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Revised Risk Management Scope

for

Boric Acid, its Salts and its Precursors (Boric Acid)

Environment and Climate Change Canada

Health Canada

March 2025

Canada

Summary of proposed risk management

This document outlines the risk management options under consideration for boric acid, its salts and its precursors, which have been proposed to be harmful to the environment and human health. For the purposes of paragraph 77(1)(a) of the *Canadian Environmental Protection Act, 1999* (CEPA), the Government of Canada proposes to recommend that boric acid, its salts and its precursors be added to Part 2 of Schedule 1 to CEPA. As a result, the Government of Canada is considering the following new risk management actions:

- **Flame retardant uses**: For mattresses and futons containing boric acid used as a flame retardant, regulatory measures to reduce or eliminate exposure;

- **Cleaning products**: Regulatory or non-regulatory actions to help reduce human exposure to certain cleaning products containing boron, including consumer products used as an abrasive powder, general purpose powder cleaner, carpet spot remover powder, floor cleaning powder and laundry powder;

- **Swimming pool and spa maintenance products**: Regulatory or non-regulatory actions to help reduce exposure to boric acid during swimming activities (excluding those uses regulated under the *Pest Control Products Act,* that is, algaecides and sanitizer pool products containing boron as a formulant); and

- **Do-it-yourself (DIY) products**: Regulatory or non-regulatory actions to help reduce exposure to boric acid from certain DIY products available to consumers, and in particular, airless spray paints for rust, that contain boron.

The Government of Canada is also considering other risk management actions, as follows:

Human Health:

- **Arts and crafts materials, and toys:** For home-made clays, slimes, and crystals, prepared with boric acid and intended for children's use, an updated public information document, outlining the potential health risks associated with boric acid and home-use of borax (as boric acid) to discourage consumers from this practice;

- **Cosmetics:** Modifying the existing entry for “Boric acid and its salts” on Health Canada’s Cosmetic Ingredient Hotlist[1] to help reduce exposure to boric acid, its salts and its precursors from certain products applied to or in contact with the skin (for example, body creams, hair colours, massage oils);

- **Natural health products and non-prescription drugs:** Modifying the existing entries for boric acid, its salts and its precursors in Health Canada’s Natural Health Products Ingredients Database (NHPID)[2] to help reduce exposure to boric acid, its salts and its precursors from certain natural health products and non-prescription drugs. Actions may aim to lower the concentration of these substances when used in certain natural health products or non-prescription drugs to levels that are protective of human health.

  In addition, reviewing the maximum daily dose allowed and associated conditions of use for boron under the Natural and Non-prescription Health Products Directorate (NNHPD)'s Multi-Vitamin/Mineral Supplements and Multiple Ingredient Joint Health Products monographs.

Ecological:

- **For a metal ore processing mill:** Working with provincial authorities and a specific mill to identify additional facility-specific risk management actions under provincial or federal jurisdiction. Further risk management actions for other facilities in the metal ore mining sector are not currently under consideration.

To inform risk management decision-making, information on the following topics should be provided (ideally on or before May 7, 2025) to the contact details identified in section 8 of this document:

[1] The Cosmetic Ingredient Hotlist is an administrative tool that Health Canada uses to communicate to manufacturers and others that certain substances may contravene the general prohibition found in section 16 of the *Food and Drugs Act* or may contravene one or more provisions of the *Cosmetic Regulations*. Section 16 of the *Food and Drugs Act* states that “No person shall sell any cosmetic that has in or on it any substance that may cause injury to the health of the user.” In addition, the Hotlist includes certain substances that may make it unlikely for a product to be classified as a cosmetic under the *Food and Drugs Act*. Compliance with the provisions of section 16 is monitored, in part, through the mandatory notification provisions of section 30 of the *Cosmetic Regulations* of the *Food and Drugs Act*, which requires that all manufacturers and importers provide a list of the cosmetic’s ingredients to Health Canada.

[2] The NHPID provides an electronic tool which enables members of the public to access information on the following topics:

- medicinal and non-medicinal ingredients used in Natural Health Products;
- standard terminology used by the Natural Health Products Online System, known as "Controlled Vocabulary", referring to quality test methods, dosage forms, non-medicinal ingredient purposes, and so on; and
- pre-cleared information such as single ingredient monographs and product monographs.

- Technically and economically feasible actions that the metal ore processing mill can implement to reduce concentrations of boric acid released to the environment beyond what is currently included in its Boron Reduction Strategy; and
- Alternative substances to the use of boric acid in pool/spa chemicals as a water clarifier/enhancer and in certain cleaning applications.

The risk management options outlined in this revised risk management scope document may evolve through consideration of assessments and risk management options or actions published for other Chemicals Management Plan (CMP) substances as required, to ensure effective, coordinated, and consistent risk management decision-making.

Note: The above summary is an abridged list of options under consideration to manage these substances and to seek information on identified gaps. Some uses of boron, such as pesticidal uses, are regulated under other Government of Canada acts, and risks have been mitigated for these uses (as applicable). 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.

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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 human health as set out in section 64 of CEPA[3,4], and if so to manage the associated risks.

The updated draft assessment and the revised risk management scope focus on boric acid, a common moiety[5] of concern, and therefore consider boric acid, its salts and its precursors, including any boron-containing substance that may release boric acid through any transformation pathway (for example, hydrolytic, oxidative, or metabolic) at environmentally or physiologically relevant conditions (for example, pH and temperature) (ECCC, HC 2025). Boron-containing chemicals and associated hydrated forms were evaluated for their potential to be salts or precursors of boric acid. As such, 126 substances (listed in Annex A) have been identified, representing a non-exhaustive list of boric acid, its salts and its precursors, which are referred to throughout this document as "boric acid" and are included in the Boric Acid, its Salts, and Precursors Group of the CMP (Canada 2017). For more information on how substances were classified as precursors or salts to boric acid, please refer to the updated draft assessment.

Throughout this document, concentrations of boric acid are reported as concentration of boron because boric acid is generally measured this way.

[3] 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.*

[4] 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.

[5] For the purpose of this document, "moiety" signifies a part of a molecule. A moiety is a discrete chemical entity, identified from a parent compound or its transformation products, that is expected to have toxicological significance.

2. Issue

Health Canada and Environment and Climate Change Canada (ECCC) conducted a joint scientific assessment of boric acid, its salts and its precursors in Canada. The first draft screening assessment was published in July 2016. Significant new use and exposure information, including additional environmental monitoring data and also human biomonitoring data from the Canadian Health Measures Survey, subsequently became available. As a result, the first draft screening assessment was updated.

A notice summarizing the scientific considerations of the updated draft assessment for these substances was published in the *Canada Gazette*, Part I, on March 8, 2025 (Canada 2025). For further information, refer to the updated draft assessment for boric acid, its salts and its precursors.

2.1 Updated draft assessment conclusion

On the basis of the information available, the updated draft assessment proposes to conclude that boric acid, its salts and its precursors are toxic under paragraphs 64*(a)* and *(c)* of CEPA because they are entering or may enter 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, and constitute or may constitute a danger in Canada to human life or health (ECCC, HC 2025).

The updated draft assessment also proposes that boric acid, its salts and its precursors do not meet the criteria under paragraph 64*(b)* of CEPA 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 (ECCC, HC 2025).

Precursors of boric acid include the following groups of boron-containing substances: oxygen compounds of boron (including boric acids, borates or boric acid salts and borate esters), boron halides, boranes (borohydrides) and organo-boron compounds. Not all boron containing substances are precursors of boric acid; notable exceptions include elemental boron, borides (such as boron nitride or carbide) and inert substances (for example, sodium borate silicates or borosilicate glass), which therefore fall outside the scope of the assessment.

The updated draft assessment also proposes that boric acid, its salts and its precursors meet the persistence criteria but do not meet the bioaccumulation criteria as set out in the *Persistence and Bioaccumulation Regulations* of CEPA (Canada 2000).

The exposure sources of concern identified in the updated draft assessment are based on the potential release of boric acid from one facility processing recovered slags from precious and base metals (metal ore processing mill facility) and from products available to consumers such as, types of arts and crafts materials, toys,

cleaning products, mattresses, cosmetics, natural health products, non-prescription drugs, DIY products, and swimming pool and spa maintenance products. As such, this document will focus on these exposure sources (refer to section 5).

2.2 Proposed recommendation under CEPA

On the basis of the findings of the updated draft assessment conducted pursuant to CEPA, the Ministers propose to recommend that boric acid, its salts and its precursors excluding borosilicates, borosilicate glass and borides be added to Part 2 of Schedule 1 to CEPA[6]. 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, boric acid, its salts and its precursors are proposed to be recommended for addition to Part 2 of Schedule 1. Following the availability of the aforementioned regulations, the substances may be moved to Part 1 of Schedule 1, if applicable.

