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Risk Management Approach for Thallium and its Compounds

Environment and Climate Change Canada

Health Canada

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Canada

Summary of proposed risk management

This document outlines the risk management actions for thallium and its compounds, which were found to be harmful to the environment.

In particular, the Government of Canada is proposing to reduce anthropogenic releases of thallium to water from the following sectors or activities:

Metal mining: by reviewing information received from regulated mines in response to environmental effects monitoring requirements under the *Metal and Diamond Mining Effluent Regulations* (MDMER), to determine if additional regulatory or non-regulatory risk management is appropriate. For mining facilities not covered by the MDMER, by working with industry and/or provinces to gather additional information from facilities not covered by the MDMER as described below.

Base metals smelting and refining: for facilities that combine their effluent with metal mines: in the same ways as described above for metal mining. For facilities that do not combine their effluent with metal mines: by working with industry to gather additional data on thallium concentrations as described below.

Interested stakeholders are invited to provide further information regarding thallium and its compounds, including:

- Metal mining:
    - In the receiving environment and reference areas of metal mining facilities (including recognized[1] closed mines under the MDMER):
        - Dissolved or total concentrations of thallium in surface waters.
- Base metal smelters and refineries that do not combine their effluent with metal mines:
    - In the receiving environment and reference areas:
        - Dissolved or total concentrations of thallium in surface waters and effluent receiving waters; and
        - Dissolved or total concentrations of thallium in wastewater effluent.

Under the Chemicals Management Plan (CMP), Environment and Climate Change Canada (ECCC) and Health Canada (HC) are conducting assessments on a variety of metals that may identify similar or additional sectors as sources of risk. ECCC is considering the risk management actions for thallium as part of a

[1] Mines subject to Part 4 of the MDMER.

more comprehensive strategy to manage the metals assessed as toxic under the third phase of the CMP. Implementation of this strategy would begin when all risk assessments and risk management approaches for phase 3 metals will have been completed and published. This strategy is focused on effluents rather than on single metals and will reduce the administrative burden on implicated sectors that would otherwise result from implementing multiple risk management approaches (e.g., repeated amendments to the MDMER).

Note: The above summary is an abridged list of actions under consideration to manage thallium and its compounds and to seek information on identified gaps. Refer to section 3 of this document for more details in this regard. It should be noted that the proposed risk management actions may evolve through consideration of additional information obtained from the public comment period, literature, and other sources.

Table of Contents

Summary of proposed risk management **1**

1. Context **1**

2. Issue **1**

2.1 Assessment conclusion 1

2.2 Recommendation under CEPA 2

3. Proposed risk management **4**

3.1 Proposed environmental objective 4

3.2 Proposed risk management objective 4

3.3 Proposed risk management actions 4

3.4 Performance measurement and evaluation 6

3.5 Additional risk management information 7

4. Background **8**

4.1 General information on thallium and its compounds 8

4.2 Natural sources 8

4.3 Current uses and identified sectors 8

5. Exposure sources of concern and identified risk **10**

5.1 Anthropogenic releases to the environment 10

6. Risk management considerations **11**

6.1 Alternatives and alternate technologies 11

6.2 Socio-economic and technical considerations 12

7. Overview of existing risk management **12**

7.1 Related canadian risk management context 12

7.2 International risk management context 15

8. Next steps **17**

8.1 Public comment period 17

8.2 Timing of actions 18

9. References **19**

1. Context

The *Canadian Environmental Protection Act, 1999* (CEPA) (Canada, 1999) provides the authority for the Minister of the Environment and the Minister of Health (the ministers) to conduct assessments to determine if substances are toxic to the environment and/or harmful to human health as set out in section 64 of CEPA[2,3], and if so, to manage the associated risks.

The ministers have conducted an assessment of thallium and its compounds. The assessment focuses on the thallium moiety and therefore considers thallium in its elemental form, thallium-containing substances, and thallium released in dissolved, solid, or particulate form.

2. Issue

ECCC and HC conducted a joint scientific assessment to evaluate thallium and its compounds in Canada. A notice summarizing the scientific considerations of the assessment for these substances was published in the *Canada Gazette*, Part I, on March 30, 2024. For further information, refer to the assessment for Thallium and its Compounds.

2.1 Assessment conclusion

On the basis of the information available, the assessment concluded that thallium and its compounds are toxic under section 64(*a*) of CEPA because they are or may be entering the environment in a quantity or concentration or under conditions that have or may have an immediate or long-term harmful effect on the environment or its biological diversity. However, these substances did not meet the criteria under paragraphs 64(*b*) as they are not entering the environment in a quantity or concentration or under conditions that constitute or may constitute a danger to the environment on which life depends, or 64(*c*) as they are not entering the environment in a quantity or concentration or under

[2] Section 64 [of CEPA]: *For the purposes of* [Parts 5 and 6 of CEPA]*, except where the expression "inherently toxic" appears, a substance is toxic if it is entering or may enter the environment in a quantity or concentration or under conditions that*

