Canadian Environmental Sustainability Indicators

Managing Metal Mining Effluent Quality in Canada
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Part 1. Managing Metal Mining Effluent Quality in Canada Indicator

Overall, in 2014, the metal mining sector achieved over 99% compliance with the authorized limits for metals, cyanide and pH, and over 97% for total suspended solids as set out in the Metal Mining Effluent Regulations (the Regulations). These results have been mostly stable since 2003, except for total suspended solids, for which compliance has increased. The percentage of test results that were not acutely lethal has remained above 95% since 2005.

The Regulations authorize the deposit of specific deleterious substances from metal mines, subject to certain conditions. They also impose limits on the pH level of the effluent, and prohibit the release of effluent that is acutely lethal.¹

**Figure 1. Percentage of regulatory data submitted by metal mines that did not exceed authorized limits, Canada, 2003 to 2014**

![Percentage of regulatory data submitted by metal mines that did not exceed authorized limits, Canada, 2003 to 2014](image)

**Data for Figure 1**

**Note:** Deleterious substances listed in the Regulations include arsenic (As), copper (Cu), cyanide (CN), lead (Pb), nickel (Ni), zinc (Zn), total suspended solids (TSS), and radium 226 (Ra-226). The regulations set a minimum (pH low) and maximum (pH high) level for the pH of effluent released. Acute lethality test refers to tests of effluent on rainbow trout in terms of mortality.

**Source:** Environment and Climate Change Canada (2016) *Summary Review of Performance of Metal Mines Subject to the Metal Mining Effluent Regulations*.

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¹ An effluent is deemed non-acutely lethal if it kills less than 50% of the rainbow trout subjected to it at 100% concentration over a 96-hour period.
The Regulations apply to all Canadian metal mines (except placer mines)\(^2\) that exceeded an effluent flow rate of 50 cubic metres per day at any time after June 6, 2002, and that deposit a deleterious substance in any water or place defined in the regulations. Mining operations that are not captured under the regulations (such as coal mines, diamond mines, quarries, and other non-metallic mineral mining facilities) are still subject to the requirements of the *Fisheries Act*, including the general prohibition on the deposit of deleterious substances.

Metal mining is an important economic activity for the Canadian economy. In 2014, the metal ore mining industry employed 35,855 Canadians,\(^3\) and contributed 1.1% of Canada's gross domestic product.\(^4\) Canada ranks among the top five countries in the mining of a number of major metals.\(^5,6\) However, without adequate regulation, metal mining could have harmful impacts on the environment. For example, the effects of untreated mining effluent could be highly damaging to the receiving aquatic environment, including fish and fish habitat. Proper management regimes can mitigate these impacts.

Pristine lakes and rivers

This indicator supports the measurement of progress towards the long-term goal of the 2016–2019 *Federal Sustainable Development Strategy*: Clean and healthy lakes and rivers support economic prosperity and the well-being of Canadians.

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\(^2\) The Regulations define mines as hydrometallurgical, milling or mining facilities that are designed or used to produce a metal, a metal concentrate, or an ore from which a metal or metal concentrate may be produced, or any facilities, including smelters, pelletizing plants, sintering plants, refineries and acid plants, where any effluent from the facility is combined with the effluent from hydrometallurgy, milling or mining. Placer mines are mining operations that extract minerals or metals from stream sediments by gravity or magnetic separation.


\(^5\) In 2014, Canada was the second-largest producer of uranium, the third-largest producer of cobalt, tungsten and platinum group metals, the fourth-largest producer of nickel and titanium, and the fifth-largest producer of cadmium.

Part 2. Data Sources and Methods for the Managing Metal Mining Effluent Quality in Canada Indicator

Introduction
The Managing Metal Mining Effluent Quality in Canada indicator is part of the Canadian Environmental Sustainability Indicators (CESI) program, which provides data and information to track Canada's performance on key environmental sustainability issues. This indicator is also used to report and measure progress towards the goals of the 2016–2019 Federal Sustainable Development Strategy.