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

Under subsection 77(3), the Ministers are required to propose recommending the addition of a substance that meets the criteria in paragraph (*a*), (*b*) or (*c*), to Part 1[7] of Schedule 1 of the Act and, in developing a proposed 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 measures such as regulations and pollution prevention planning notices,

[6] 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 Schedule 1 to CEPA (for substances that pose the highest risk) or recommend the addition of the substance to Part 2 of Schedule 1 to CEPA (for other CEPA-toxic substances).

[7] Under subsection 77(3), a substance must be recommended for addition to Part 1 of Schedule 1 of 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
    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.

or non-regulatory measures such as environmental release guidelines, codes of practice, or environmental performance agreements, if warranted.

The Ministers have taken into consideration comments made by stakeholders during the 60-day public comment period on the first draft screening assessment for boric acid, its salts and its precursors and its associated risk management scope.

If the Ministers finalize the recommendation to add boric acid, its salts and its precursors to Part 2 of Schedule 1, a risk management instrument must, unless an exception in section 91 of CEPA applies, be proposed within 24 months from the date on which the Ministers recommended that boric acid, its salts and its precursors be added to Schedule 1 to CEPA, and finalized within 18 months from the date on which the risk management instrument is proposed, as outlined in sections 91 and 92 of CEPA (refer to section 8 for publication timelines applicable to this group of substances). Adding a substance to Schedule 1 does not restrict its use, manufacture, or import. Rather, it enables the Government of Canada to take enforceable risk management actions under CEPA.

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

The first draft screening assessment for boric acid, its salts and its precursors (ECCC, HC 2016a) and its associated risk management scope (ECCC, HC 2016b) summarizing the proposed risk management options under consideration at that time, were published on July 23, 2016. Interested stakeholders were invited to submit comments on both documents during a 60-day comment period.

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

3. Proposed risk management

3.1 Proposed environmental and human health objectives

Proposed environmental and human health objectives are quantitative or qualitative goals to address environmental and human health concerns.

For this grouping, the proposed objectives address the risks outlined in section 5 of this document. The proposed environmental and human health objectives for boric acid are to:

- Prevent or minimize adverse effects on the aquatic environment from anthropogenic releases of boric acid to water. The predicted no-effect

concentration (PNEC) of 1.5 mg B/L (milligrams of boron per litre) may be used as a goal to achieve this objective; and
- Reduce exposure of the general population to these substances to levels that are protective of human health.

3.2 Proposed risk management objectives

Proposed risk management objectives set quantitative or qualitative targets to be achieved by the implementation of risk management measures such as regulations, and other instruments and/or tools for a given substance or substances. In this case, the proposed risk management objectives for boric acid are to:

- Reduce anthropogenic releases to water to the greatest extent practicable so as not to exceed the PNEC (1.5 mg B/L, equivalent to the Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines), or the natural background concentration, whichever is higher, taking into consideration socio-economic factors;
- Reduce dermal exposure to boric acid, its salts and its precursors used as flame retardants in certain products such as mattresses;
- Reduce inhalation, dermal, and/or oral exposures of the general population to boric acid, its salts and its precursors from certain cleaning products;
- Reduce inhalation, dermal and/or oral exposures to boric acid, its salts and its precursors from swimming pool and spa maintenance products;
- Reduce inhalation and/or dermal exposures of the general population to boric acid, its salts and its precursors from certain DIY products, such as rust paint;
- Reduce inhalation, dermal, and/or oral exposures of children to boric acid, its salts and its precursors from certain arts and crafts materials and toys;
- Reduce dermal, ocular, oral and/or inhalation exposures of the general population to boric acid, its salts and its precursors from certain cosmetics, natural health products, and non-prescription drugs.

These objectives will be refined on the basis of stakeholder consultation and new information, the proposed risk management, the outcome of the assessment, and socio-economic and technical considerations (refer to section 6). Revised environmental and human health and risk management objectives will be presented in the risk management approach for boric acid, its salts and its precursors that will be published concurrently with the final assessment.

3.3 Proposed risk management options under consideration

To achieve the proposed risk management objectives and to work towards achieving the proposed environmental and human health objectives, the risk management options under consideration for boric acid, its salts and its precursors are outlined in the subsequent subsections.

Note that these proposed risk management options are preliminary and subject to change. Following the publication of this document, additional information obtained from the public comment period and from other sources will also be considered in the instrument selection and development process[8]. The risk management options may also evolve through consideration of assessments and risk management options or actions published for other CMP substances to ensure effective, coordinated, and consistent risk management decision-making.

3.3.1 Human Health

For the purposes of paragraph 77(1)(a) of CEPA, the Government of Canada proposes to recommend that boric acid, its salts and its precursors be added to Part 2 of Schedule 1 to CEPA. As a result, the Government of Canada is considering the following new risk management actions:

Flame retardant uses: For mattresses and futons that contain boric acid used as a flame retardant, regulatory measures to reduce or eliminate exposure. This could entail regulatory measures under the *Canada Consumer Product Safety Act* (CCPSA) to prohibit/restrict the import, manufacture, advertisement and sale of mattresses and similar products containing boron compounds. Alternatively, addition of boron compounds to regulations under CEPA, including for the restriction/prohibition of boron in mattresses could be considered.

Cleaning products: Regulatory or non-regulatory actions to help reduce exposure for cleaning scenarios in which sodium borate (borax) is used as an abrasive powder, general purpose powder cleaner, carpet spot remover powder, floor cleaning powder and laundry powder, and/or pre-mixed cleaning products containing boron that pose a risk. This could include regulatory measures under the CCPSA or under CEPA. Non-regulatory measures under CEPA such as performance agreements, codes of practice or public information material on the potential health implications of exposure to borax could also be considered.

Swimming pool and spa maintenance products: Regulatory or non-regulatory actions to help reduce exposure to boric acid during swimming activities. Investigate the feasibility of safe concentration limits for boric acid in pools, and/or public information material on methods to reduce exposure, guided by discussion with, and information received from, industry stakeholders.

DIY products: Regulatory or non-regulatory measures to help reduce exposure to boric acid from DIY products, and in particular, airless spray paints for rust, that contain boron. This could include regulatory measures under the CCPSA or under CEPA. Non-regulatory measures under CEPA such as performance

[8] 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 Regulation (TBS 2018a), the Policy on Regulatory Development (TBS 2018b), the Red Tape Reduction Action Plan (TBS 2012), and, in the case of a regulation, the *Red Tape Reduction Act* (Canada 2015).

agreements or codes of practice to reduce or eliminate the presence of boron compounds in these products, could also be considered, guided by discussion with, and information received from, industry stakeholders.

The Government of Canada is also considering other risk management actions, as follows:

Arts and crafts materials, and toys: For home-made clays, slimes, and crystals, prepared with boric acid and intended for children's use, an updated public information document, outlining the potential health risks associated with boric acid and home-use of borax (as boric acid) to discourage consumers from this practice.

Cosmetics: Modifying the existing entry for "Boric acid and its salts" on Health Canada's Cosmetic Ingredient Hotlist to help reduce exposure to boric acid, its salts and its precursors from certain products applied to or in contact with the skin (for example, body creams, hair colours, massage oils).

Natural health products and non-prescription drugs: Modifying the existing entries for boric acid, its salts and its precursors in Health Canada's Natural Health Products Ingredients Database (NHPID)[9] to help reduce exposure to boric acid, its salts and its precursors from certain natural health products and non-prescription drugs. Actions may aim to lower the concentration of these substances when used in certain natural health products or non-prescription drugs to levels that are protective of human health.

In addition, reviewing the maximum daily dose allowed and associated conditions of use for boron under the Natural and Non-prescription Health Products Directorate (NNHPD)'s Multi-Vitamin/Mineral Supplements and Multiple Ingredient Joint Health Products monographs.

3.3.2 Environment

Metal ore mining

The Government of Canada is considering the following ecological risk management actions, as described below.

The updated draft assessment determined that concentrations of boric acid in the aquatic environment may be harmful to aquatic organisms as a result of

[9] The NHPID provides an electronic tool which enables members of the public to access information on the following topics:

- medicinal and non-medicinal ingredients used in Natural Health Products;
- standard terminology used by the Natural Health Products Online System, known as "Controlled Vocabulary", referring to quality test methods, dosage forms, non-medicinal ingredient purposes, and so on; and
- pre-cleared information such as single ingredient monographs and product monographs.

operations at a single metal ore processing mill facility that recovers precious and base metals from a range of feeds. Activities at other facilities in the metal ore mining sector are not expected to be harmful to aquatic organisms at current levels.

