Government of Canada Gouvernement du Canada

Risk Management Scope

for

Copper and its compounds

Environment Canada

Health Canada

May 2019

Canada

Summary of proposed risk management

This document outlines the proposed risk management options under consideration for copper and its compounds (referred to as copper throughout this document), which has been proposed to be harmful to the environment.

In particular, the Government of Canada is considering measures to manage anthropogenic releases of copper to water from the following sectors or activities:

> **1. Metal mining:** by applying the updated copper effluent limits (which will come into force in 2021) in the *Metal and Diamond Mining Effluent Regulations* (MDMER) and reviewing information received from regulated mines in response to environmental effects monitoring requirements under these regulations to determine if additional regulatory or non-regulatory risk management is appropriate.
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> **2. Base metals smelting and refining**: by addressing facilities that combine their effluent with metal mining operations through the MDMER, using the same approach as described above for metal mining. For facilities which do not combine effluent with metal mines, by working with industry to gather additional data on copper concentrations as described below.
>
> **3. Publicly-owned wastewater treatment systems**: by considering the effect of the *Wastewater Systems Effluent Regulations* on levels of copper in effluent to determine if additional risk management is required.

Interested stakeholders are invited to provide the following information to help in refining ECCC's proposed ecological risk management activities:

- Concentrations of copper in effluents, receiving environments, and reference areas for surface waters (preferably dissolved concentrations) and sediments;
- Measurements of dissolved organic carbon (DOC), pH, total hardness, and temperature related to these dissolved concentrations of copper;
- Uses of copper-containing substances in wastewater treatment processes.

In particular, metal mines, base metal smelters and refineries (that do or do not combine their effluent with that of metal mines), as well as publically owned wastewater treatment stystems, are invited to provide the above additional information.

This information should be provided on or before July 17, 2019, to the contact identified in Section 8 of this document.

Under the third phase of the Chemicals Management Plan (CMP), Environment and Climate Change Canada (ECCC) and Health Canada (HC) are conducting assessments of a variety of metals that may also identify metal mines and base metals smelting and refining facilities as sources of risk. ECCC is considering the risk management actions for copper as part of a more comprehensive strategy to manage the metals assessed as toxic under the third phase of the CMP. Implementation of this strategy would begin in 2023, when all risk assessments and risk management approaches for these metals will have been completed and published. This strategy will be 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) over a five year period, for metals assessed and found to be toxic.

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

Table of Contents

1. Context

The *Canadian Environmental Protection Act, 1999* (CEPA) (Government of 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[1,2], and if so to manage the associated risks.

As part of the third phase of the Chemicals Management Plan (CMP), the ministers plan to assess and manage, where appropriate, the potential health and ecological risks associated with approximately 1550 substances (Government of Canada, 2016) (ECCC, HC, 2017).

The Minister of the Environment and the Minister of Health have conducted a screening assessment of copper and its compounds (referred to as copper throughout this document). Twenty-six of these substances were identified as priorities for assessment as they met categorization criteria under subsection 73(1) of CEPA, and are listed in Annex A. Another 11 additional substances were considered following prioritization on the Revised In-Commerce List. The draft screening assessment focuses on the copper moiety and therefore considers copper in its elemental form, copper-containing substances and copper released in dissolved, solid or particulate form. As such, it is not limited to consideration of the 37 substances identified as priorities for assessment.

2. Issue

Environment and Climate Change Canada (ECCC) and Health Canada (HC) conducted a joint scientific assessment relevant to the evaluation of copper and its compounds in Canada. A notice summarizing the scientific considerations of the draft Screening Assessment Report for these substances was published in the *Canada Gazette*, Part I, on [May 18, 2019] (Canada 2019). For further information on the draft Screening Assessment Report for Copper and its

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[1] 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.*

[2] 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.

Compounds, refer to the Draft Screening Assessment Report for Copper and its Compounds.

2.1 Draft screening assessment report conclusion

On the basis of the information available, the draft Screening Assessment Report proposes that copper 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 (Canada 2019).

The draft Screening Assessment Report also proposes that copper meets the criteria for persistence, but does not meet the criteria for bioaccumulation, as defined in the *Persistence and Bioaccumulation Regulations* made under CEPA (Government of Canada, 2000)

The ecological risks of concern, identified in the draft Screening Assessment Report, are primarily based on the potential release of copper to water from some facilities engaged in metal mining, base metals smelting and refining, and publicly-owned wastewater treatment. As such, this document will focus on these activities and exposure sources of concern (refer to section 5.2).

2.2 Proposed recommendation under CEPA

On the basis of the findings of the draft screening assessment conducted as per CEPA, the Ministers propose to recommend that copper and its compounds be added to the List of Toxic Substances in Schedule 1 of the Act .

The Ministers will take into consideration comments made by stakeholders during the 60-day public comment period on the draft Screening Assessment Report and Risk Management Scope document. If the Ministers finalize the recommendation to add copper and its compounds to Schedule 1, a risk management instrument must be proposed and finalized within a set period of time, as outlined in sections 91 and 92 of CEPA (refer to section 8 for publication timelines applicable to this group of substances).

