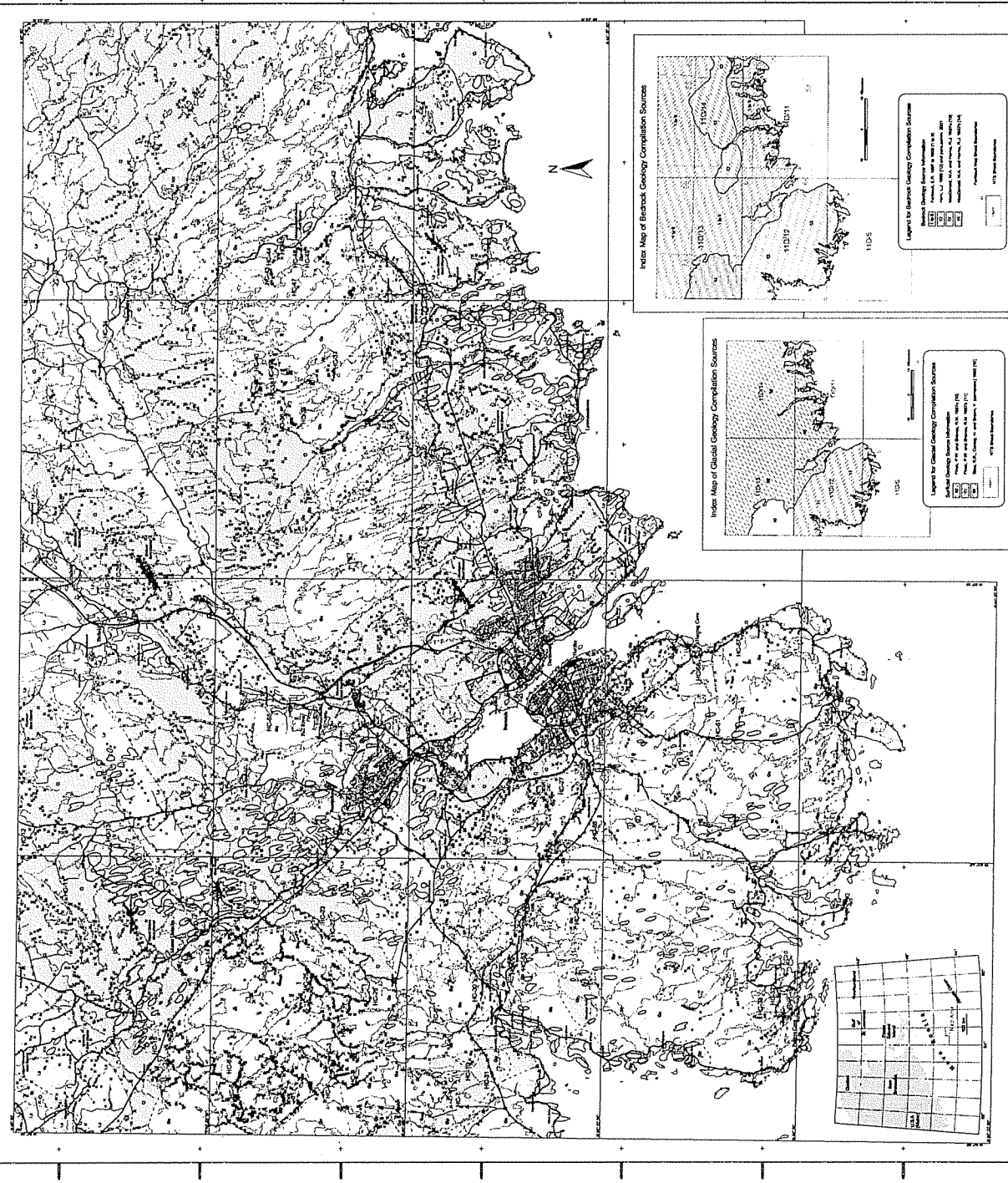
Checked: G. Payne

Date: 2001

Descriptive Notes

This map was compiled from a variety of sources, including aerial photography, geological maps, and topographic maps. It is intended for use as a general guide to the distribution of bedrock aggregate potential in the Halifax-Dartmouth Metropolitan Area. The map is not intended to be used as a legal document or for engineering purposes. The map is compiled from a variety of sources, including aerial photography, geological maps, and topographic maps. It is intended for use as a general guide to the distribution of bedrock aggregate potential in the Halifax-Dartmouth Metropolitan Area. The map is not intended to be used as a legal document or for engineering purposes.

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LEGEND

- OS: Open Grade Aggregate
- OK: Secondary Grade Aggregate
- O: Other
- LI: Low Potential

Symbols

- Water
- Highway
- Other
- Bedrock
- Topography
- Other

Sources of Information

1:50,000 Scale Bedrock Geology Map of Nova Scotia, 1970
 1:50,000 Scale Topographic Map of Nova Scotia, 1970
 1:50,000 Scale Geological Map of Nova Scotia, 1970
 1:50,000 Scale Geologic Map of Nova Scotia, 1970
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Sulphide Bearing Material Disposal Regulations

made under Section 66 of the

Environment Act

S.N.S. 1994-95, c. 1

O.I.C. 95-296, N.S. Reg. 57/95

April 11, 1995

Printed by
the Registrar of Regulations

Halifax, Nova Scotia
1995

Sulphide Bearing Material Disposal Regulations
made under Section 66 of the
Environment Act
S.N.S. 1994-95, c. 1
Order in Council 95-296 (April 11, 1995), N.S. Reg. 57/95

Citation

- 1 These regulations may be cited as the "Sulphide Bearing Material Disposal Regulations".