In 2011, the facility of concern was issued a permit from the provincial government which outlined a Boron Reduction Strategy. As part of its Boron Reduction Strategy, the facility has stopped processing feeds with high concentrations of boron. This has resulted in a significant reduction of boron content within the feeds that the facility processes. However, the presence of boron in the feedstock has not been eliminated as elevated boron concentrations in the effluent of the mill have been confirmed in the monitoring data submitted to provincial authorities. This means that both historical tailings stored on site and new tailings and process waters produced by the facility are sources of boric acid released to the environment.

To further control the releases of boric acid from its historical tailings, the facility proposed to cap sections of its tailings storage area with a clay liner while continuing to monitor its effluent. According to information shared by the provincial authority, portions of the tailings pond were capped in 2015. Since the risk management actions taken in 2015, the concentrations of boron have decreased in the receiving environment. In 2018, the provincial authority issued an amended approval stating that the entire inactive tailings area will be covered and vegetated and that ditches will be constructed to the west and southern borders of the tailings area to collect storm water runoff.

ECCC will work with provincial authorities and the specific mill to identify additional facility-specific risk management actions under provincial or federal jurisdiction to reduce releases of boric acid to the environment. Further risk management actions for other facilities in the metal ore mining sector are not currently under consideration.

3.4 Performance measurement evaluation

Performance measurement evaluates the ongoing effectiveness and relevance of the actions taken to manage risks from toxic substances[10]. ECCC and Health Canada have developed a Performance Measurement Evaluation Strategy that sets out the

[10] Performance measurement can be performed at 2 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 (that is, evaluate whether risk management objectives have been met); and
- Substance-based performance measurement 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 (that is, evaluate whether human health and/or environmental objectives have been met).

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

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 those substances. Selection of a substance for performance measurement evaluation is conducted through readiness, prioritization and work planning 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.

The Government of Canada may measure the effectiveness of the risk management actions and the progress towards meeting the risk management and environmental and human health objectives for boric acid, its salts and its precursors.

To do so, the Government of Canada may collect and analyze data, such as provincial monitoring data and/or data submitted by metal mines through the *Metal and Diamond Mining Effluent Regulations* (MDMER) under the *Fisheries Act* on the presence of boric acid in surface water and effluents. The Government of Canada may also collect and analyze data in certain consumer products of concern in order to measure progress towards meeting the risk management objectives. This includes measuring the effectiveness of previous public information campaigns concerning the use of consumer products containing boron, such as the Health Canada public advisory notice, *Information Update - Health Canada advises Canadians to avoid homemade craft and pesticide recipes using boric acid*, on its website which describes risks associated with boric acid and measures that can be taken to avoid exposure in children's craft products.

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 people in Canada along with recommendations for further action, if applicable.

3.5 Risk management information gaps

Interested stakeholders are invited to provide further information to inform risk management decision-making regarding boric acid, its salts and its precursors, including:

- Technically and economically feasible actions that the metal ore processing mill can implement to reduce concentrations of boric acid released to the environment beyond what is currently included in its Boron Reduction Strategy; and
- Alternative substances to the use of boric acid in pool/spa chemicals as a water clarifier/enhancer and in certain cleaning applications.

Stakeholders that have information to help address these gaps should provide it on or before May 7, 2025 to the contact details identified in section 8.

4. Background

4.1 General information on boric acid, its salts and its precursors

Boron occurs naturally in the terrestrial crust in the form of borosilicate minerals, boric acid, or borates (Gupta 1993; Cotton and Wilkinson 1999; Holleman and Wiberg 2001; Parks and Edwards 2005). The main sources of global emissions to the atmosphere include sea salt aerosols, soil dusts, volcanoes, biomass burning (for example, forest fires) and plant aerosols (Park and Schlesinger 2002). Rock and weathering constitute another important source of boric acid to the environment (Park and Schlesinger 2002). The introduction of boric acid into surface water and soil as a result of these natural processes are reflected in the geochemical background concentrations in these media.

Anthropogenic sources are also significant and include the manufacture, import and use of boric acid, its salts and its precursors in products and manufactured items. Other anthropogenic sources include the incidental production and subsequent release of boric acid as a result of activities such as coal-fired power generation, metal ore mining (including base metals, precious metals, and uranium), base metals and precious metals smelting and refining, coal mining, oil sands extraction and processing, oil and gas extraction, and wastewater treatment (including the land application of biosolids) (ECCC, HC 2025).

4.2 Current uses and identified sectors

Boric acid, its salts and its precursors are used in a wide variety of products and applications, including: cellulose and fibreglass insulation manufacturing, industrial and consumer cleaning products, self-care products (that is, cosmetics, natural health products, and non-prescription drugs), pest control products, other chemicals, gypsum board manufacturing, engineered wood products manufacturing, oil and gas extraction, agriculture (for example, fertilizers), pulp and paper manufacturing and packaging, rubber manufacturing, chemical manufacturing, metallurgical applications, and surface finishing. In addition, boric acid, its salts and its precursors are present in a number of consumer products including arts and crafts materials and toys, DIY products (including adhesives and sealants, automotive maintenance, home maintenance, paints and coatings), flame retardants in mattresses and futons, and swimming pool and spa maintenance products (ECCC, HC 2025).

The use of boron in cosmetics, drugs including natural health products, pest control products, and toys is regulated in Canada. The use of boron in consumer chemical products is regulated under the *Consumer Chemicals and Containers Regulations 2001* (CCCR 2001), based on acute hazard. The use of boron in natural health products is regulated under the *Natural Health Products Regulations* made under the *Food and Drugs Act* (Canada 2003; 1985a). Boric

acid, its salts and its precursors are present as both medicinal and non-medicinal ingredients in these products. Boric acid precursors are also listed in the Drug Product Database (2023) as being present in human and veterinary drugs. For humans primarily as a non-medicinal ingredient in ophthalmic products and contact lens disinfectants, and for veterinary use, in optic and topical products and injectable solutions (Health Canada 2023a; 2023b; 2023c).

Boric acid may be present in a wide variety of self-care products (that is, cosmetics, natural health products, and non-prescription drugs) and are most common in skin lotion/moisturizer and skin cleaner products. Boric acid and its salts (CAS RNs[11] 10043-35-3, and 11113-50-1 including sodium borate 7775-19-1, sodium tetraborate 1330-43-4, borax 1303-96-4, zinc borate 1332-07-6, MEA borate 10377-81-8, MIPA borate 26038-90-4, sodium perborate 7632-04-4, boron oxide perboric acid 1303-86-2, sodium salt 11138-47-9, and sodium tetraborate pentahydrate 12179-04-3) are included on the List of Prohibited and Restricted Cosmetic Ingredients (the Cosmetic Ingredient Hotlist), an administrative tool that Health Canada uses to communicate to manufacturers and others that cosmetic products containing certain substances may contravene the general prohibition found in section 16 of the *Food and Drugs Act*, or a provision of the *Cosmetic Regulations* (Canada 2019; Health Canada 2022a). The current listing for boric acid and its salts does not include all precursors of boric acid and it describes a concentration limit of 5% for boric acid and its salts, including sodium borate. However, based on notifications submitted under the *Cosmetic Regulations* to Health Canada, concentrations of boric acid in diaper creams, and other cosmetic baby products, sold in Canada are much lower than the maximum level of 5% (that is, less than 0.1%). Also, the Hotlist indicates the label of a cosmetic containing these substances at concentrations greater than 0.1% is required to carry a cautionary statement to the effect of: “Do not use on broken or abraded skin, not to be used by children under 3 years of age.”

In addition, several boron-containing substances are active ingredients in pest control products regulated under the *Pest Control Products Act* (2002), particularly in wood and material preservatives, and for other pest control applications (Health Canada 2016). For example, some algaecide and sanitizer pool products regulated under the *Pest Control Products Act* contain boron as a formulant, which, when used according to label directions, results in a final concentration range in pool/spa water of 5 parts per trillion (ppt) to 1 part per million (ppm), depending on the use. Pool and spa uses evaluated in the updated draft assessment are not regulated under the *Pest Control Products Act* as they are not algaecide and/or do not control microorganisms (2002). Boron is also a

[11] CAS RN: Chemical Abstracts Service Registry Number. The CAS RN is the property of the American Chemical Society, and any use or redistribution, except as required in supporting regulatory requirements and/or for reports to the Government of Canada when the information and the reports are required by law or administrative policy, is not permitted without the prior, written permission of the American Chemical Society.

recognized plant micronutrient and is regulated as a fertilizer under the *Fertilizers Act* (Canada 1985b). As well, the presence of boric acid and salts of boric acid in toys is regulated under section 22 of the *Toys Regulations* (Canada 2011b). Food packaging materials may also have boron present (for example, in adhesives, paper and paperboard).