3. Proposed risk management

3.1 Proposed environmental objective

The proposed environmental objective is a quantitative or qualitative statement of what should be achieved to address environmental concerns.

The proposed environmental objective for copper is to reduce the anthropogenic releases of copper to water so as not to exceed levels that cause 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.

In this case, the proposed risk management objective for copper and its compounds is to achieve the lowest level of releases of copper to water that is technically and economically feasible, taking into consideration socio-economic factors and natural background concentrations.

This objective will be refined if needed based on consultation with stakeholders, the proposed risk management options, consideration of further information received, the outcome of the final Screening Assessment Report, and socio-economic and technical considerations.

The final environmental risk management objective will be presented in the Risk Management Approach document that will be published concurrently with the final Screening Assessment Report for these substances.

3.3 Proposed risk management options under consideration

To achieve the proposed risk management objective and to work towards achieving the proposed environmental objective, the risk management options under consideration for copper and its compounds will focus on reducing releases of copper to surface freshwaters from the sectors of concern identified in the draft Screening Assessment – metal mining, base metals smelting and refining, and publicly-owned waste water treatment systems. These proposed actions are described below.

Note that the proposed risk management options, 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[3], if required. The risk management options outlined in this document may also evolve through consideration of assessments and risk management options published for other CMP substances to ensure effective, coordinated, and consistent risk management decision-making.

[3] The proposed risk management regulation(s), instrument(s) or tool(s) will be 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 Regulatory Management (TBS 2012a), the Red Tape Reduction Action Plan (TBS 2012b), and in the case of a regulation the *Red Tape Reduction Act* (Canada, 2015).

3.3.1 Metal Mining

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

The MDMER prescribe maximum authorized monthly mean concentrations in effluent for a list of deleterious substances, including a maximum authorized monthly mean effluent concentration of 0.30 mg/L of total copper for existing mines and a lower limit of 0.10 mg/L of total copper for mines that become subject to the Regulations on or after June 1, 2021.

Under the third phase of the Chemicals Management Plan (CMP), ECCC and HC are conducting assessments of 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 MDMER to determine if additional regulatory or non-regulatory risk management of effluents from metal mines is needed for one or more assessed metals.

ECCC is considering the RM actions for copper as part of a more comprehensive strategy to manage the metals assessed as toxic under CMP3. Implementation of this strategy would begin in 2023, when all risk assessments and risk management approaches for these metals will have been completed and published. Risk management will focus on managing all CEPA toxic metals in effluents, rather than managing single metals. This strategy will reduce the administrative burden on metal mines 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

Facilities within the base metals smelting and refining sector vary significantly due to their different feedstocks, processes and products. It is therefore expected that these facilities would have varying levels of copper in their effluent, ranging from insignificant to potentially high enough to be of concern. The MDMER applies to 6 out of the 12 existing smelters and refineries because they combine their effluent with that of metal mining effluent. For those facilities ECCC would apply the same RM approach as decribed for metal mining.

For the remaining six facilities that do not combine their effluent with metal mines, Environment and Climate Change Canada is proposing to work with these facilities to gather additional data on their effluent copper concentrations, as well as concentrations in the receiving environment(s) and reference area(s) for surface waters and sediment. This will allow ECCC to determine what risk management measures should be developed, if any, for these facilities.

3.3.3 Publicly-owned wastewater treatment systems (WWTS)

Results of Chemical Management Plan Environmental Monitoring and Surveillance Program data from 2009-2012 indicate that copper is consistently present in WWTS effluents across Canada and therefore released into the aquatic environment. Predicted environmental concentrations (modeled from effluent concentrations and background median concentrations) suggest that concentrations of copper in the receiving environment of WWTSs are exceeding the Federal Water Quality Guideline for copper (ECCC 2019), despite evidence of some incidental removal during the treatment process (ECCC, 2013c). The data used in the assessment represent a small sample of the numerous publicly owned wastewater treatment plants in Canada. The copper in WWTS effluent is expected to originate from upstream consumer uses (such as copper piping and plumbing fixtures) or industrial uses. However, chemicals containing copper could also be used within the wastewater treatment process.

In 2012, Environment Canada published the *Wastewater Systems Effluent Regulations* (WSER), which set standards, achievable through secondary wastewater treatment, for the quality of effluent discharged from wastewater treatment facilities (Government of Canada, 2012) As wastewater systems with no treatment or primary treatment will be upgraded to achieve the standards of these regulations, a reduction in copper releases to the environment is anticipated over time. It is expected that copper released via wastewater effluent from upstream sources, such as various industries that send their effluent to publicly owned wastewater treatment facilities, domestic and industrial use of copper water piping, and the consumer use of products containing copper that are washed down the drain, will be addressed by the regulations.

If actions are deemed necessary to address an identified risk following a review of the effect of the WSER on effluent quality, Environment and Climate Change Canada will prioritize measures that aim to reduce copper releases from the original emitter(s).