- *(a) have or may have an immediate or long-term harmful effect on the environment or its biological diversity;*
- *(b) constitute or may constitute a danger to the environment on which life depends; or*
- *(c) constitute or may constitute a danger in Canada to human life or health.*

[3] A determination of whether one or more of the criteria of section 64 are met is based upon an assessment of potential risks to the environment and/or to human health associated with exposures in the general environment. For humans, this includes, but is not limited to, exposures from ambient and indoor air, drinking water, foodstuffs, and products used by consumers. A conclusion under CEPA is not relevant to, nor does it preclude, an assessment against the hazard criteria specified in the *Hazard Product Regulations*, which are a part of the regulatory framework for the Workplace Hazardous Materials Information System for products intended for workplace use. Similarly, a conclusion on the basis of the criteria contained in section 64 of CEPA does not preclude actions being taken under other sections of CEPA or other Acts.

conditions that constitute or may constitute a danger in Canada to human life or health.

The assessment determined that thallium and its compounds meet the criteria for persistence, but do not meet the criteria for bioaccumulation, as defined in the *Persistence and Bioaccumulation Regulations* made under CEPA (Canada, 2000).

The ecological risks of concern, identified in the assessment, are based on the release of thallium from a small number of metal mining facilities and base metals smelters and refineries. As such, this document will focus on these activities and exposure sources of concern (refer to section 5.2).

2.2 Recommendation under CEPA

On the basis of the findings of the assessment conducted pursuant to CEPA, the Ministers recommend that thallium and its compounds be added to Part 2 of Schedule 1 to CEPA[4]. Addition of a substance to Schedule 1 to CEPA enables the Government to propose certain risk management measures under CEPA to manage potential ecological and human health risks associated with the substance.

Until regulations specifying criteria for the classification of substances that pose the highest risk or that are carcinogenic, mutagenic, or toxic to reproduction are available, thallium and its compouds are recommended for addition to Part 2 of Schedule 1. Following the availability of the aforementioned criteria, the substance may be moved to Part 1 of Schedule 1, if applicable.

CEPA sets out a 2-track approach for managing risks.

Under sub-section 77(3), the Ministers are required to propose recommending the addition of a substance that poses the highest risk, as defined in paragraph (a), (b) or (c), to Part 1[5] of Schedule 1 of the Act and, in developing a proposed

[4] After an assessment of a given substance under Part 5 of CEPA, other than section 83, the Ministers shall propose one of the following measures: take no further action with respect to the substance, add the substance to the List referred to in section 75.1 of the Act (unless the substance is already on that List), recommend the addition of the substance to Part 1 of the list of toxic substances in Schedule 1 to CEPA (for substances that pose the highest risk) or recommend the addition of the substance to Part 2 of the list of toxic substances in Schedule 1 to CEPA (for other CEPA-toxic substances).

[5] Under subsection 77(3), a substance must be recommended for addition to Part 1 of Schedule 1 to the Act when the substance is determined to be toxic and the Ministers are satisfied that:

> (a) the substance may have a long-term harmful effect on the environment and
> (i) is inherently toxic to human beings or non-human organisms, as determined by laboratory or other studies,
> (ii) is persistent and bioaccumulative in accordance with the regulations,
> (iii) is present in the environment primarily as a result of human activity, and

regulation or instrument respecting preventive or control actions, to give priority to the total, partial, or conditional prohibition of activities in relation to the substance or to the release of the substance into the environment.

For other substances recommended for addition to Part 2 of Schedule 1 of the Act, the Ministers shall give priority to pollution prevention, and this could include regulatory or non-regulatory measures such as prohibition if warranted.

Thallium and its compounds are found not to meet the criteria per subsection 77(3) for addition to Part 1 of Schedule 1 of the Act.

The ministers have taken into consideration comments made and information provided by stakeholders during the 60-day public comment period on the draft assessment and its associated risk management scope.

As the Ministers finalize the recommendation to add thallium and its compounds to Part 2 of Schedule 1, risk management instruments must be proposed within 24 months from the date on which the Ministers recommended that thallium and its compounds be added to Schedule 1 to CEPA, and finalized within 18 months from the date on which the risk management instruments are proposed, as outlined in sections 91 and 92 of CEPA (refer to section 8 for publication timelines applicable to this group of substances).

2.3 Public comment period on the draft assessment and the risk management scope

The draft assessment for thallium and its compounds (ECCC, HC, 2020) and its associated risk management scope, which summarized the proposed risk management options under consideration at that time, were published in September, 2020. Interested stakeholders were invited to submit comments on both documents during a 60-day comment period.

Comments received on the draft assessment and risk management scope were taken into consideration in the development of this document. A summary of responses to public comments received is available.

(iv) is not a naturally occurring radionuclide or a naturally occurring inorganic substance;

(b) the substance may constitute a danger in Canada to human life or health and is, in accordance with the regulations, carcinogenic, mutagenic or toxic for reproduction; or

(c) the substance is, in accordance with the regulations, a substance that poses the highest risk.

3. Proposed risk management

3.1 Proposed environmental objective

Proposed environmental objectives are quantitative or qualitative statements of what should be achieved to address environmental concerns.