5. Exposure sources of concern and identified risks

5.1 Anthropogenic releases to the environment

Anthropogenic releases of boric acid to water from a metal ore processing mill facility have been identified in the updated draft assessment as posing a potential risk to aquatic organisms.

Boron compounds are not mined in Canada; however, boron is ubiquitous in nature and may be found in ores at varying concentrations. Additionally, boron is known to be frequently associated with “vein-type” gold mineralization (Boyle 1974; Closs & Sado 1981). Boron could potentially be released as boric acid into the environment as a result of the mining and production of metal concentrates and diamonds. Borates may also be used in precious metals recovery as they associate with metallic oxide contaminants to minimize the loss of precious metal (Borax 2021).

Environmental concentrations of boric acid are generally reported as concentration of boron. In the ecological assessment of boric acid, its salts and its precursors, measured boron concentrations in the receiving environment or effluent of metal ore mines across Canada were gathered and analyzed. This information was submitted to ECCC under the environmental effects monitoring provisions of the MDMER. Monitoring data for boron in the aquatic environment (existing as boric acid) available for 115 sites between 2003 and 2020 were analyzed. Among those sites, the majority showed low boron concentrations. While a few sites showed higher boron concentrations (which did not exceed the PNEC), only a single mill facility that recovers precious and base metals from a range of feeds was associated with high boron concentrations in the receiving environment which exceeded the PNEC for aquatic organisms.

The site of concern is a mill that processed feeds with high boron content for the purpose of concentrating precious metals. Although as part of its Boron Reduction Strategy the facility has stopped processing feeds with high concentration of boron, the presence of boron has not been completely eliminated in the feedstock. At this mill the process produces tailings and other process waters that are stored together on site for proper management in a tailings storage area. The effluent from the tailings storage area is monitored, treated, and discharged in an adjacent water body. Elevated boron

concentrations in the effluent of the mill have been confirmed in the monitoring data submitted to provincial authorities.

5.2 Human health

The updated draft human health assessment being conducted for boric acid, its salts and its precursors under CEPA indicates that boric acid adversely affects fertility, reproduction and development. Notwithstanding variations in recommended toxicological reference doses, the proposed conclusions set out in the updated draft assessment are similar to those of other jurisdictions. These findings are based on animal studies, as although some epidemiological studies in humans are available, collectively it was determined that the available epidemiological data is insufficiently robust to confirm the absence of reproductive or developmental effects in humans (ECCC, HC 2025).

People in Canada are exposed to naturally occurring and anthropogenic boric acid from environmental media, food, drinking water and products. Exposure of people in Canada to boric acid was characterized through the use of biomonitoring data from Canadian surveys and studies. Total boron measured in blood and urine in individuals provides a measure of integrated exposure of the population, from all routes (that is, oral, dermal, and inhalation) and all sources including environmental media, food, drinking water and the daily or frequent use of products. A comparison of estimates of intake predicted from biomonitoring data from people in Canada to critical health effect levels results in margins of exposure which are potentially inadequate to address uncertainties. Males have higher concentrations of boron in blood than females. However, females were found to have higher urinary boron concentration than males. For adults, there is a steady increase in the concentration of boron in blood with age; despite this trend in adults, blood boron concentrations are higher overall in children. Children aged 3 to 5 years have the highest urinary boron measurements. Intake estimates from environmental media, food, drinking water and several products were generated to characterize important sources of exposure. As boron is an essential micronutrient for the growth of plants, these estimates indicate, as expected, that naturally occurring boron in fruits and vegetables and to a lesser extent, drinking water, are the primary sources of exposure. Estimates of intakes from uses of boric acid in specific types of arts and crafts materials, toys, cleaning products, self-care products (that is, cosmetics, natural health products, and non-prescription drugs), flame retardants in mattresses and futons, DIY products and swimming pool and spa products indicate that these may also be sources of exposure posing a risk to the general population (ECCC, HC 2025).

The Government of Canada considered, where available, risk assessment information relevant to children’s exposure to these substances. As part of the CMP, the Government of Canada asked industry and interested stakeholders to submit any information on the substances that may be used to inform risk assessment, risk management and product stewardship. In particular, stakeholders were asked if any of the products or manufactured items containing the substances were intended for

use by children. Given that the most critical health effects are reproductive and developmental toxicity, and that available information indicates that children may receive higher exposure than adults in some instances involving products available to consumers, children should be considered disproportionately impacted in risk management decisions. Additionally, due to testicular effects which may impact males of all ages, adults with testicles were found to be susceptible to adverse effects of boron.

6. Risk management considerations

6.1 Alternatives and alternate technologies

For the mill facility of ecological concern identified in the updated draft assessment, since the exposure of concern is associated with its incidental boric acid releases, it is not expected that alternative substances or alternate process technologies would be a practical approach to minimizing releases of boric acid.

Additional effluent control technologies (that is, additional on-site or off-site effluent treatment), process optimization, and recovery of waste compounds at the end of the process may be effective approaches for the metal ore processing mill facility of concern, as appropriate and economically feasible.

To address the potential socio-economic impact and feasibility of proposed risk management measures for boric acid, further consultation with industry associations and a determination as to the availability and effectiveness of alternatives to boron in consumer applications highlighted in the updated draft assessment is required.

It is notable that boric acid increasingly appears to be substituted with sodium percarbonate in cleaning-type and other products, particularly in the United States (US) and Europe. In the European Union (EU), as borax is no longer approved to be sold for household use, sodium sesquicarbonate has been marketed under the name “borax substitute” (European Chemicals Agency 2022a). However, in other similar products, boric acid is still used. Therefore, information on present and future use of sodium percarbonate as a substitute for boric acid in cleaning products manufactured by members of major cleaning associations has been requested in section 3.5 (Information gaps) of this document.

Alternatives to boric acid, its salts and its precursors when used as flame retardants may include the use of inherently flame-resistant materials (such as polyester or wool) or chemical-free fire barrier systems, or a combination of these or other measures. Health Canada recently published a Notice to stakeholders on the use of flame-retardant chemicals in certain consumer products in Canada. The objective of the notice is to encourage Canadian manufacturers, importers,

advertisers, and sellers of consumer products to achieve compliance with the flammability performance requirements for certain consumer products set out in regulations under the CCPSA without using chemical flame retardants.

6.2 Socio-economic and technical considerations

About 10% of the global consumption of boron in Canada is in the form of mineral concentrates, mainly used in the production of enamels, glass products and fertilizers. Canada has no boron mining activities; its consumption is based solely on imports. Canada imports natural calcium borates from the US and occasionally, Bolivia. There are no producers of boron chemicals in Canada, as all demand is met by imports. Disodium tetraborates is the leading consumed boron product in Canada, accounting for 68% in 2021, followed by boric acid at 22% (S&P Global 2022).

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 objectives, as per the guidance provided in the Treasury Board document Policy on Regulatory Development (TBS 2018b).

In addition, socio-economic factors will be considered in the development of regulations, instrument(s) or tool(s), to address risk management objectives, as identified in the Cabinet Directive on Regulation (TBS 2018a), the Red Tape Reduction Action Plan (TBS 2012) and the *Red Tape Reduction Act* (Canada 2015).

7. Overview of existing risk management

7.1 Related Canadian risk management context

7.1.1 Metal ore mining

The MDMER, under the *Fisheries Act*, authorize the deposit of certain deleterious substances from metal mines into waters frequented by fish or in any place where the deleterious substances could enter such waters at regulated limits. Schedule 4 of these regulations lists authorized release limits for deleterious substances as defined under the MDMER. Schedule 5 of the regulations requires effluent characterization, sublethal toxicity testing, and water quality monitoring be conducted for some specific substances. However, neither boron, boric acid, nor any other of its compounds is listed in either schedule. As a result, the *Fisheries Act* prohibition of the deposit of deleterious substances to waters frequented by fish or in any place where these deleterious substances could enter such waters, would apply to boric acid, its salts and its precursors (Canada 1985c). Of note, the MDMER apply to hydrometallurgical, milling, or mining facilities, as defined under the regulations, but can also apply to base metals smelters and refineries if their effluent is combined with one of those types of facilities.

Metal ore mining and milling facilities are also subject to the *Environmental Code of Practice for Metal Mines* (EC 2009), which includes general practices for the lifecycle stages of concern identified in the updated draft assessment, including tailings management.

7.1.2 Other (acts, regulations, and communications products)

Environmental Emergency Regulations (CEPA) – Under these regulations, ECCC requires any person who owns or manages certain hazardous substances on a property, at or above the established thresholds, to notify ECCC when this quantity threshold is met or when the maximum container capacity meets or exceeds this threshold. This includes boron trichloride (CAS RN 10294-34-5), boron trifluoride (CAS RN 7637-07-2), boron trifluoride, dimethyl etherate (CAS RN 353-42-4), and diborane (CAS RN 19287-45-7). If the total quantity and container capacity threshold are both met, there is an additional requirement to prepare and exercise an environmental emergency (E2) plan. The E2 plan ensures that any individual that owns or manages specific toxic or hazardous substances above a certain threshold has a plan for preparedness, prevention, response, and recovery in the event of an environmental emergency. Environmental emergency occurrences must also be reported.