3.3.4 Other initiatives

The Government of Canada has published the Federal Water Quality Guideline (FWQG) for copper using the Biotic Ligand Model (BLM) (ECCC 2019). FWQGs provide benchmarks for the quality of the ambient environment and serve three functions: first, they can be an aid to prevent pollution by providing targets for acceptable environmental quality; second, they can assist in evaluating the significance of concentrations of chemical substances currently found in the environment (monitoring of water, sediment and biological tissue); and third, they can serve as performance measures of the success of risk management activities.

The FWQG for copper was developed following the Canadian Council of Ministers of the Environment protocol (CCME, 2007) and will update the 1987 CCME guideline for copper (CCME, 1987). FWQGs are similar to CCME guidelines in that they set benchmarks for the quality of the ambient environment and are based solely on toxicological effects data. Both FWQGs and CCME guidelines are widely recognized reference tools for environmental monitoring and management. In practice, they are often referenced in environmental assessments and used to establish conditions in permits.

3.4 Risk management information gaps

Interested stakeholders are invited to provide further information, as outlined below, to help in refining ECCC's proposed risk management:

- Metal mining
    - In the receiving environment and reference areas:
        - Dissolved or total concentrations of copper in surface waters and corresponding measurements of DOC, pH, total hardness, and temperature.
- Base metal smelting and refining
    - In the receiving environment and reference areas:
        - Dissolved or total concentrations of copper in surface waters and corresponding measurements of DOC, pH, total hardness, and temperature;
        - Concentrations of copper in sediments.
- Wastewater treatment
    - Concentrations of copper (dissolved preferably, or total) in publicly-owned wastewater treatment system effluent;
    - Uses of copper-containing substances in wastewater treatment processes.

Stakeholders are requested to provide further information to help address these gaps on or before July 17, 2019 to the contact identified in section 8 of this document.

4. Background

4.1 General information on copper and its compounds

Copper is a naturally occurring element in the terrestrial crust. It exists naturally in its elemental (metallic) form, in many minerals including chalcopyrite ($CuFeS_2$)

and malachite ($Cu_2CO_3(OH)_2$) and in many compounds (Reimann & de Caritat, 1998). Copper is an essential element necessary for optimal growth and development of micro-organisms, plants, animals, and humans. It is involved in numerous physiological and enzymatic processes in animals. Copper deficiency has been observed in fish, crops, and farm animals (WHO, 1998).

4.2 Current uses and identified sectors

Globally, the main uses for copper are in the manufacture of equipment (31%), building construction (30%), infrastructure (15%), industrial (12%) and transportation (12%) (NRCan, 2018). It is also combined with zinc to make brass.

In Canada, the major uses of copper compounds and the sectors where use occurs were identified from the 2011 Phase 2 Domestic Substances List Inventory Update, which looked at substances in commerce (ECCC, 2013b). Activities or uses reported for copper substances having the highest quantities in commerce are: incidental production as a by-product; laboratory substances; paint additives and coating additives; pigments and pest control substances. Other activities or uses were reported in quantities in the order of a few tens of tonnes such as; adhesives and sealant substances; processing aids, specific to petroleum production and agricultural substances (non-pesticidal) (ECCC, 2013a).

According to the International Copper Study Group (ICSG, 2017), elemental copper (not surveyed) is shipped to fabricators mainly as cathode, wire rod, billet, cake (slab) or ingot. Through extrusion, drawing, rolling, forging, melting, electrolysis or atomization, fabricators form wire, rod, tube, sheet, plate, strip, castings, powder and other shapes. Copper is used in a wide variety of sectors including the electrical industry (cables and wires), water piping, roofing, pigments/dyes, alloys, coins, algaecide, bactericide molluscicide, fungicide and insecticide (Reimann & de Caritat, 1998) (Nordberg, Fowler, & Nordberg, 2015) (CDA, 2018). As well, many emerging and clean technologies such as solar cells and electric vehicles use copper (NRCan, 2018).

4.2.1 Metal mining

In 2016, Canada was the tenth world producer of copper ore and concentrates from mines (ICSG, 2017), with a production of 707 605 tonnes (t) of copper (NRCan, 2018). Copper ore was mined in the following provinces and territories in 2016 (from highest to lowest quantities): British Columbia, Ontario, Manitoba, Quebec, Newfoundland and Labrador, and Yukon (NRCan, 2018). Canada exported 475 500 tonnes of copper concentrate in 2016.

4.2.2 Base metals smelting and refining

The base metals smelting and refining (BMS) sector processes concentrates from metal mines and mills as well as recycled materials to recover and purify metals, including copper (ECCC, 2017a). Canada ranked twelfth in the world for copper production from smelters (approx. 340 900 t) and eighteenth in the world for refined copper products from refineries (approx. 304 300 t) (i.e., elemental copper and copper compounds) in 2016 (ICSG, 2017). Canada exported 224 700 tonnes of refined copper in 2016 (NRCan, 2018).

4.2.3 Publicly owned wastewater treatment systems

Effluent from wastewater treatment systems (WWTS) may contain copper despite undergoing wastewater treatment. Although some chemicals containing copper may be used in some wastewater treatment processes, the main sources of copper in WWTS effluent originates from consumer or industrial uses upstream of the WWTS and from rainwater runoff (i.e. brake pad wear) in combined sewer systems (CDA, 2017). In addition, most drinking water produced runs through copper pipes inside residences and other buildings before it ends up at WWTS.