Description and rationale of the Managing Metal Mining Effluent Quality in Canada indicator

Description
The Managing Metal Mining Effluent Quality in Canada indicator presents the percentage of reported monthly average monitoring results for deleterious substances, pH levels and acute lethality tests that did not exceed authorized limits from 2003 to 2014. The indicator helps Environment and Climate Change Canada evaluate the effectiveness of pollution prevention and control technologies, practices and programs within the metal mining sector. This indicator summarizes the results achieved since the Metal Mining Effluent Regulations came into effect in 2002, replacing and expanding the scope of the 1977 Metal Mining Liquid Effluent Regulations.

Rationale
The Metal Mining Effluent Regulations (the Regulations) were promulgated on June 6, 2002 and came into force on December 6, 2002. The Regulations include provisions to allow the discharge of metal mine effluent into fish-frequented water bodies, subject to certain requirements. Mines that are subject to the Regulations may deposit an effluent that contains a deleterious substance if: (a) the concentration of the deleterious substance in the effluent does not exceed the authorized limits; (b) the pH of the effluent is equal to, or greater than, 6.0 but is not greater than 9.5; and (c) the effluent is not acutely lethal. An effluent is deemed non-acutely lethal if it kills less than 50% of the rainbow trout subjected to it at 100% concentration over a 96-hour period. Table 1 summarizes the monthly mean concentration limits, in milligrams per litre (mg/L) or in becquerel per litre (Bq/L), for the deleterious substances listed in the Regulations.
Table 1. Authorized limits for deleterious substances (monthly means)

<table>
<thead>
<tr>
<th>Substances</th>
<th>Monthly mean concentration limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>0.50 mg/L</td>
</tr>
<tr>
<td>Copper</td>
<td>0.30 mg/L</td>
</tr>
<tr>
<td>Cyanide</td>
<td>1.00 mg/L</td>
</tr>
<tr>
<td>Lead</td>
<td>0.20 mg/L</td>
</tr>
<tr>
<td>Nickel</td>
<td>0.50 mg/L</td>
</tr>
<tr>
<td>Zinc</td>
<td>0.50 mg/L</td>
</tr>
<tr>
<td>Total suspended solids</td>
<td>15.00 mg/L</td>
</tr>
<tr>
<td>Radium 226</td>
<td>0.37 Bq/L</td>
</tr>
</tbody>
</table>

Note: mg/L = milligrams per litre. Bq/L = becquerel per litre. Monthly mean limits are one of three types of limits included in the Regulations, the others being the maximum authorized concentration in a composite sample and the maximum authorized concentration in a grab sample. More information about these is available in Schedule 4 of the Regulations.

Recent changes to the indicator
The Managing Metal Mining Effluent Quality in Canada indicator has been updated with the latest information available.

Data

Data source
This indicator uses monthly mean compliance data provided by metal mines to Environment and Climate Change Canada under section 22 of the Metal Mining Effluent Regulations (the Regulations). Starting in 2004, Environment and Climate Change Canada has made the data available through the annual release of the Summary Review of Performance of Metal Mines Subject to the Metal Mining Effluent Regulations, which can be found online. The website is updated as new reports are published.

The frequency of test measurement varies depending on the individual mine and its performance. Under the regulations, operators are required to test the effluent at each discharge point weekly, and record the results for all deleterious substances. However, this frequency can be reduced to once per quarter for certain substances (arsenic, copper, cyanide, lead, nickel and zinc) if the concentration of the substance from a discharge point is less than 10% of the regulations monthly mean concentration limit for that substance over a period of 12 consecutive months. The reporting frequency for radium 226 can also be reduced to once per quarter for metal mines, other than uranium mines, provided that the concentration of radium 226 is less than 0.037 becquerel per litre in 10 consecutive tests.

Spatial coverage
This indicator uses data from all metal mines subject to the Regulations. Table 2 presents the number of such mines by province and territory for the 2003–2014 period.
## Table 2. Number of metal mines subject to the regulations by jurisdiction, 2003 to 2014

<table>
<thead>
<tr>
<th>Province or territory</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
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<td>105</td>
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</tr>
</tbody>
</table>

**Temporal coverage**

The indicator uses the quarterly and annual reports of metal mine effluent discharges submitted to Environment and Climate Change Canada under the Regulations since they came into force on December 6, 2002.

**Data completeness**

The indicator includes all monthly mean compliance data derived from sampling results submitted to Environment and Climate Change Canada for the years reported in this indicator.