For this substance grouping, the proposed objective is focused on addressing the exposure sources of concern from the sectors outlined in section 5 of this document. As such, the proposed environmental objective for thallium and its compounds is to reduce anthropogenic releases of thallium to water so as not to exceed levels that cause long-term adverse effects to aquatic organisms.

3.2 Proposed risk management objective

Proposed risk management objectives set quantitative or qualitative targets to be achieved by the implementation of risk management regulations, instrument(s) and/or tool(s) for a given substance or substances. The proposed risk management objective for thallium and its compounds is to achieve the lowest level of releases of thallium to water that is technically and economically feasible, taking into consideration socio-economic factors and natural background concentrations.

3.3 Proposed risk management actions

To achieve the proposed risk management objective and to work towards achieving the proposed environmental objective, the proposed risk management actions being considered for thallium and its compounds focus on reducing releases of thallium to water from the sectors of concern identified in the assessment: metal mining, and base metals smelting and refining. The proposed actions are described below.

Note that the proposed risk management actions described in this document are preliminary and subject to change. Following the publication of this document and publication of other metal assessments, additional information obtained from the public comment period and from other sources will be considered, along with the information presented in this document, in further instrument selection and development processes[6], if required.

The risk management actions outlined in this document may also evolve through consideration of assessments and risk management actions published for other

[6] The proposed risk management regulation(s), instrument(s) or tool(s) are selected using a thorough, consistent and efficient approach and take into consideration available information in line with the Government of Canada's Cabinet Directive on Regulation (TBS, 2018), the Red Tape Reduction Action Plan (TBS, 2012b), and in the case of a regulation the *Red Tape Reduction Act* (Canada, 2015).

CMP substances to ensure effective, coordinated, and consistent risk management decision-making.

3.3.1 Metal mining

The existing risk management instrument for thallium in effluents discharged from the metal mining sector is the *Metal and Diamond Mining Effluent Regulation* (MDMER), developed pursuant to subsections 34(2), 36(5) and 38(9) of the *Fisheries Act* (Canada, 2018a). The Government of Canada is proposing to reduce anthropogenic releases of thallium to water from the metal mining sector by reviewing information received from regulated mines in response to environmental effects monitoring, as required in section 7 of the MDMER to determine if additional regulatory or non-regulatory risk management is appropriate. For facilities not covered by the MDMER, by working with industry and/or provinces to gather additional information.

The MDMER prescribes environmental effects monitoring, including effluent characterization for a list of substances for any metal producing mines, as defined in section 2 of the MDMER, that on or after June 1, 2018 exceed an effluent flow rate of 50 m^3 per day. Thallium was added to the list of substances included in effluent characterization on Schedule 5, Environmental Effects Monitoring Studies of the MDMER, in an amendment that came into effect in June, 2018 (Canada, 2018b). This requires mines subject to the MDMER to analyze and report thallium concentrations in samples collected as part of effluent and water quality monitoring. In addition, mines are required to consider thallium in any investigation of cause studies carried out where effects from mine effluent have been identified from the environmental effects monitoring conducted in accordance with the MDMER.

Under the third phase of the CMP, ECCC and HC are conducting assessments on a variety of metals that may also identify metal mines as sources of risk. Following publication of these metal assessments, ECCC will review the information received from regulated mines in response to environmental effects monitoring requirements under the MDMER to determine if additional regulatory or non-regulatory risk management of effluents from metal mines is appropriate for one or more assessed metals. ECCC is considering the risk management actions for thallium as part of a more comprehensive strategy to manage the metals assessed as toxic under the third phase of CMP. Implementation would begin in 2023, when all risk assessments and risk management approaches for these metals are expected to be completed and published. This risk management is focused on managing all CEPA toxic metals in effluents from metal mines, rather than managing single metals. This strategy will reduce the administrative burden on implicated sectors that would otherwise result from implementing multiple risk management approaches (e.g., repeated amendments to the MDMER) over a five year period, for metals assessed and found to be toxic.

3.3.2 Base metals smelting and refining

Base metals smelting and refining facilities vary significantly in terms of their feedstocks, processes and products, and are therefore expected to have varying levels of thallium in their effluent, ranging from insignificant to high enough to be a source of concern.

At the time of the assessment, the MDMER applied to six smelters and refineries which combine their effluent with that of a metal mine effluent. As of April 1st, 2022, five base metals smelting and refining facilities are covered by the MDMER. For these facilities, ECCC would proceed in the same way as described for metal mining. For the remaining five facilities that do not combine their effluent with metal mines, ECCC is proposing to work with these facilities to gather additional data on their effluent thallium concentrations, as well as concentrations in the receiving environment(s) and reference area(s) for surface waters at the point sources of release. This will allow ECCC to determine what risk management measures should be developed, if any, for these facilities. Implementation would be done as part of the comprehensive metals strategy as described above in section 3.3.1.