4.2.4 Other uses and sectors

Copper and its compounds are used or found incidentally, due to their natural occurrence, in a variety of other sectors. The draft Screening Assessment identified the following sectors for which information on environmental or effluent concentrations was readily available: pulp, paper, and paperboard mills; electric power generation (from coal); landfill leachates; oil sands mining; traffic (essentially from brake pad wear); and use of fertilizers in agriculture. Agriculture and traffic activities are of particular importance since large and widespread copper quantities are released (ECHA, 2008) However, risks were not identified from these uses or from the releases from these activities.

5. Exposure sources and identified risks

5.1 Natural sources

Copper (symbol: Cu) is a naturally occurring element in the terrestrial crust. In some areas of Canada which are not impacted by anthropogenic activities, background concentrations of copper may be naturally elevated. Copper concentrations in the upper continental crust have been determined to average about 22 mg/kg and to range between 2 and 90 mg/kg (Reimann & de Caritat, 1998) (Rauch & Pacyna, 2009).Copper exists naturally in its elemental (metallic) form and in many minerals. Copper can be found in sulfide deposits (e.g. as chalcopyrite), in carbonate deposits (e.g. as azurite), in silicate deposits (e.g. as chrysycolla) and as elemental copper (ICSG, 2017) .

Global natural emissions to the atmosphere have been estimated to range between 2 300 and 54 000 tonnes of copper per year, with a median of 28 000 tonnes (Nriagu, 1989). Sources include windblown dust, volcanoes, biogenic (e.g. decaying vegetation), forest fires and sea spray (Nriagu, 1989). Atmospheric deposition and introduction of copper into surface water and soil as a result of these natural processes are reflected in the geochemical background levels in these media.

Naturally occurring background levels of copper were identified in the draft Screening Assessment Report and were taken into consideration when estimating the exposure of ecological receptors to copper-containing substances.

5.2 Anthropogenic releases to the environment

Anthropogenic releases of copper and its compounds to the environment have been identified in the draft screening assessment as posing a risk in some sectors, which are identified below, particularly when released directly to the aquatic environment.

5.2.1 Metal mining

Copper is mined in Canada and ore may be extracted from underground or above ground mines (Rauch & Pacyna, 2009). 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 leachate from tailings ponds, and effluent releases to surface water are all pathways from which copper may be released into the surrounding environment (Rashed, 2010).

In 2016, 86 mining facilities in Canada reported releases, disposal and/or off-site recycling of copper and its compounds to the National Pollutant Release Inventory (NPRI). A total of 49 tonnes were released on-site to air, 5.3 tonnes were released to water and 4.2 tonnes were released to land. A total of 102 622 tonnes were disposed on site and 14 tonnes were recycled off-site (ECCC, 2016). It should be noted that “disposal” includes the disposal of tailings and waste rock, which tend to be disposed on-site.

Data presented in the draft Screening Assessment Report, pulled from provincial environmental monitoring databases and from metal scans submitted under the Environmental Effects Monitoring requirements of the MDMER, indicate that copper releases from this sector are likely the cause of the elevated copper levels found near these sites (ECCC, 2017b).

For this sector, dissolved copper concentrations in water bodies and total copper concentrations in sediment and soils near sources of releases may exceed estimated no-effect levels for aquatic organisms, sediment-dwelling organisms and terrestrial organisms.

5.2.2 Base metals smelting and refining

In 2016,12 smelters and refineries reported releases, disposal and/or off-site recycling of copper and its compounds to the NPRI. A total of 94 tonnes were released to air, 0.24 tonnes were released to water and 53 tonnes were disposed off-site. A total of 6 051 tonnes were recycled off-site (ECCC, 2016). Note that this represents all copper releases to the environment from facilities meeting NPRI reporting criteria, even if they are not a primary or secondary producer of copper.

While the focus of risk management will be the release of copper to water, the draft Screening Assessment Report also identifies the release of copper to air from the base metals smelting and refining sector as a potentially significant contributor to copper levels in environmental media.

Releases varied significantly among facilities, as expected, due to their different processes and products. Modelled data of releases to water and measured data in water, sediment and soil indicate that releases from this industrial activity may contribute to the elevated levels of copper found near base metal smelters and refineries.

5.2.3 Publicly owned wastewater treatment systems

In 2016, 12 wastewater treatment facilities in Canada reported releases, disposal and/or off-site recycling of copper and its compounds to the NPRI. A total of 24 tonnes were released on site to water and 123 tonnes were disposed off-site. A total of 15 tonnes were recycled off-site (ECCC, 2016).

According to the draft screening assessment report, effluents from some waste water treatment plants may contribute to elevated levels of copper in their surroundings.

6. Risk management considerations

6.1 Alternatives and alternate technologies

For sectors of concern identified in the draft screening assessment report, it is not expected that chemical alternatives or alternate process technologies would be a practical approach to minimizing releases of copper and its compounds.