**Data timeliness**

The most recent data available at the time this indicator was produced are for 2014.
Methods
The indicator is calculated by measuring the percentage of tests for all metal mines that did not exceed authorized limits for the deleterious substances, pH levels and acute lethality. For each substance, this is done by dividing the number of monthly mean results that met authorized limits by the total number of monthly mean results reported.\(^7\)

Caveats and limitations
The data were compiled by staff of the Mining Section of Environment and Climate Change Canada based on effluent quality information provided by the metal mines in their submitted annual reports. In some cases, Environment and Climate Change Canada staff used quarterly reports to complete missing information that was not properly reported by the owners or operators of some mines.

\(^7\) For each substance, weekly test results reported by mines (the frequency of testing varies depending on regulatory conditions) are used to calculate a monthly mean concentration for each final discharge point.
# Part 3. Annexes

Annex A. Data tables for the figures presented in this document

**Table A.1. Data for Figure 1. Percentage of regulatory data submitted by metal mines that did not exceed authorized limits, Canada, 2003 to 2014**

<table>
<thead>
<tr>
<th>Type of test</th>
<th>2003 (%)</th>
<th>2004 (%)</th>
<th>2005 (%)</th>
<th>2006 (%)</th>
<th>2007 (%)</th>
<th>2008 (%)</th>
<th>2009 (%)</th>
<th>2010 (%)</th>
<th>2011 (%)</th>
<th>2012 (%)</th>
<th>2013 (%)</th>
<th>2014 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic (As)</td>
<td>99.8</td>
<td>99.7</td>
<td>99.5</td>
<td>99.8</td>
<td>99.8</td>
<td>100.0</td>
<td>99.9</td>
<td>99.8</td>
<td>99.8</td>
<td>99.8</td>
<td>99.8</td>
<td>99.9</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>99.8</td>
<td>99.6</td>
<td>99.7</td>
<td>100.0</td>
<td>99.9</td>
<td>99.7</td>
<td>99.5</td>
<td>99.9</td>
<td>99.8</td>
<td>99.7</td>
<td>99.7</td>
<td>99.7</td>
</tr>
<tr>
<td>Cyanide (CN)</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
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<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>99.3</td>
</tr>
<tr>
<td>Lead (Pb)</td>
<td>99.9</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
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<td>100.0</td>
<td>100.0</td>
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</tr>
<tr>
<td>Nickel (Ni)</td>
<td>99.6</td>
<td>99.2</td>
<td>98.6</td>
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<td>99.2</td>
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<td>99.8</td>
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<tr>
<td>Radium 226 (Ra-226)</td>
<td>99.0</td>
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<td>99.8</td>
<td>100.0</td>
<td>100.0</td>
<td>99.1</td>
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<td>Zinc (Zn)</td>
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<td>99.9</td>
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<td>99.7</td>
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<td>99.6</td>
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<td>99.9</td>
<td>99.9</td>
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</tr>
<tr>
<td>Rainbow trout acute lethality (toxicity)</td>
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<td>91.7</td>
<td>97.8</td>
<td>97.7</td>
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<td>97.5</td>
<td>98.8</td>
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<td>Total suspended solids (TSS)</td>
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<td>95.4</td>
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<td>96.3</td>
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<td>97.6</td>
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</tbody>
</table>

**Note:** Deleterious substances listed in the Regulations include arsenic (As), copper (Cu), cyanide (CN), lead (Pb), nickel (Ni), zinc (Zn), total suspended solids (TSS), and radium 226 (Ra-226). The regulations set a minimum (pH low) and maximum (pH high) level for the pH of effluent released. Acute lethality test refers to tests of effluent on rainbow trout in terms of mortality.

**Source:** Environment and Climate Change Canada (2016) *Summary Review of Performance of Metal Mines Subject to the Metal Mining Effluent Regulations.*
Annex B. References and additional information

References and further reading


Related information

Environmental Code of Practice for Metal Mines
Managing Pulp and Paper Effluent Quality in Canada
Additional information can be obtained at:

Environment and Climate Change Canada
Public Inquiries Centre
7th Floor, Fontaine Building
200 Sacré-Cœur boul.
Gatineau, QC K1A 0H3
Telephone: 1-800-668-6767 (in Canada only) or 819-938-3860
Fax: 819-994-1412
TTY: 819-994-0736
Email: ec.enviroinfo.ec@canada.ca