Definitions

- 2 In these regulations

- (a) "Act" means the Environment Act;
- (b) "Administrator" means a person appointed by the Minister pursuant to these regulations, and includes an acting Administrator;
- (c) "aggregate" means all consolidated and unconsolidated material excluding minerals, gypsum or limestone for which a mining approval is required under the Mineral Resources Act;
- (d) "approved disposal site" means a disposal site that is designed to prevent an adverse effect resulting from the disposal of sulphide bearing material and is approved by the Minister or Administrator under these regulations;
- (e) "Department" means the Department of the Environment;
- (f) "developer" means a person who develops or proposes to develop land that contains a sulphide bearing material and includes any agent or contractor who works for the developer;
- (g) "development" means any disturbance of land which contains a sulphide bearing material;
- (h) "disposal site" means a parcel of land used for the disposal of sulphide bearing materials;
- (i) "excavation" means the process used for the removal of a sulphide bearing material by mechanical means;
- (j) "excavation site" means the area or site where a sulphide bearing material is removed by mechanical means;
- (k) "impervious material" means a 750 mm layer of clay with a hydraulic conductivity less than 1×10^{-6} cm/sec or any other material with an equivalent hydraulic conductivity;
- (l) "inspector" means a person appointed pursuant to Section 21 of the Act;

- (m) "Minister" means the Minister of the Environment;
- (n) "site plan" means an accurate drawing of 1:2000 scale that includes
 - (i) a key map showing the location of the site,
 - (ii) the shape, dimensions, topography, size and type of geology of the site,
 - (iii) any existing or proposed roads on the site,
 - (iv) the location of any watercourse or well on the site and separation distances noted in Section 10, and
 - (v) the location of a centralized collection point and contours to prevent ponding noted in Section 11;
- (o) "sulphide bearing material" means aggregate having a sulphide sulphur content equal to or greater than 0.4% (12.51 kg H₂SO₄/tonne);
- (p) "watercourse" means a watercourse as defined in the Act.

Administrator

3 The Minister may appoint an Administrator to administer these regulations.

Application of regulations

- 4 (1) Subject to subsection (2), no person shall dispose of a sulphide bearing material in the Province where the total volume excavated is greater than 500 m³ *in situ* or 1300 tonnes unless the person responsible for the disposal holds a valid approval issued under these regulations.
- (2) A developer of land which contains a sulphide bearing material shall ensure that sulphide bearing material is disposed of at
- (a) an approved disposal site owned and operated by the developer;
 - (b) an approved disposal site owned and operated by a person other than the developer;
 - (c) a disposal site under the jurisdiction of the Government of Canada and approved by the appropriate federal authority to receive a sulphide bearing material, provided the evaluation, excavation and disposal of the sulphide bearing material are conducted in a manner which is consistent with Sections 6 to 11 of these regulations.

Exemptions

5 These regulations do not apply to

- (a) an excavation site where less than 500 m³ *in situ* or 1300 tonnes of aggregate is to be removed unless the Administrator believes on reasonable and probable grounds that an adverse effect may be caused by the excavation;
- (b) a sulphide bearing material where the arithmetic mean and the majority of samples analyzed contain less than 0.4% sulphide by weight or 12.51 kg H₂SO₄/tonne;
- (c) a sulphide bearing material that is found not to be net acid producing based on the test results provided under subsection 8(5);
- (d) a pit which contains a sulphide bearing material and is used primarily as an aggregate source, if the evaluation, excavation and disposal of the sulphide bearing material are conducted in a manner that is consistent with Sections 6 to 11 of these regulations; or
- (e) any mining activities under approval or otherwise permitted by the Department of Natural Resources, if the evaluation, excavation and disposal of the sulphide bearing material are conducted in a manner that is consistent with Sections 6 to 11.

Initial screening

- 6
- (1) Where a developer of any proposed development knows or ought to know that the proposed development will involve the physical disturbance or disposition of aggregate in a measure greater than 500 m³ *in situ* or 1300 tonnes and which contains a sulphide bearing material, the developer shall immediately notify an Administrator of the proposed development.
 - (2) The developer identified in subsection (1) shall supply an Administrator with a map number and grid reference (1:50 000 map series) that identifies the location of the proposed development.
 - (3) An Administrator shall use information provided under subsection (2), ground truthing or any other data to conduct an initial screening to determine whether the land to be developed contains a sulphide bearing material.
 - (4) If an Administrator is satisfied that the land to be developed does not contain a sulphide bearing material, the Administrator shall advise the developer.
 - (5) If an Administrator informs the developer that the Administrator is uncertain on an initial screening whether the land to be developed contains a sulphide bearing material, the developer shall provide the Administrator with the analysis of the samples that are required to be taken under these regulations.