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 will be considered in the selection process for a regulation or instrument respecting preventive or control actions, and in the development of the risk management objective(s). Socio-economic factors will also be considered in the development of regulations, instrument(s) or tool(s) as identified in the *Cabinet Directive on Regulation* (TBS, 2018) and the guidance provided in the Treasury Board document *Assessing, Selecting, and Implementing Instruments for Government Action* (TBS, 2007).

7. Overview of existing risk management

7.1 Related Canadian risk management context

7.1.1 Metal mines

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

The MDMER prescribe maximum concentration limits in effluent for certain harmful substances including for total copper at 0.30 mg/L(monthly mean) for existing mines and a lower limit of 0.10 mg/L (monthly mean) for mines that become subject to the Regulations on or after June 1, 2021. MDMER also require environmental effects monitoring (EEM) to identify potential effects caused by effluents on fish, fish habitat and use by humans of fish. EEM is a science-based performance measurement tool used to evaluate the adequacy of effluent regulation. EEM studies include: water quality monitoring; effluent chemical characterization; effluent sublethal toxicity testing; and, biological monitoring in the receiving environment.

For complete details, please refer to the MDMER (Government of Canada, 2018).In 2009, Environment Canada published the Environmental Code of Practice for Metal Mines, according to subsection 54(4) of CEPA, to support the previous *Metal Mining Effluent Regulations* (MMER) and to include other subjects that were not dealt with in the MMER, 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. The limits are generally the same as those in the MMER, but may be more stringent to address site-specific or jurisdiction-specific circumstances.

7.1.2 Base metals smelters and refineries

Atmospheric emissions from smelters and refineries were assessed under the Priority Substances List 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. The Notice includes release targets for particulate matter, which contains most of the metals emitted to air, including copper. The Notice requires facilities to take into consideration a number of factors including the Environmental Code of Practice for Base Metals Smelters and Refineries, which recommends particulate matter emission limits to air and effluent limits for chemical parameters and certain metals including copper. The Code of Practice lists an effluent limit for copper at a maximum monthly mean concentration of 0.3 mg /L. In addition, the Code of Practice recommends that each facility design and operate effluent discharge systems, taking local conditions into account to obtain a maximum ambient water quality objective of 2-4 µg/L for total copper (ECCC, 2006).

The base metals smelting and refining facilities subject to the notice reduced particulate matter releases by a total of 50% between 2005 and 2015 (ECCC, 2017a).

As a result of the implementation of the Base-Level Industrial Emission Requirements (BLIERs) through performance agreements, it is expected that particulate matter emissions will be further reduced from 2015 levels. Since most metals from these facilities are discharged to the atmosphere as particulate matter emissions, it is anticipated that emissions of metals, including copper, would also be reduced as a co-benefit of particulate matter emission reductions. While copper is not specifically monitored in the emissions or in the environment as part of the BLIERs program, it is expected that copper reductions will be reflected in the annual emissions data reported by smelters and refineries to the National Pollutant Release Inventory (NPRI).

7.1.3 Publicly owned wastewater treatment systems

The *Wastewater Systems Effluent Regulations*, established under the *Fisheries Act*, include mandatory minimum effluent quality standards that can be achieved through secondary wastewater treatment (Government of Canada, 2012). Although the regulations do not directly target copper, the requirement for additional treatment at some publicly owned wastewater systems (WWTS) is expected to generate co-benefits for industrial sectors that send their effluent to a publicly owned WWTS, as additional levels of treatment (e.g., secondary treatment) have been shown to further reduce the quantities of copper released.

7.1.4 Federal, provincial and territorial water quality guidelines

Established in 1987 by the CCME, the *Canadian Water Quality Guideline*(CWQG) for the protection of freshwater aquatic life lists maximum concentrations for total copper from 2 µg/L to 4 µg/L depending on the water hardness (CCME, 1987). The Government of Canada is updating the FWQG for copper and plans to publish it in 2019 (ECCC 2019). This updated FWQG was used to generate predicted no-effect concentrations (PNECs) in the draft screening assessment of copper and its compounds.

While some provinces have implemented guidelines and standards more specific than that of the CCME, Alberta, British Columbia, Manitoba, New Brunswick, Newfoundland, Nova Scotia, Prince Edward Island, Quebec, Saskatchewan, Northwest Territories, Nunavut and Yukon have guidelines derived from the CCME's equations (BWP Consulting, 2001; Stats Can, 2008). The provinces of Alberta and Manitoba have other gidelines that apply to the sites monitored under a provincial monitoring program. In Alberta, the provincial guideline for surface water for long-term exposure is 7 µg/L of total copper for a hardness of ≥50 mg/L, and in Manitoba the provincial guideline is $0.96e^{0.8545*\ln(\text{hardness})-1.702}$ µg/L of total extractible copper (ECCC, 2018). In Ontario, the interim provincial water quality guidelines for copper are 1 µg/L total unfiltered copper for a hardness of 0-20 mg/L, and 5 µg/L for a hardness of >20 mg/L (MoEE, 1994).