New Substances Notification Regulations (Chemicals and Polymers) (CEPA) – These regulations require that the Government of Canada be notified before a chemical or polymer that is not on the *Domestic Substances List* is manufactured or imported into Canada to determine whether it is toxic or capable of becoming toxic. Under these regulations, new substances that are polymers that are 0.2% boron or more by weight are not a reduced regulatory requirement polymer.

Transportation of Dangerous Good Regulations (*Transportation of Dangerous Goods Act*) – These regulations specify transportation requirements for several boron containing substances, classified as dangerous goods.

Cosmetics – The human health risks from substances in cosmetics are primarily managed under the *Food and Drugs Act* and the *Cosmetic Regulations*. The addition or modification of the entries in the *Cosmetic Ingredient Hotlist* (Hotlist) inform stakeholders and the public about substances that, according to Health Canada, may contravene section 16 of the *Food and Drugs Act* or may contravene one or more provisions of the *Cosmetic Regulations* when they are present in a cosmetic. Section 16 of the *Food and Drugs Act* states, among other things, that “No person shall sell any cosmetic that has in or on it any substance that may cause injury to the health of the user.”

Boric acid and its salts are described as restricted on the List of Prohibited and Restricted Cosmetic Ingredients (the Cosmetic Ingredient Hotlist). The Hotlist entry describes a maximum permitted concentration of equal to or less than 5% and indicates labels of cosmetics containing boric acid and its salts at concentrations greater than 0.1% should contain a cautionary statement to the

effect of: “Do not use on broken or abraded skin, not to be used by children under 3 years of age.”

Natural health products – Natural health products are regulated under *the* *Food and Drugs Act* and the *Natural Health Products Regulations (NHPR)* and undergo pre-market review in accordance with the NHPR. The risks to human health from substances in natural health products are primarily managed under section 7 of the NHPR, which provides for issuance or amendments to a product licence if the licence is not likely to result in injury to the health of a purchaser or consumer. The NHPID provides information on substances used as medicinal and/or non-medicinal ingredients in natural health products. The NHPID entries for substances can be revised to describe limits on the quantity and recommended uses of substances in natural health products to inform the public and stakeholders on potential health concerns. Natural health product applicants may access the information when completing a product licence application. Health Canada may access the information in the NHPID when reviewing a product licence application which may inform how a product is managed under the provisions of the NHPR, such as section 7.

Boric acid is present in a large number of licensed natural health products in Canada, both as a medicinal ingredient and a non-medicinal ingredient (Health Canada 2023d; 2022b; 2023a; 2023b; 2023c). It is most commonly used as a medicinal ingredient in multi-vitamin/mineral supplements, and at higher doses, in multiple ingredient joint health products. These products are regulated under the NHPR made under the *Food and Drugs Act*. The maximum daily dose currently permitted by the NNHPD’s Multi-Vitamin/Mineral Supplements monograph and the NNHPD Multiple Ingredient Joint Health Products monograph are 0.7 mg and 3.36 mg boron per day, respectively. The intended subpopulation listed for boron in these monographs is adults only. The source ingredients listed are boric acid, borax, boron aspartate, boron citrate, boron glycinate, boron hydrolyzed animal protein (HAP) chelate, boron hydrolyzed vegetable protein (HVP) chelate, calcium borate, calcium borogluconate, calcium fructoborate, magnesium borate, and sodium borate (Health Canada 2023d).

Non-prescription drugs – Non-prescription drugs are regulated under the *Food and Drugs Act* and the *Food and Drug Regulations* and undergo pre-market review in accordance with the *Food and Drug Regulations*. The risks to human health from substances in non-prescription drugs is primarily managed under section C.01.014.2 of the *Food and Drug Regulations*, which provides for refusal of issuance of a drug identification number if the sale of the non-prescription drug may cause injury to the health of the purchaser or consumer. The NHPID provides information on substances used as non-medicinal ingredients in non-prescription drugs. The NHPID entries for substances can be revised to describe limits on the quantity and recommended uses of substances in non-prescription drugs to inform the public and stakeholders on potential health concerns. A manufacturer of a drug may access the information in the NHPID when making an application for a drug identification number. Health Canada may access the information in the NHPID when reviewing a drug application

which may inform how a non-prescription drug is managed under provisions of the *Food and Drugs Regulations*, such as section C.01.014.2.

Toys Regulations (CCPSA) – These regulations specify that a toy must not contain boric acid or salts of boric acid if they could, under reasonably foreseeable circumstances, become accessible to a child or, if they are used as a filling, could be released on breakage or leakage.[12]

Homemade crafts using boric acid – In 2016, Health Canada published a public advisory notice, *Information Update - Health Canada advises Canadians to avoid homemade craft and pesticide recipes using boric acid*, on its website which describes risks associated with boric acid and measures that can be taken to avoid exposure.

Consumer Chemicals and Containers Regulations, 2001 (CCPSA) – These regulations include prohibitions and restrictions on dangerous chemical products and set out labelling and container requirements to inform consumers of the potential acute (short-term) hazards that a chemical product may pose during use. Labelling and container requirements are determined based on whether the product formulation meets certain scientifically derived classification criteria relating to toxicity, corrosivity, flammability, pressurized containers, or quick skin bonding.

Science Education Sets Regulations (CCPSA) – These regulations prohibit the inclusion of inorganic acids other than an aqueous solution of hydrochloric acid containing less than 5% of the acid.

Food and Drug Regulations (*Food and Drugs Act*) – Under these regulations, the inner and outer labels of drugs that contain boric acid or sodium borate as a medicinal ingredient shall carry a cautionary statement to the effect that the drug should not be administered to a child under 3 years of age.

Fertilizers Regulations (*Fertilizers Act*) – These regulations describe labelling requirements in respect to boron.

Pest Control Products Regulations (*Pest Control Products Act*) – The final re-evaluation decision on the non-antisapstain (that is, not used to protect export lumber from decay) uses of boric acid and its salts was published in July 2016 (for example, structural and residential uses). The final decision included risk reduction measures and label amendments to protect human and environmental health and must be followed by law (Canada 2016). Borax, boron, disodium tetraborate, boric acid, and boric acid disodium salt pentaborate are included on the Pest Management Regulatory Agency's list of formulants as List 3 and 4B formulants and thus may be present in other pest control products (Canada 2021). Existing formulants contained in registered pest control products in Canada are assigned to one of the following 5

[12] In June 2023, Health Canada published a notice of intent to amend the *Toys Regulations* relating to boric acid and salts of boric acid (Health Canada [modified 2023f]).

lists ranked in descending order of concern to establish priorities for regulatory activities. List 1 consists of formulants identified as being of significant concern with respect to their potential adverse effects on health and the environment. List 2 contains formulants that are considered to be potentially toxic, based on either structural similarity to List 1 formulants or data suggestive of toxicity. List 3 contains the formulants in use in registered pest control products that do not meet the criteria of any of the other lists but may become List 1 or 2 formulants if uses were to change. List 4B includes formulants, some of which may be toxic, but for which there are sufficient data to reasonably conclude that the specific use pattern of the pest control product will not adversely affect public health or the environment. List 4A includes formulants that are generally regarded to be of minimal toxicological concern as well as substances commonly consumed as foods.

Guidelines for Canadian Drinking Water Quality – These guidelines, developed by the Federal-Provincial-Territorial Committee on Drinking Water, and published by Health Canada, have established a maximum acceptable concentration of 5 mg/L for boron in drinking water (Health Canada 2023e).

Canadian Environmental Quality Guidelines – These guidelines, published by the CCME, recommend limits for the protection of aquatic life, and water and soil for agricultural use. For the protection of aquatic life, the short-term benchmark and long-term guideline concentration limits for boron are 29 mg B/L and 1.5 mg B/L, respectively, for fresh water (CCME 2009). There are no recommended guidelines for marine water. For the protection of agriculture, the guidelines are variable for irrigation and 0.5 mg B/L for livestock (CCME 1999).

7.1.3 Federal, provincial, and territorial water quality guidelines

Provinces and territories use the Guidelines for Canadian Drinking Water Quality as the basis to establish their own requirements for drinking water quality. These requirements may be established in policies, regulations or permits for individual treatment plants. The provinces and territories have a mandatory limit for boron in drinking water, based on the maximum acceptable concentration of 5 mg/L established in the Guidelines for Canadian Drinking Water Quality (Health Canada 2023). Overall, Canadian data (calculated as the weighted mean of the data from provinces and territories) show that the mean concentrations of boron across Canada in all types of municipal water supplies (that is, distributed and treated water, from ground and surface water) are below 0.1 mg/L (Health Canada 2023e).