Sampling

- 7 (1) Unless exempted under Section 5, a developer shall
 - (a) have samples collected;
 - (b) take two samples that are representative of the lands to be developed for each hectare or part thereof to be developed;
 - (c) analyze the samples collected under clause (b) as required in Section 8; and
 - (d) send the results to the Administrator.
- (2) A sample provided under subsection (1) may be taken by
 - (a) the test pit method at 0.5 m intervals for the first 2 m depth of sulphide bearing material and thereafter at 1 m intervals to the depth of the proposed excavation site;
 - (b) the core method with the sample being split along its axis half and the core analyzed along its entire length; or
 - (c) the trenching method with the sample being analyzed along its entire length.
- (3) An Administrator or an inspector may require angled boring or a slight modification to the procedures and frequencies prescribed in subsections (1) and (2) based on bedding planes or any other relevant variables.
- (4) The developer shall pay all costs of sampling and analysis required under these regulations.

Analysis and evaluation

- 8 (1) Each sample gathered under Section 7 shall be analyzed to determine the total sulphur and sulphate sulphur content.
- (2) Sulphide sulphur content shall be determined by calculating the difference between total sulphur and sulphate sulphur.
- (3) Test results obtained under subsection (2) shall be expressed as kg H_2SO_4 /tonne.
- (4) Sample testing analysis under subsection (1) shall be conducted using test methods approved in writing by an Administrator.
- (5) No person shall fail to forward test results obtained under subsection (1) to an Administrator before work commences on a development.

- (6) Where test results indicate a sulphide bearing material, the developer may have the sample reanalysed for net acid production by using the British Columbia Research Confirmation Test (Duncan 1972) or by another test approved in writing by an Administrator.

Excavation requirements

- 9 (1) No person shall excavate land that contains a sulphide bearing material unless the following conditions are met:
- (a) the removal of any vegetation or soil overlying aggregate is limited to satisfy a construction or operational requirement;
 - (b) surface run-off is diverted away from the disturbed area where the sulphide bearing material is exposed or will be exposed so that no adverse effect is caused or may be caused;
 - (c) the volume of aggregate disturbed is minimized in all cases;
 - (d) excavated material is removed immediately and disposed of in accordance with these regulations unless written approval is obtained from the Administrator authorizing the temporary storage of the material on the land for reuse;
 - (e) all construction activities are scheduled to minimize exposure time of the sulphide bearing material; and
 - (f) run-off from the disturbed area is diverted to a centralized point before leaving the property and, if required by a written direction made by the Administrator, is monitored so that no adverse effect is caused or may be caused.
- (2) No person shall store or use a sulphide bearing material on or near an excavation site without the written approval of the Minister or an Administrator.

Disposal of excavated sulphide bearing material

- 10 (1) Subject to Sections 4 and 5, no person shall dispose of a sulphide bearing material other than at an approved disposal site.
- (2) No disposal site shall be approved unless the disposal site is located
- (a) a minimum distance of 60 m from a watercourse or well; or
 - (b) a minimum distance from a watercourse or well to be established by the Minister where the Minister believes on reasonable and probable grounds that the requirement set forth in clause (a) will not prevent an adverse effect.

- (3) No person shall dispose of a sulphide bearing material in marine waters located within the jurisdiction of the Province unless the disposal is approved by the Minister.
- (4) No person shall dispose of a sulphide bearing material in fresh water.

Operation of a disposal site

- 11 An approved disposal site shall meet the following conditions of operation:
 - (a) effluent or runoff must be directed to a centralized collection point and monitored for pH, aluminum, conductivity and other items detailed in the approval;
 - (b) effluent from the centralized collection point must meet the following criteria:
 - (i) $\text{pH} \geq 4.0$,
 - (ii) aluminum $\leq 0.8 \text{ mg/l}$
 - (iii) conductivity ≤ 500 micromhos/cm;
 - (c) unless authorized in writing by the Administrator, the sulphide bearing material must be covered with an impervious material no later than 30 days after the first load of sulphide bearing material is deposited on the disposal site; and
 - (d) the disposal site surface must be contoured to prevent ponding.

Approval application information/approval

- 12 (1) The owner, operator, developer or person responsible for a disposal site shall supply the following information to an Administrator when an application for an approval is made:
 - (a) an estimate of the total volume of sulphide bearing material to be deposited at the disposal site; and
 - (b) information, design and site plans showing how the owner, operator or developer intends to address all items required under Sections 10 and 11 of these regulations and rehabilitate the site.
- (2) The amount of security required for an approved disposal site shall be in the amount of \$25.00 per m^3 of disposed sulphide bearing material.
- (3) The form of security required under subsection (2) shall be as prescribed in the Approvals Procedure Regulations.

- (4) Upon receipt of the information required under subsection (1) and the security required under subsection (2) and subject to the provisions of the Approvals Procedure Regulations, the Minister or Administrator may issue an approval for a disposal site.

Effective date

- 13 These regulations shall come into force on, from and after April 11, 1995.