7.1.5 Municipalities

The largest cities in Canada all have limits in place for copper releases to wastewater collection systems. In Toronto, many programs cite the provincial water quality guidelines for copper as the limit they use. However, there are city by-laws that limit the concentration of total copper that can be discharged to the wastewater collection system to 2000 µg/L, and the concentration of total copper in discharges to storm sewers to 40 µg/L (City of Toronto, 2010). In Montreal, the total copper level must be below 3000 µg/L for discharge into the wastewater collection system and below 1000 µg/L for discharge into storm sewers or natural waterways (Communauté Métropolitaine de Montréal, 2012). In Vancouver, there is a concentration limit of 2000 µg/L for copper discharges to the wastewater collection system (Metro Vancouver, 2007). Vancouver also has water quality objectives for the Burrard Inlet. The maximum concentration objective is 3 µg/L, while the average concentration objective is 2 µg/L (Phippen, 2001). The regional municipality of Halifax sets a maximum total copper concentration of 1000 µg/L in discharges to wastewater collection or treatment systems (Halifax Regional Municipality, 2001). Halifax has a Harbour Water Quality Monitoring program that uses a guideline of 2.9 µg/L (AMEC Earth & Environmental, 2011).

7.2 Pertinent international risk management context

7.2.1 United States - statutes

Over 586 copper compounds are regulated in the USA under different statues, with legal requirements ranging from reporting and notifications to restrictions. Of relevance to water releases is the *Clean Water Act* (CWA).

Under the CWA the discharge of oil or hazardous substances into or upon navigable waters as well as contiguous waters and areas of the United States is prohibited. Cupric acetate (CAS No. 142-71-2), cupric acetoarsenite (CAS No. 12002-03-8), cupric chloride (CAS No. 7447-39-4), cupric nitrate (CAS No. 3251-23-8), cupric oxalate (CAS No. 5893-66-3), cupric sulfate (CAS No. 7758-98-7), ammoniated copper sulfate (CAS No. 10380-29-7), and cupric tartrate (CAS No. 815-82-7) are all listed as hazardous substances under the CWA (US EPA, 2018a).

Considering that copper and copper compounds are listed on the *Hazardous Substance List* of Section 311 of the CWA, there are effluent guidelines in place in certain industries for their control (US EPA, 2018b). These industries include nonferrous metals forming and metal powders, battery manufacturing, metal molding and casting, coil coating, copper forming, metal finishing, centralized waste treatment, ore mining and dressing, transportation equipment cleaning, waste combustors, nonferrous metals manufacturing, steam electric power generating and timber products processing point source categories (US EPA, 2018b).

Copper and copper-containing substances are not on the 2014 *Toxic Substances Control Act* (TSCA) Work Plan for Chemical Assessments and are therefore not being considered for further risk assessment by the agency (US EPA, 2014).

7.2.2 United States – guidelines

Pursuant to Section 304(a) of the *Clean Water Act* (CWA), the *United States Environmental Protection Agency* (US EPA) publishes national recommended water criteria. For copper, the U.S. EPA uses the Biotic Ligand Model (BLM) to calculate freshwater criteria. The acute and chronic criteria are 4.8 µg/L and 3.1 µg/L dissolved copper, respectively, for the protection of saltwater life (US EPA, 2007). The US EPA also provides a human health consumption criterion of 1300 µg/L for water and organisms (US EPA, 1992). There is also a maximum drinking water contaminant level for copper of 1300 µg/L in the *National Primary Drinking Water Regulations*, which are for contaminants that pose a risk for human health consumption and are legally enforceable. However, the *Secondary Drinking Water Standards*, which are to assist public water systems in managing their drinking water for aesthetic considerations and are not enforceable, have set a concentration limit of 1000 µg/L for copper (US EPA, 2012).

Some states have also published their own guidelines. For example, Minnesota has established a chronic standard of 9.8 µg/L and an acute standard of 18 µg/L total copper in state waters based on a hardness of 100 mg/L (Minnesota Pollution Control Agency, 2016). New York uses equations based on water hardness as well to determine its state freshwater values, listing a chronic equation of $0.96e^{0.8545(\ln(\text{ppm hardness})) - 1.702}$ and an acute equation of $0.96e^{0.9422[\ln(\text{ppm hardness})] - 1.7}$ for dissolved copper. For saline environments, it has an acute value of 4.8 µg/L and a chronic value of 3.4 µg/L for dissolved copper (New York State Department of Environmental Conservation, 2017). Washington State uses equations based on water hardness to provide criteria for dissolved copper concentrations in state freshwaters as well with an acute criterion of ≤ $0.96e^{0.9422(\ln(\text{harness})) - 1.464)}$ and chronic criterion of ≤ $0.96e^{0.8545(\ln(\text{harness})) - 1.465)}$. Its acute (4.8 µg/L) and chronic (3.1 µg/L) criteria for the marine environment match those of the current US guidelines. Washington also provides a human health consumption criterion of 1300 µg/L for water and organisms (Washington State, 2016).

7.2.3 European Union – statutes

In the European Union neither copper nor any copper containing compounds are listed on the Candidate List or the Authorisation List of the regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals, or REACH (ECHA, 2018b; ECHA, 2018a). There are currently no recommendations for their addition.