3.4 Performance measurement and evaluation

Performance measurement evaluations for toxic substances evaluate the ongoing effectiveness and relevance of the actions taken to manage risks from toxic substances[7]. ECCC and HC have developed a Performance Measurement Evaluation Strategy that sets out the approach to evaluate the effectiveness of actions taken on substances found toxic under CEPA.. The aim is to determine whether human health and/or environmental objectives have been met and whether there is a need to revisit the risk management approach for that substance. Selection of a substance for performance measurement evaluation is conducted through readiness, prioritization and workplanning as outlined in the Performance Measurement Evaluation Strategy. In evaluating progress and revisiting risk management, as warranted, these activities together will aim to manage risks effectively over time. . To achieve this, the Government of Canada may review the effectiveness of the risk management actions for thallium and its compounds by:

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[7] Performance measurement can be performed at two levels:

- Instrument-based performance measurement evaluates the effectiveness of an individual instrument in meeting the specific risk management objectives that were set out when the risk management tool was designed. The results of performance measurement will help determine if additional risk management or assessment is needed (i.e., evaluate whether risk management objectives have been met); and
- Performance measurement evaluations for toxic substances considers performance of all final risk management instruments applied to a chemical substance and relevant data or indicators of exposure to the environment or human health (i.e., evaluate whether human health and/or environmental objectives have been met).

  For more information on performance measurement evaluation (including Health Canada and Environment and Climate Change Canada's Performance Measurement Evaluation Strategy) please visit Performance measurement for toxic substances - Canada.ca.

- collecting and analyzing data submitted by metal mines under the MDMER to measure progress towards meeting the risk management objective;
- considering monitoring and other data on air emissions from the mining sector; and
- assessing the potential co-benefits of the base-level industrial emission requirements (BLIERs) performance agreements through monitoring the releases of particulate matter (PM) which includes metals, through the National Pollutant Release Inventory (NPRI).

In addition, the Government of Canada may plan to collect and analyze monitoring data, such as data on the presence of thallium and its compounds in surface water, in order to establish a baseline environmental presence, and over time to measure progress towards meeting the environmental objective.

As part of performance measurement evaluation, new information (e.g., emerging concerns or new sources of exposure) may be taken into consideration to ensure long-term effectiveness of actions in place.

When undertaken, the results of performance measurement and evaluation are used to inform whether further risk management action is warranted and are made available to Canadians along with recommendations for further action, if applicable.

3.5 Additional risk management information

Interested stakeholders are invited to provide further information regarding thallium and its compounds, including:

- Metal mining:
    - In the receiving environment and reference areas of metal mining facilities (including recognized[8] closed mines under the MDMER):
        - Dissolved or total concentrations of thallium in surface waters.
- Base metal smelters and refineries that do not combine their effluent with metal mines:
    - In the receiving environment and reference areas:
        - Dissolved or total concentrations of thallium in surface waters and effluent receiving water concentrations;
        - Dissolved or total concentration of thallium in wastewater effluent.

[8] Mines subject to Part 4 of the MDMER.

Stakeholders are requested to provide further information to help address these gaps on or before May 29, 2024 to the contact identified in section 8 of this document.

4. Background

4.1 General information on thallium and its compounds

Thallium exists in the earth's crust at the level of 0.7 mg/kg (USGS, 2021). It is typically associated with sulfide ores of various metals including zinc, copper, iron, lead, and in coal (Kazantzis, 1979). Certain minerals such as crookesite ($(Cu,Tl,Ag)_2Se$), lorandite ($TlAsS_2$), hutchinsonite ($(Tl,Pb)_2As_5S_9$) and avicennite (Tl_2O_3) contain thallium up to 60% (Reimann & de Caritat, 1998), but these minerals are rare. Thallium is also present in meteorites, volcanic rocks, plants, and trace amounts in most living organisms, although it is not an essential element.

4.2 Natural sources

Natural releases of thallium to the aquatic environment occur primarily by the weathering of minerals and rocks that contain thallium (CCME, 1999a). Soil erosion, forest fires, and volcanic activity can also contribute to thallium entering the aquatic environment naturally.

Naturally occurring background levels of thallium were identified in the assessment and were taken into consideration when estimating the exposure of ecological receptors to thallium-containing substances.

4.3 Current uses and identified sectors

Internationally, the main uses of thallium substances include use in fiber (optical) glasses to increase the refractive index and density, in photoelectric cells, as an activator in gamma radiation detection devices (scintillometers), in semiconductor material, in infrared radiation detection and transmission equipment, in crystalline filters for light diffraction for acoustic-optical measuring devices, in mercury-thallium alloy for low-temperature measurements, in high-density liquid for sink-float separation of minerals, and as intermediates in chemical production (ATSDR 1992; Peter and Viraraghavan 2005; USGS 2021).

Thallium is also used in mercury arc lamps, alloys with other metals, jewellery, fireworks, pigments and dyes, for mineralogical separation, and for the impregnation of wood and leather against fungi and bacteria. In addition, the radioactive isotope thallium-201 is used in imaging of the heart to determine the location and extent of coronary artery blockages, and scar tissue from previous heart attacks (Blumenthal et al. 2013). Thallium's use in bactericides, rodenticides, and insecticides has been banned in most countries due to its high

toxicity, accumulation in body tissues and persistence in the environment. In Canada, thallium sulfate-based insecticides for ants were the only registered agricultural use for thallium and this use was discontinued in 1974 (CCME, 1999a).