Surface water quality guidelines for boron were found for many provinces, but not for territories. Roughly half of the provinces refer to the CCME guidelines, which recommends 1.5 and 29 mg B/L (chronic and acute, respectively) for the protection of aquatic life in fresh water, 0.5 to 6 mg B/L (crop dependent) for irrigation, and 5 mg B/L for livestock feed water (CCME 1999; 2009). A few notable exceptions are British Columbia, Ontario, and Quebec. British Columbia developed a guideline of 1.2 mg B/L for the protection of aquatic life in fresh water (Moss and Nagpal 2003). Ontario has set an interim criterion of 0.2 mg B/L for all surface waters (Ontario Ministry of

the Environment 1994). It is relevant to note that the guidelines developed by British Columbia and Ontario were put in place prior to the CCME guideline. Quebec has established a chronic limit of 28 mg B/L, and an acute limit of 55 mg B/L for the protection of aquatic life in fresh water (Gouvernement du Quebec 2022).

The CCME guideline for the long-term protection of aquatic life (1.5 mg B/L) is used by ECCC as the PNEC in the ecological assessment of boric acid, its salts and its precursors.

7.2 Pertinent international risk management context

7.2.1 United States

7.2.1.1 Statutes

Over 100 boron compounds are regulated in the US under different statutes, with legal requirements ranging from reporting and notifications to restrictions. Of relevance to the ecological risk characterized in the updated draft assessment is the *Clean Water Act* (CWA).

Under the CWA, the discharges of oil or hazardous substances into or upon navigable waters as well as contiguous waters and areas of the US is prohibited. Zinc borate (CAS RN 1332-07-6), lead fluoroborate (CAS RN 13814-96-5), and ammonium fluoroborate (CAS RN 13826-83-0) are all listed as hazardous substances under the CWA (US eCFR 2022).

In 2001, the Institute of Medicine US Food and Nutrition Board determined that, boron products regulated as dietary supplements may provide up to 20 mg of elemental boron equivalents per day in a 70 kg adult (IOM 2001). Under the *Dietary Supplements Health and Education Act* of 1994, there is no mandatory pre-market review for these products, but they are not permitted to be labelled or advertised with claims to treat any disease.

The United States Environmental Protection Agency (US EPA) has established a chronic oral reference dose of 0.2 mg/kg/day. The US EPA also has established the Lifetime Health Advisory Level for children at 2.0 mg/L and for adults at 5.0 mg/L (US EPA 2004). As well, the Agency for Toxic Substances and Disease Registry set an oral Minimal Risk Level of 0.2 mg/kg/day for acute-duration oral exposure (Agency for Toxic Substances and Disease Registry 2010).

7.2.1.2 Federal and state guidelines

Pursuant to section 304(a) of the CWA, the US EPA publishes national recommended water quality criteria. The US EPA published a criterion of 0.75 mg B/L for boron in irrigation water to protect sensitive crops during long-term exposure (US EPA 1986).

Some states have also published their own guidelines. For example, Illinois State has established acute (40.1 mg B/L) and chronic (7.6 mg B/L) water quality standards for the protection of aquatic organisms (IPCB 2014). New York State also developed chronic standards for the protection of aquatic organisms for both fresh water and saline waters of 10 mg B/L and 1 mg B/L, respectively (NY-CRR 2022). Furthermore, New York State developed a fresh groundwater limit for the protection of human health of 1 mg B/L.

7.2.2 European Union

7.2.2.1 Statutes

Boric acid (CAS RNs 10043-35-3, and 11113-50-1), boron oxide (CAS RN 1303-86-2), borax (CAS RN 1303-96-4), boron sodium oxide (CAS RN 1330-43-4), perboric acid, sodium salt (CAS RN 7632-04-4), tetraboron disodium heptaoxide, hydrate (CAS RN 12267-73-1), lead bis(tetrafluoroborate) (CAS RN 13814-96-5), boric acid, sodium salt (CAS RN 1333-73-9), sodium perborate tetrahydrate (CAS RN 10486-00-7), and sodium perborate, or perboric acid, sodium salt (CAS RN 15120-21-5) have been identified by the EU as Substances of Very High Concern for their reproductive toxicity. As a result, these substances have been listed on the Candidate List of the regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals (European Chemicals Agency 2022a). Being listed on the Candidate List may imply legal obligations for producers, importers, and suppliers of those substances (European Chemicals Agency 2022b). More importantly, substances on the Candidate List can be recommended for inclusion in the Authorisation List. Recommendations for inclusion in the Authorisation List have been published for 9 of these boron-containing substances. If added to the Authorisation List, substances cannot be placed on the market or used after a given date, unless an authorisation is granted for their specific use, or the use is exempted from authorisation (European Chemicals Agency 2022c). Perboric acid, sodium salt (CAS RN 7632-04-4), sodium perborate tetrahydrate (CAS RN 10486-00-7) and sodium perborate (CAS RN 15120-21-5) have been added to the Authorisation List (European Chemicals Agency 2022d). In the EU, as borax is no longer approved to be sold for household use, sodium sesquicarbonate has been marketed under the name “borax substitute” (European Chemicals Agency 2022a).

Dibutyltin hydrogen borate (CAS RN 75113-37-0), ammonium borate (CAS RN 22694-75-3), ammonium borate (CAS RN 27522-09-4), lead fluoroborate (CAS RN 13814-96-5), ammonium fluoroborate (CAS RN 13826-83-0), and cadmium fluoroborate (CAS RN 14486-19-2) are listed on the List of Restrictions (European Chemicals Agency 2022e). 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 EU (European Chemicals Agency 2022f). In the case of dibutyltin hydrogen borate, it cannot be placed on the market, or used, as a substance, or in mixtures in a concentration equal to, or

greater than 0.1 % by weight. An exemption exists for conversion into articles (European Chemicals Agency 2016).

Regarding nutritional supplements, the European Food Safety Authority (EFSA) set a Tolerable Upper Intake Level (UL) for boron as boric acid or sodium borate, of 10 mg/person/day for adults and stated that on the basis of safety, boric acid and sodium borate are suitable for use in foods for particular nutritional purposes, food supplements and foods intended for the general population providing the UL is not exceeded (EFSA 2004). In 2013, EFSA re-evaluated their scientific opinion of boric acid and borax as food additives and determined an acceptable daily intake of 11.2 mg/day in adults (EFSA 2013).

7.2.2.2 Guidelines

In 2013, the EU published Directive 2012/39/EU on Environmental Quality Standards. Annex I of the directive establishes limits on concentrations of certain pollutants in surface waters. However, none of the targeted pollutants is boron or a boron-containing substance (EU 2013).

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 section 3). Please submit additional information and comments prior to May 7, 2025.

If the final assessment confirms that boric acid is toxic to the environment and/or human health, a risk management approach document outlining and seeking input on the proposed risk management instrument(s) would be published concurrently with the assessment. At that time, there would be further opportunity for consultation.

Comments and information submissions on the risk management scope should be submitted to the following address:

Substances Management Information Line
Chemicals Management Plan
Environment and Climate Change Canada
Gatineau, Quebec 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 boric acid are encouraged to identify themselves as stakeholders. The stakeholders will be informed of future decisions regarding boric acid, its salts and its precursors 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 members of the public who would like to receive CMP Publication Plans on a quarterly basis by email can contact: substances@ec.gc.ca.

8.2 Timing of actions

Electronic consultation on the updated draft assessment and revised risk management scope: March 8, 2025 to May 7, 2025. This should include the submission of public comments, additional studies or information on boric acid, its salts and its precursors.

Publication of responses to public comments on the updated draft assessment and revised risk management scope: Concurrent with the publication of the final assessment and, if required, the risk management approach.

Publication of responses to public comments on the risk management approach, if applicable and if required, the proposed instrument(s): At the latest, 24 months from the date on which the Ministers recommended that boric acid, its salts and its precursors be added to Schedule 1 to CEPA.

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

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

These are planned timelines and are subject to change.