Under REACH, some copper substances are restricted. Restricted substances (on their own, in a mixture or in an article) are substances for which manufacture, placing on the market or use is limited or banned in the European Union. Slimes and Sludges, copper-lead ore roasting off gas scrubbing, arsenic-contg. (CAS RN 102110-62-3); arsenic acid, copper(2+) salt (CAS RN 29871-13-4); ammonium copper arsenate (CAS RN 32680-29-8); slime and sludges, copper refining (other than electrolytic) (CAS 266-977-2); copper diarsenite (CAS RN 16509-22-1); arsenic acid, copper salt (CAS RN 10103-61-4); tricopper arsenide (CAS RN 12005-75-3); and slimes and sludges, copper electrolytic refining, decopperized, arsenic-rich (CAS RN 309-772-6) are all restricted (ECHA, 2018c).

7.2.4 European Union – guidelines

In 2008, the European Union published Directive 2008/105/EC on Environmental Quality Standards. Annex I of the directive establishes limits on concentrations of certain pollutants in surface waters. Annex II lists the priority substances in the field of water policy. None of the targeted pollutants are copper or copper-containing substances (European Commission, 2008)**.** As well, a proposal submitted in January 2012 to amend Directives 2000/60/EC and 2008/105/EC with regards to priority substances in the field of water policy does not include any copper containing substances (European Commission, 2012)**.**

8. Next steps

8.1 Public comment period

Industry and other interested stakeholders are invited to submit comments on the content of this Risk Management Scope 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 [July 17, 2019]. The Risk Management Approach document, which will outline and seek input on the proposed risk management instrument(s), will be published at the same time as the final Screening Assessment Report. At that time, there will be further opportunity for consultation.

Comments and information submissions on the Risk Management should be submitted to the address provided below:

Program Development and Engagement Division
Environment and Climate Change Canada
Gatineau Quebec K1A 0H3
Tel: 1-800-567-1999 (In Canada)| 819- 938-3232
Fax: 819-938-3231
Email: eccc.substances.eccc@canada.ca

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

8.2 Timing of actions

Electronic consultation on the Draft Screening Assessment Report and Risk Management Scope]: [May 18, 2019] to [Jul 17, 2019]

Submission of additional studies or information on copper and its compounds: on or before [July 17, 2019]

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-month from the publication of each proposed instrument(s)

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ANNEX A. Substance identity information

Table A-1: Substance identity information for copper and its compounds

CAS RN	DSL or R-ICL name	Common name or simplified name[a]	Substance category	Molecular formula[b]	Inventory
137-29-1	Copper, bis(dimethylcarbamodithioato-S,S)-, (SP-4-1)-	Copper dimethyldithiocarbamate	Organometallics	$C_6H_{12}CuN_2S_4$	DSL
142-71-2	Acetic acid, copper(2+) salt	Copper acetate	Organic-metal salt	$C_2H_4O_2.½Cu$	DSL
527-09-3	Copper, bis(D-gluconato-o1,o2)-	Copper gluconate	Organometallics	$C_{12}H_{22}CuO_{14}$	DSL
866-82-0	1,2,3-Propanetricarbonxylic acid, 2-hydroxy-, copper (2+) salt (1 :2)	Cupric citrate	Organic-metal salts	$C_6H_4O_7.2Cu$	R-ICL
1111-67-7	Thiocyanic acid, copper(1+) salt	Copper(I) thiocyanate	Inorganics	CuSCN	DSL
1317-38-0	Copper oxide	Copper(II) oxide	Inorganics	CuO	DSL

CAS RN	DSL or R-ICL name	Common name or simplified name[a]	Substance category	Molecular formula[b]	Inventory
1317-39-1	Copper oxide	Copper(I) oxide	Inorganics	Cu_2O	DSL
1317-40-4	Copper sulfide	Copper(II) sulfide	Inorganics	CuS	DSL
1319-53-5	Malachite	Malachite	Inorganics	$CH_2Cu_2O_5$	R-ICL
1328-51-4	C.I. Solvent Blue 38	Solvent Blue 38	UVCB-organic-metal salts	$C_{32}H_{12}CuN_8Na_2O_6S_2$	DSL
1328-53-6[c]	C.I. Pigment Green 7	Pigment Green 7	UVCB-organometallic	$C_{32}Cl_{16}CuN_8$	DSL
1337-20-8	Chlorophyllins, copper potassium salt	Chlorophyllins, copper potassium sodium	UVCB-organometallics	NA	R-ICL
1338-02-9	Naphthenic acids, copper salts	Copper naphthenate	UVCB-organic-metal salts	$2(C_{11}H_7O_2)Cu$	DSL
1344-73-6	Sulfuric acid, copper salt, basic	Copper sulfate	UVCB-inorganic	$CuH_2O_8S_2$	DSL
3251-23-8	Nitric acid, copper(2+) salt	Copper nitrate	Inorganics	$Cu(NO_3)_2$	DSL
7440-50-8	Copper	Elemental copper	Inorganics	Cu	DSL
7447-39-4	Copper chloride	Copper(II) chloride	Inorganics	$CuCl_2$	DSL
7492-68-4	Carbonic acid, copper salt	Carbonic acid, copper salt	Inorganics	CH_2O_3Cu	R-ICL
7681-65-4	Copper iodide	Copper iodide	Inorganics	CuI	DSL
7758-89-6	Copper chloride	Copper(I) chloride	Inorganics	$CuCl$	DSL
7758-98-7	Sulfuric acid copper(2+) salt (1:1)	Copper(II) sulfate	Inorganics	$CuSO_4$	DSL
7798-23-4	Phosphoric acid, copper(2+) salt (2:3)	Copper phosphate	Inorganics	$Cu_3(PO_4)_2$	DSL