Additional uses of thallium in Canada are in products available to consumers: as a radiopharmaceutical in human drug products (HC, 2018), (HC, 2016) and as a medicinal ingredient in natural health products licensed as homeopathic medicines (HC, 2019). Thallium may also be used in Canada as a component in the manufacture of food packaging materials.

Anthropogenic sources of thallium are primarily associated with incidental releases of residues or by-products from various industrial activities, such as the smelting/refining process and metal mining, wastewater treatment systems, or fly ashes of coal-fired electrical power plants. Thallium production was less than 8 tonnes globally in 2020 (USGS, 2021).

4.3.1 Metal mining

Thallium is not intentionally mined in Canada. However, it is often recovered from sulfide ores of lead, copper and zinc and may also be associated with cadmium, iron and potassium minerals such as feldspars and micas (CCME, 1999b).

The processing of ore during extraction and concentration generates dust that may escape and be deposited nearby, and produces effluent which may be stored in tailings ponds or treated and released to surface water. The generated dusts, potential leachates from tailings ponds, and effluent releases to surface water are all pathways from which thallium may be released into the surrounding environment.

Mines and mills, even if they do not produce thallium, may release thallium to the environment, since this metal is present in a variety of ores.

The iron ore pelletizing sector has important air emissions related to the use of induration furnaces, which differ from air emissions from traditional mining and ore concentration activities. The large majority of the thallium emitted to air originates from the induration process at the pelletizing plant.

4.3.2 Base metals smelting and refining

Thallium is recovered commercially as a by-product from cadmium refineries and copper, zinc and lead smelters (CCME, 1999a). Base metals smelting and refining facilities produce one or more metals, such as copper, lead, nickel, zinc and cobalt, from feed material that primarily comes from ores. They also produce

intermediate and compound products and other saleable metals, such as precious metals.

The smelting process uses heat and chemical reduction to extract the metal from mined ores. Traces of thallium are found in many mined ores, but primarily ores with zinc, copper or lead deposits (CCME, 1999a). Thallium may be found in intermediate products, residues or main products from the smelting or refining process.

4.3.3 Coal-fired electrical power generation

Thallium is found as a trace element in coal, particularly in sulfide-rich coal deposits. The combustion of coal at coal-fired electrical power generation plants results in thallium being concentrated in the fly-ash.

The deposition of fly ashes and effluent released from ash lagoons from the power generation sector has the potential to release thallium into the environment. However, the assessment indicated that effluents discharged to the surface freshwater from coal-fired power generating facilities are not likely to pose ecological concern.

5. Exposure sources of concern and identified risk

5.1 Anthropogenic releases to the environment

Since 2014, Canadian facilities must annually report releases, disposals, and transfers for recycling of thallium and its compounds to the NPRI if they meet specific requirements.

Anthropogenic releases of thallium to the environment have been identified in the assessment as posing a risk in some sectors, which are identified below.

5.1.1 Metal mining

In 2017, 31 metal ore mining facilities in Canada reported releases, disposal and/or off-site recycling of thallium and its compounds to the NPRI (ECCC, 2019). These facilities reported on-site releases of 161 kg to air, and 31 kg to water. In 2020, metal mine facilities reported total releases of 317 kg to air and 9 kg to water. (ECCC, 2019). It should be noted that “disposal” includes information on the disposal of tailings and waste rock, which tend to be disposed of on-site.

When the MDMER was amended in June 2018, thallium was added to the list of substances to be monitored in effluent and water (reference and exposure areas) under the environmental effects monitoring provisions . Before the amendments, some mines voluntarily reported to ECCC the thallium concentrations in effluent and water along with their other EEM results. EEM reports from 157 metal ore

mining and milling sites (from EEM studies under the MDMER between 2004 and 2020) were reviewed in the assessment, including voluntary information. The assessment indicates that thallium releases from this sector are likely the cause of the elevated thallium levels found near some of the exposure sites compared to reference sites.

For this sector, thallium concentrations in some receiving surface waters near a small number of facilities may exceed the predicted no-effect concentration for aquatic organisms. When updated monitoring data for thallium are available for the sector, further data analysis will be performed to better understand the potential releases from this industrial sector.

5.1.2 Base metals smelting and refining

In 2019, 3 base metals smelters and refineries reported thallium and its compounds to the NPRI (ECCC, 2019). These facilities reported on-site releases of 339 kg to air, 1151 kg to water, while on-site disposal amounted to 14 kg, off-site disposal was 2179 kg and off-site recycling was 547 kg (ECCC, 2019).