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ANNEX A. Non-exhaustive list of boric acid, its salts and its precursors

CAS RN	Chemical name	Common name	Chemical class	List
1303-86-2[b]	Boron oxide (B_2O_3)	Boron oxide	Boric acids	DSL
10043-35-3[a]	Boric acid (H_3BO_3)	Boric acid	Boric acids	DSL
11113-50-1[b]	Boric acid (crude natural)	Boric acid	Boric acids	DSL
13460-50-9	Boric acid (HBO_2)	Boric acid	Boric acids	DSL
13460-51-0	Metaboric acid	Boric acid	Boric acids	R-ICL
1303-96-4[a]	Borax ($B_4Na_2O_7.10H_2O$) (disodium tetraborate decahydrate)	Borax	Borates	DSL
1318-33-8	Colemanite ($CaH(BO_2)_3.2H_2O$)	Colemanite	Borates	NA[c]
1319-33-1	Ulexite ($CaNaH_{12}(BO_3)_5.2H_2O$)	Ulexite	Borates	NA[c]
1330-43-4[a]	Boron sodium oxide ($B_4Na_2O_7$)	Sodium tetraborate	Borates	DSL
1332-07-6[a]	Boric acid, zinc salt	Zinc borate	Borates	DSL
1332-77-0	Boron potassium oxide ($B_4K_2O_7$)	Potassium tetraborate	Borates	DSL
1333-73-9	Boric acid, sodium salt	-	Borates	DSL
7632-04-4[a]	Perboric acid ($HBO(O_2)$), sodium salt	Sodium perborate	Borates	DSL
7775-19-1	Boric acid (HBO_2), sodium salt	Sodium borate	Borates	DSL
10332-33-9[b]	Perboric acid ($HBO(O_2)$), sodium salt monohydrate	Sodium perborate monohydrate	Borates	DSL
10486-00-7	Perboric acid ($HBO(O_2)$), sodium salt tetrahydrate	Sodium perborate tetrahydrate	Borates	NA[d]
10555-76-7	Sodium metaborate tetrahydrate ($Na_2B_2O_4.8H_2O$)	Sodium metaborate tetrahydrate	Borates	NA[d]
11128-29-3	Boron potassium oxide (B_5KO_8)	Potassium pentaborate	Borates	DSL
11128-98-6	Boric acid, ammonium salt	Ammonium borate	Borates	R-ICL
11138-47-9[b]	Perboric acid, sodium salt	-	Borates	DSL
12007-60-2[a]	Boron lithium oxide ($B_4Li_2O_7$)	Lithium tetraborate	Borates	DSL
12007-89-5[a]	Ammonium boron oxide ($(NH_4)B_5O_8$)	Ammonium pentaborate	Borates	DSL
12008-41-2	Boron sodium oxide ($B_8Na_2O_{13}$)	Disodium octaborate	Borates	DSL
12045-78-2	Boron potassium oxide ($B_4K_2O_7$), tetrahydrate	Potassium tetraborate tetrahydrate	Borates	NA[d]
12045-88-4	Sodium tetraborate pentahydrate (borax pentahydrate)	Borax pentahydrate	Borates	NA[d]
12046-04-7	Borate(5-), bis[m-oxotetraoxodiborato (4-)]-, ammonium tetrahydrogen, dihydrate, (T-4)-	Ammonium pentaborate tetrahydrate	Borates	NA[d]
12179-04-3	Sodium tetraborate pentahydrate	Borax pentahydrate	Borates	NA[d]
12229-12-8	Ammonium pentaborate tetrahydrate	Ammonium pentaborate tetrahydrate	Borates	NA[d]

CAS RN	Chemical name	Common name	Chemical class	List
12229-13-9	Boron potassium oxide (B_5KO_8), tetrahydrate	Potassium pentaborate octahydrate	Borates	NA[d]
12267-73-1	Boron sodium oxide ($B_4Na_2O_7$), hydrate (1:?)	Tetraboron disodium heptaoxide	Borates	NA[d]
12271-95-3[a]	Boron silver oxide ($B_4Ag_2O_7$)	Disilver tetraborate	Borates	DSL
12280-01-2	Zinc triborate monohydrate	Zinc hexaborate (Firebrake)	Borates	NA[d]
12280-03-4	Boron sodium oxide ($B_8Na_2O_{13}$), tetrahydrate	Disodium octaborate tetrahydrate (DOT)	Borates	NA[d]
12291-65-5	Colemanite ($CaH(BO_2)_3.2H_2O$)	Colemanite	Borates	NA[c]
12447-61-9	Boron zinc oxide ($B_6Zn_2O_{11}$) hydrate (2:15)	Zinc borate	Borates	NA[d]
12767-90-7[a]	Boron zinc oxide ($B_6Zn_2O_{11}$)	Zinc borate	Borates	DSL
13453-69-5[a]	Boric acid (HBO_2), lithium salt	Lithium metaborate	Borates	DSL
13701-59-2	Boric acid (HBO_2), barium salt	Barium borate	Borates	DSL
13701-64-9	Boric acid (HBO_2), calcium salt	Calcium metaborate	Borates	DSL
13709-94-9	Boric acid (HBO_2), potassium salt	Potassium metaborate	Borates	DSL
13840-56-7[b]	Boric acid (H_3BO_3), sodium salt	Sodium orthoborate	Borates	DSL
16800-11-6	Sodium metaborate dihydrate ($Na_2B_2O_4.4H_2O$)	Sodium metaborate dihydrate	Borates	NA[d]
20786-60-1	Boric acid (H_3BO_3), potassium salt	Potassium orthoborate	Borates	DSL
22694-75-3	Boric acid (H_3BO_3), triammonium salt	Ammonium borate	Borates	R-ICL
27522-09-4	Boric acid (H_3BO_3), ammonium salt	Ammonium borate	Borates	R-ICL
68442-99-9	Manganese, borate neodecanoate complexes	Manganese boron neodeconate	Borates	DSL
68457-13-6[a]	Cobalt, borate neodecanoate complexes	Cobalt boron neodeconate	Borates	DSL
138265-88-0	Boron zinc hydroxide oxide ($B_{12}Zn_4(OH)_{14}O_{15}$)	Zinc borate (Firebrake)	Borates	NA[d]
149749-62-2	Zinc borate ($4ZnO.B_2O_3.H_2O$)	Zinc borate	Borates	NA[d]
102-24-9	Boroxin, trimethoxy-	Trimethoxyboroxine	Borate esters	DSL
121-43-7	Boric acid (H_3BO_3), trimethyl ester	Trimethyl borate	Borate esters	DSL
150-46-9	Boric acid (H_3BO_3), triethyl ester	Triethyl borate	Borate esters	DSL
2467-16-5	Boric acid (H_3BO_3), tricyclohexyl ester	Tricyclohexyl borate	Borate esters	DSL
2665-13-6	1,3,2-Dioxaborinane, 2,2'-[(1-methyl-1,3-propanediyl)bis(oxy)]bis[4-methyl-	Tributyleneglycol biborate	Borate esters	DSL
5743-34-0	D-Gluconic acid, cyclic 4,5-ester with boric acid (H_3BO_3), calcium salt (2:1)	Calcium borogluconate	Borate esters	DSL
7091-41-0	2,4,8,10-Tetraoxa-3,9-diboraspiro[5.5]undecane, 3,9-bis(4-methylphenyl)-	-	Borate esters	DSL

CAS RN	Chemical name	Common name	Chemical class	List
14697-50-8	1,3,2-Dioxaborinane, 2,2'-oxybis[4,4,6-trimethyl-	Hexyleneglycol biborate	Borate esters	DSL
51136-86-8	Hexanoic acid, 2-ethyl-, trianhydride with boric acid (H_3BO_3)	-	Borate esters	DSL
67859-60-3	Boroxin, tris[(2-ethylhexyl)oxy]-	Tri-2-ethylhexyl metaborate	Borate esters	DSL
68130-12-1	Boric acid, 2-aminoethyl ester	MEA-borate	Borate esters	R-ICL
68298-96-4	Ethanol, 2,2'-iminobis-, monoester with boric acid	DEA-borate	Borate esters	DSL
71889-05-9	Benzenemethanol, 4-amino-α-(4-amino-3,5-dimethylphenyl)-α-(2,6-dichlorophenyl)-3,5-dimethyl-, monoester with boric acid (H_3BO_3)	-	Borate esters	DSL
89325-22-4	9-Octadecenoic acid (Z)-, (2-hydroxy-1,3,2-dioxaborolan-4-yl)methyl ester	-	Borate esters	DSL
10377-81-8	Ethanol, 2-amino-, monoester with boric acid	MEA-borate	Borate esters (monoalkanolamine borate)	DSL
26038-87-9	Boric acid (H_3BO_3), compd. with 2-aminoethanol	MEA-borate	Borate esters (monoalkanolamine borate)	DSL
26038-90-4	Boric acid (H_3BO_3), compd. with 1-amino-2-propanol	MIPA-borate	Borate esters (monoalkanolamine borate)	DSL
68003-13-4	Boric acid (H_3BO_3), compd. with 1-amino-2-propanol (1:1)	MIPA-borate	Borate esters (monoalkanolamine borate)	R-ICL
68586-07-2	Boric acid (H_3BO_3), compd. with 2-aminoethanol (1:1)	Orthoboric acid ethanolamine salt	Borate esters (monoalkanolamine borate)	DSL
68797-44-4	Boric acid (H_3BO_3), compd. with 2-aminoethanol (1:3)	Boric acid, monoethanolamine salt	Borate esters (monoalkanolamine borate)	DSL
93964-50-2	Boric acid (H_3BO_3), compd. with 2-amino-2-methyl-1-propanol	-	Borate esters (monoalkanolamine borate)	DSL
64612-24-4	Boric acid (H_3BO_3), compd. with 2,2'-iminobis[ethanol] (1:1)	Orthoboric acid diethanolamine salt	Borate esters (dialkanolamine polyborate)	DSL
67952-33-4	Boric acid (H_3BO_3), compd. with 2,2'-iminobis[ethanol]	Orthoboric acid diethanolamine salt	Borate esters (dialkanolamine polyborate)	DSL
68425-66-1	Boric acid, compd. with 2,2'-iminobis[ethanol]	Diethanolamine borate	Borate esters (dialkanolamine polyborate)	DSL
68954-07-4	Boric acid, reaction products with diethanolamine	-	Borate esters (dialkanolamine polyborate)	DSL
10049-36-2	Boric acid (H_3BO_3), compd. with 2,2',2''-nitrilotris[ethanol]	Boric acid, triethanolamine salt	Borate esters (trialkanolamine borate)	DSL
10220-75-4	Boric acid (H_3BO_3), compd. with 2,2',2''-nitrilotris[ethanol] (1:1)	Boric acid, triethanolamine salt	Borate esters (trialkanolamine borate)	DSL