CAS RN	DSL or R-ICL name	Common name or simplified name[a]	Substance category	Molecular formula[b]	Inventory
11006-34-1	Cuprate(3-), [18-carboxy-20-(carboxymethyl)-8-ethenyl-13-ethyl-2,3-dihydro-3,7,12,17-tetramethyl-21H,23H-porphine-2-propanoato(5-)-N21,N22,N23,N24]-, trisodium, [SP-4-2-(2S-tra*ns)]-	Chlorophyllin	Organometallics	$C_{34}H_{29}CuN_4Na_3O_6$	DSL
12222-04-7	Direct Blue 199	C. I. Direct Blue 199	Organometallics	$C_{32}H_{18}CuN_9NaO_5S_2$	R-ICL
20427-59-2	Copper hydroxide	Copper hydroxide	Inorganics	$Cu(OH)_2$	DSL
22205-45-4	Copper sulfide	Copper(I) sulfide	Inorganics	Cu_2S	DSL
22221-10-9	Hexanoic acid, 2-ethyl-, copper salt	Copper(II) ethylhexanoate	Organic-metal salt	$C_8H_{16}O_2.{}^1/_2Cu$	DSL
26317-27-1	Cuprate(3-), [(7S,8S)-3-carboxy-5-(carboxymethyl)-13-ethenyl-18-ethyl-7,8-dihydro-2,8,12,17-tetramethyl-21H,23H-porphine-7-propanoato(5-)-.kappa.N21,.kappa.N22,.kappa.N23,.kappa.N24]-, trihydrogen, (SP-4-2)-	NA / Copper chlorophyllin	Organometallics	$C_{34}H_{34}CuN_4O_6$	R-ICL

CAS RN	DSL or R-ICL name	Common name or simplified name[a]	Substance category	Molecular formula[b]	Inventory
28302-36-5	Cuprate(3-), [(7S,8S)-3-carboxy-5-(carboxymethyl)-13-ethenyl-18-ethyl-17-formyl-7,8-dihydro-2,8,12-trimethyl-21H,23H-porphine-7-propanoato(5-)-.kappa.N21,.kappa.N22,.kappa.N23,.kappa.N24]-, sodium (1:3), (SP-4-2)-	NA / Sodium copper chlorophyllin	Organometallics	$C_{34}H_{29}CuN_4NaO_7$ $^{(-2)}$	R-ICL
68084-48-0	Neodecanoic acid, copper(2+) salt	Copper neodecanoate	Organic-metal salt	$C_{10}H_{20}O_2$.xCu	DSL
68512-13-0[c]	Copper, [29H,31H-phthalocyaninato(2-)-N29,N30,N31,N32]-, brominated chlorinated	Brominated chlorinated copper phthalocyanine	UVCB-organometallic	NA	DSL
68987-63-3[c]	Copper, [29H,31H-phthalocyaninato(2-)-N29,N30,N31,N32]-, chlorinated	Chlorinated copper phthalocyanine	UVCB-organometallic	NA	DSL
105883-51-0	Copper, bis[N-acetyl-.kappa.O)-L-methioninato-.kappa.O]-	Copper acetylmethionate	Organometallics	$Cu(C_7H_{12}NO_3S)_2$	R-ICL
131044-77-4	Copper, N-acetyl-L-tyrosine hydroxy-terminated (S)-[2-(acetylamino)-3-(4-hydroxyphenyl)-1-oxopropoxy] Me siloxanes	NA	UVCB-organometallics	NA	R-ICL

CAS RN	DSL or R-ICL name	Common name or simplified name[a]	Substance category	Molecular formula[b]	Inventory
131044-78-5	Copper, hydroxyl-terminated Me (S)-[[5-oxo-2-pyrrolidinyl) carbonyl]oxy] siloxanes 5-oxo-L-proline complexes	Copper PCA methylsilanol	UVCB-organometallics	NA	R-ICL
147550-61-6	Copper carbonate hydroxide	Copper carbonate hydroxide	Inorganics	$CHCuO_4$	R-ICL
CDSL 10024-7[d]	Metal alkyldithiophosphates	NA	UVCB-inorganic	NA	DSL

NA: not available and/or not applicable
[a] A list of additional chemical names (e.g., trade names) is available from the National Chemical Inventories (NCI 2012).
[b] Molecular formula found from NCI (2017) or ChemIDplus (1993-).
[c] These CAS did not meet categorization criteria under Section 73(1) of CEPA; they were considered a priority on the basis of other human health concerns.
[d] CDSL (Confidential DSL) accession #10024-7.