At the time of the assessment, six base metals smelting and refining facilities combined their effluents with metal mines. These facilities submitted measured thallium concentrations in surface water and combined effluent under the MDMER (EEM, 2021). Thallium releases from two stand-alone base metals smelting and refining facilities that do not combine their effluent with metal mines were also analyzed. The assessment focused on these eight facilities with available data. As of September 2022, four facilities continued to combine their effluent with metal mines.

Releases varied significantly among facilities, as expected, due to their different processes and products. Predicted and measured data in water in exposure areas of a small number of facilities indicate that effluents from this industrial activity contribute to be a potential risk for thallium exposure.

While the focus of risk management and risk assessment is the releases of thallium to water, the assessment also identified the release of thallium to air from the base metals smelting and refining sector as a potential contributor to thallium in the environment. The Government of Canada plans on reviewing the effectiveness of the risk management actions for thallium and its compounds in the future so as to determine whether human health and/or environmental objectives have been met and whether there is a need to revisit the risk management approach.

6. Risk management considerations

6.1 Alternatives and alternate technologies

For sectors of concern identified in the assessment, it is not expected that alternate process technologies would be a practical approach to minimizing releases of thallium. As the exposures of concern are associated with incidental thallium releases from these industrial sectors, consideration of the use of alternatives is not relevant in these cases.

Additional effluent control technologies (e.g., additional on-site or off-site effluent treatment), process optimization, and recovery of waste metals at the end of the process may be effective approaches for most sectors, as appropriate and economically feasible.

6.2 Socio-economic and technical considerations

Socio-economic factors have been considered in the selection process for a regulation respecting preventive or control actions, and in the development of the risk management objective(s). In addition, socio-economic factors will also be considered in the development of any regulations, instrument(s) or tool(s) to address risk management objective(s), as identified in the *Cabinet Directive on Regulation*(TBS, 2018), Red Tape Reduction Action Plan (TBS, 2012a) and the *Red Tape Reduction Act* (Canada, 2015a).

7. Overview of existing risk management

7.1 Related canadian risk management context

7.1.1 Metals mines

The existing risk management instrument for thallium in effluent discharged from the metal mining sector is the *Metal and Diamond Mining Effluent Regulations* (MDMER) under the *Fisheries Act* (Canada, 2018a).

The MDMER authorizes the deposit of certain deleterious substances into waters frequented by fish within regulated limits. Thallium is not listed in Schedule 4 (prescribes effluent limits for certain deleterious substances). However, as part of amendments to the MDMER that came into force on June 1, 2018, thallium is listed in Schedule 5 (prescribes environmental effects monitoring studies) and is measured as part of the effluent characterization and water quality monitoring for the MDMER environmental effects monitoring provisions.

You can find complete details on the MDMER here.

In 2009, Environment Canada published the *Environmental Code of Practice for Metal Mines*, made pursuant to subsection 54(4) of CEPA, to support the MDMER and to include other subjects that are not dealt with in the MDMER, which may have an influence on the environmental impact of mining operations.

The objective of the code is to identify and promote recommended best practices to facilitate and encourage continual improvement in the environmental performance of mining facilities throughout the mine life cycle (ECCC, 2009).

Provinces and territories may have established effluent limits for metal mines, either by regulations, permits, licenses, or certificates of approval.

Iron ore pelletizing facilities in Canada were subject to air emissions requirements set under an environmental performance agreement signed in 2018 under the initiatives of the Air Quality Management System. The agreement includes release limits for PM 2.5, which contain metals emitted to air, including thallium.

7.1.2 Base metal smelting and refining

Atmospheric emissions from primary and secondary copper smelters and refineries and primary and secondary zinc smelters and refineries were assessed under the *Priority Substances List* (2) assessment program and concluded to be toxic under CEPA (ECCC, HC, 2001).

Base metals smelting and refining facilities were subject to a Pollution Prevention Planning Notice published in 2006 that was fully implemented in December 2018. The notice included 2008 and 2015 annual release targets for PM, which contains most of the metals emitted to air, including thallium. The notice required facilities to take into consideration a number of factors including the Environmental Code of Practice for Base Metals Smelters and Refineries, which recommends PM emission limits to air and effluent limits for chemical parameters and certain metals (ECCC, 2006).

The base metals smelting and refining facilities subject to the notice reduced PM releases by a total of 52% between 2005 and 2015.

In May 2016, as part of a diverse set of base-level industrial emission requirements (BLIERs), ECCC published five company-specific performance agreements for the base metals smelting sector (ECCC, 2019). These performance agreements include annual reporting of data on particulate matter emission intensity, collected every year between 2017 and 2025. As a result of the implementation of the BLIERs through performance agreements, it is expected that PM emissions will be further reduced from that of 2015 levels. Since most metals from these facilities are discharged to the atmosphere as PM emissions, it is anticipated that emissions of metals, including thallium, would also be reduced as a co-benefit of PM emission reductions. While thallium is not specifically monitored in the emissions or in the environment as part of the BLIERs program, it is expected that thallium reductions will be reflected in the annual emissions data reported by smelters and refineries to the NPRI.

7.1.3 Other national actions

The Canadian Council of Ministers of the Environment (CCME) has a recommended Canadian water quality guideline (CWQG) for protection of aquatic life for thallium of 0.8 µg/L (CCME, 2008) and a Canadian soil quality guideline of 1 mg/kg. These non-regulatory guidelines often set the basis on which many Canadian provincial, territorial, and municipal regulations, guidelines and standards are formed, though further research and data is required if limits are to be implemented instead.

On July 12, 2014, Environment Canada added thallium and its compounds to the *NPRI* Substance List at an alternate reporting threshold of 100 kg manufactured, processed or otherwise used (MPO), as well as a concentration threshold of 1%. This is due to the fact that thallium is mainly a by-product released by industries, such as metal mines and smelters, coal-fired power plants, and cement manufacturers using coal as fuel. Alternate thresholds are considered when the nature of the substance is such that small releases may be of more significance locally or regionally compared to on a national basis. For Thallium, the lower threshold ensures better coverage of the major industrial facilities, and encourages industries to take voluntary action while tracking the progress in reducing thallium releases, improve public understanding and identify priorities for action (ECCC, 2015c; ECCC, 2015d; ECCC, 2015d).

7.1.4 Provincial and territorial

The following provinces have CWQG standards for thallium: British Columbia, Alberta, Saskatchewan, Manitoba, and New Brunswick (Government of Alberta: Environment and Parks, 2014; Saskatchewan Environment, 2006; Government of Manitoba, 2011; Government of British Columbia, 2015; ECCC, 2015a). However, no provincial or territorial guidelines for thallium could be found for Newfoundland and Labrador, Prince Edward Island, the Northwest Territories, Nunavut, and the Yukon Territory.

British Columbia refers to the 2007 version of the CCME CWQG to form both water quality guidelines and working water quality guidelines for freshwater aquatic life at 0.8 µg/L, though the working water quality objective is site-specific to the lower Columbia River based on a 30-day average concentration (ECCC, 2015a), (BC MoECCS, 2017). The concentration dictates the level that should not be exceeded by the average value from 5 or more samples collected at similar time intervals within the 30-day frame. The ambient water quality objective for the river was developed to protect designated wildlife, aquatic life, livestock, irrigation and primary-contact recreation (BC MoECCS, 2000).

Ontario's *Interim Provincial Water Quality Objectives* provides a protection value for thallium of 0.3 /µg/L to ensure that the ambient surface water quality is acceptable for aquatic life and recreation (MoEE, 1994). This value may change

as there is insufficient toxicological information to provide an actual provincial water quality objective.

Nova Scotia does not have any water quality guidelines for thallium or thallium-containing substances; even so, the province recognizes thallium as a potential substance of concern. Therefore, to abide with *Contaminated Sites Regulations*, the fresh water pathway specific standard for surface water is 0.8 /µg/L in specific contaminated sites (Nova Scotia Environment, 2014).

7.2 International risk management context

Thallium and its compounds are listed in Annex 1 of the *Basel Convention on the Control Transboundary Movements of Hazardous Wastes and their Disposal*, an international treaty designed to reduce the movements of hazardous waste between parties.

7.2.1 United States – statutes

There are a number of thallium compounds that appear on various United States (US) environmental statute lists.

The *Federal Water Pollution Control Act*, also known as the *Clean Water Act* (CWA), promotes national goals and policies to protect, reduce and eliminate pollutants by setting the surface water quality standards as well as the discharge limits and/or regulations for pollutants in waters in order to maintain and re-establish its biology, chemistry, and physicality. Section 311(b)(2)(A) of CWA requires the United States Environmental Protection Agency (US EPA) to compile a list of hazardous substances which, when discharged to navigable waters of adjoining shorelines, present an imminent and substantial danger to the public health or welfare. This includes danger to fish, shellfish, wildlife and beaches. Thallium (I) sulfate (CAS RNs 7446-18-6 and 10031-59-1) is on the CWA *List of Hazardous Substances* (US EPA, 2019).

In addition, the CWA includes *Thallium and compounds* on its toxic pollutant list and *Thallium* on its priority pollutant list. Under this Act, the EPA developed the water quality criteria and standards, Effluent Guidelines, and the National Pollutant Discharge Elimination System (NPDES) permit requirements in order to address the problems of these pollutants in waterways.

The Effluent Guidelines, developed under CWA, are national wastewater discharge standards, based on an industry-by-industry basis. These include the Mineral Mining and Processing Effluent Guidelines and the Nonferrous Metals Manufacturing Effluent Guidelines (smelting). These are technology-based regulations intended to represent the greatest pollutant reductions that are economically achievable for an industry. The regulations require facilities to

achieve the regulatory standards which were developed based on a particular model technology.

The NPDES permit program addresses water pollution by regulating point sources that discharge pollutants to waters of the Unites States by prohibiting the discharing of "pollutants" through a "point source" into a "water of the United States" unless they have an NPDES permit. The permit contain limits on what can be discharged, monitoring and reporting requirements, and other provisions to ensure that the discharge does not hurt water quality or people's health. In essence, the permit translates general requirements of the Clean Water Act into specific provisions tailored to the operations of each person discharging pollutants.

Title III of the *Superfund Amendments and Reauthorization Act* of 1986 (SARA), also known as the *Emergency Planning and Community Right-to-Know Act* of 1986 (EPCRA), establishes a program designed to encourage state and local planning and preparedness for spills and releases of extremely hazardous substances (EHS). Under Section 302 of SARA, the US EPA developed a list of extremely hazardous substances and established threshold planning quantities (TPQs) for each of these substances. Facilities that have present an EHS in excess of its TPQ must notify its state emergency response commission and participate, as necessary, with the local emergency planning committee in the local emergency planning process. Thallium(I) carbonate (CAS RN 6533-73-9), thallium(I) chloride (CAS RN 771-12-0) and thallium(I) sulfate (CAS RN 7446-18-6) are on the EHS list.

7.2.2 United States – individual states

Numerous states provide different criteria for thallium and its compounds regarding their priorities for surface waters. The State of Florida has a surface water quality criterion applicable to non-mixing zones. The following classes listed in increasing order reflect the least degree of protection necessary, while the limited classes contain specific values for parameters such as alkalinity and pH. Thallium (CAS RN N/A): Class II: <6.3 µg/L, Class III and Class III-Limited (Fresh waters <6.3 µg/L and marine waters <6.3 µg/L) (US EPA, 2015b; US EPA, 2015a).

Table 1: State of Florida Surface Water Classifications

Class	Description
Class II	Shellfish Propagation or Harvesting
Class III	Fish Consumption; Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife
Class III-Limited	Fish Consumption; Recreation or Limited Recreation; and/or Propagation and Maintenance of a Limited Population of Fish and Wildlife

For the State of Illinois, thallium (CAS RN 7440-28-0) has general use aquatic life criteria of 86 µg/L(acute) and 11 µg/L(chronic), as well as a criteria for Lake Michigan of 54 µg/L(acute) and 15 µg/L(chronic). The acute criterion cannot be exceeded at any time, whereas the chronic criterion cannot be exceeded by an arithmetic average of at least four consecutive samples collected over at least a time frame of four days (Illinois Environmental Protection Agency, 2013).

The State of Massachusetts has deemed 11 thallium compounds as seen in the *Toxics Use Reduction Act* to no longer be on the *Toxic or Hazardous Substance List*. Yet they are still subject to reporting as defined in Section 313 of the EPCRA (Commonwealth of Massachusetts, 2013).

7.2.3 European Union – statutes

Under the *Classification, Labelling and Packaging Regulation* (CLRP), a list of harmonized classification and labelling of hazardous substances can be found for thallium and its compounds (ECHA, 2008). The Regulation was enacted to protect workers, consumers, and the environment from hazardous chemicals. Under the Regulation, thallium compounds are considered toxic to aquatic life with long lasting effects and may cause damage to organs through prolonged or repeated exposure.

As part of the *Registration, Evaluation, Authorisation and Restriction of Chemicals* (REACH) regulation, thallium and its compounds are not listed on the *List of Restrictions* or the *Candidate List of Substance of Very High Concern for Authorisation*. Thus, no recommendations have been considered for the addition of thallium and its compounds to the *Authorisation List.* This indicates that these substances are permitted to be used within the European market as there may not be a high concern for human health and/or the environment (ECHA, 2018).

8. Next steps

8.1 Public comment period

Interested stakeholders are invited to submit comments on the content of this document or other information that would help to inform decision-making (such as outlined in sections 3.2 or 3.3). Please submit additional information and comments prior to May 29, 2024.

Comments and information submissions on the risk management approach should be submitted to the address provided below:

Substances Management Information Line
Chemicals Management Plan

Environment and Climate Change Canada
Gatineau, Québec K1A 0H3
Telephone: 1-800-567-1999 (in Canada) or 819-938-3232
Fax: 819-938-3231
Email: substances@ec.gc.ca

Companies who have a business interest in thallium and its compounds are encouraged to identify themselves as stakeholders. The stakeholders will be informed of future decisions regarding thallium and may be contacted for further information.

Stakeholders and members of the public who are interested in being notified of CMP publications are invited to subscribe for the latest news on the CMP. Stakeholders and member of the public who would like to receive CMP Publication Plans on a quarterly basis by email, can contact: substances@ec.gc.ca.

Following the public comment period on the risk management approach, the Government of Canada will further work on addressing the risks posed by thallium and its compounds where necessary, and comments received on the risk management approach will be taken into consideration.

8.2 Timing of actions

Electronic consultation on the risk management approach: March 30, 2024 to May 29, 2024.

Submission of additional studies or information on thallium: on or before May 29, 2024.

Publication of responses to public comments on the risk management approach: on or before the publication of the proposed instrument(s).

Publication of the proposed instrument(s), if required: at the latest, 24 months from the publication of the assessment.

Consultation on the proposed instrument(s), if required: 60-day public comment period starting upon publication of each proposed instrument(s).

Publication of the final instrument(s). if required: at the latest, 18 months from the publication of each proposed instrument(s).

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