CAS RN	Chemical name	Common name	Chemical class	List
68512-53-8	Boric acid (H_3BO_3), reaction products with ethanolamine and triethanolamine	-	Borate esters (monoalkanolamine/trialkanolamine polyborate)	DSL
75-23-0	Boron, (ethanamine)trifluoro-, (T-4)-	Boron trifluoride ethylamine	Boron halides	DSL
109-63-7	Boron, trifluoro[1,1'-oxybis[ethane]]-, (T-4)-	Boron fluoride monoetherate	Boron halides	DSL
368-39-8	Oxonium, triethyl-, tetrafluoroborate(1-)	Triethoxonium fluoroborate	Boron halides	DSL
456-27-9	Benzenediazonium, 4-nitro-, tetrafluoroborate(1-)	4-Nitrobenzenediazonium tetrafluoroborate	Boron halides	DSL
592-39-2	Boron, trifluoro(piperidine)-, (T-4)-	Trifluoro(piperidine)boron	Boron halides	DSL
2145-24-6	Benzenediazonium, 4-sulfo-, tetrafluoroborate(1-)	-	Boron halides	DSL
7445-38-7	Boron, trifluoro[N-(phenylmethyl) benzenemethanamine]-, (T-4)-	Boron trifluoridedibenzylamine complex	Boron halides	DSL
7637-07-2	Borane, trifluoro-	Boron trifluoride	Boron halides	DSL
10294-33-4	Borane, tribromo-	Boron tribromide	Boron halides	DSL
10294-34-5	Borane, trichloro-	Boron trichloride	Boron halides	DSL
13755-29-8	Borate(1-), tetrafluoro-, sodium	Sodium fluoborate	Boron halides	DSL
13814-96-5[a]	Borate(1-), tetrafluoro-, lead(2++) (2:1)	Lead fluoroborate	Boron halides	DSL
13814-97-6	Borate(1-), tetrafluoro-, tin(2++) (2:1)	Tin fluoroborate	Boron halides	DSL
13826-83-0[a]	Borate(1-), tetrafluoro-, ammonium	Ammonium fluoroborate	Boron halides	DSL
14075-53-7	Borate(1-), tetrafluoro-, potassium	Potassium fluoroborate	Boron halides	DSL
14486-19-2[a]	Borate(1-), tetrafluoro-, cadmium (2:1)	Cadmium fluoborate	Boron halides	DSL
16872-11-0	Borate(1-), tetrafluoro-, hydrogen	Fluoroboric acid	Boron halides	DSL
34762-90-8	Boron, trichloro(N,N-dimethyl-1-octanamine)-, (T-4)-	-	Boron halides	DSL
36936-37-5	Benzeneethanaminium, 4-[[4-[ethyl[2-hydroxy-3-(trimethylammonio)propyl]amino]-2-methylphenyl]azo]-N,N,N-trimethyl-β-oxo-, bis[tetrafluoroborate(1-)]	-	Boron halides	DSL
72140-65-9	Sulfonium, (2-cyano-1-methylethyl)dodecylethyl-, tetrafluoroborate(1-)	-	Boron halides	DSL
74-94-2	Boron, trihydro(N-methylmethanamine)-, (T-4)-	Dimethylamine borane	Boranes	DSL
7337-45-3	Boron, trihydro(2-methyl-2-propanamine)-, (T-4)-	tert-Butylamine borane	Boranes	DSL
12386-10-6	Methanaminium, N,N,N-trimethyl-, octahydrotriborate(1-)	Tetramethylammonium octahydrotriborate	Boranes	DSL
16940-66-2	Borate(1-), tetrahydro-, sodium	Sodium borohydride	Boranes	DSL
19287-45-7	Diborane	Diborane	Boranes	DSL

CAS RN	Chemical name	Common name	Chemical class	List
98-80-6	Boronic acid, phenyl-	Benzeneboronic acid	Organoboron compounds	DSL
143-66-8	Borate(1-), tetraphenyl, sodium	Sodium tetraphenylborate	Organoboron compounds	DSL
3262-89-3	Boroxin, triphenyl	Triphenyl boroxin	Organoboron compounds	DSL
13331-27-6	Boronic acid, (3-nitrophenyl)-	3-Nitrobenzeneboronic acid	Organoboron compounds	DSL
66472-86-4	Boronic acid, (3-aminophenyl)-, sulfate (2:1)	3-Aminophenylboric acid hemisulphate	Organoboron compounds	DSL
91782-44-4	1,2-Ethanediol, reaction products with boron sodium oxide ($B_4Na_2O_7$)	Boric acid ($H_2B_4O_7$), disodium salt, reaction products with ethylene glycol	Organics	DSL
39405-47-5	Dextrin, reaction products with boric acid	Borated dextrine	UVCBs	DSL
58450-10-5	D-gluco-Heptonic acid, (2ξ)-, ester with boric acid (H_3BO_3), sodium salt	-	UVCBs	DSL
68131-51-1	Caseins, borated	Borated casein	UVCBs	DSL
68411-21-2	Boric acid (HB_5O_8), sodium salt, reaction products with propylene glycol	-	UVCBs	DSL
68411-22-3	Phosphoric acid, reaction products with aluminum hydroxide and boric acid (H_3BO_3)	-	UVCBs	DSL
68511-18-2	Starch, borate	Starch borate	UVCBs	DSL
68610-78-6	Acetic acid, anhydride, reaction products with boron trifluoride and 1,5,9-trimethyl-1,5,9-cyclododecatriene	-	UVCBs	DSL
68855-38-9	Formic acid, reaction products with boron trifluoride and [1S-(1α,3aβ,4α,8aβ)]-decahydro-4,8,8-trimethyl-9-methylene-1,4-methanoazulene	Longifolene formate	UVCBs	DSL
69898-30-2	Starch, base-hydrolyzed, borated	-	UVCBs	DSL
72066-70-7	Sulfite liquors and cooking liquors, spent, borated	-	UVCBs	DSL
90530-04-4	2-Propanol, reaction products with boron trifluoride and 5-ethylidenebicyclo[2.2.1]hept-2-ene	-	UVCBs	DSL
91770-03-5	Fatty acids, tall-oil, reaction products with boric acid (H_3BO_3) and diethanolamine	-	UVCBs	DSL
93924-91-5	Boric acid (H_3BO_3), reaction products with 2,2'-[(C16-18 and C16-18-unsaturated alkyl)imino]bis[ethanol]	-	UVCBs	DSL
121053-02-9	Sulfonic acids, petroleum, calcium salts, overbased, reaction products with acetic acid, boric acid and 12-hydroxyoctadecanoic acid	-	UVCBs	DSL

CAS RN	Chemical name	Common name	Chemical class	List
124751-09-3	Caseins, reaction products with ammonium hydroxide, boron sodium oxide ($B_4Na_2O_7$), sodium hydroxide and trisodium phosphate	-	UVCBs	DSL
125328-30-5	Starch, acid-hydrolyzed, borated	-	UVCBs	DSL
127087-85-8	Boric acid (H_3BO_3), reaction products with 2-(butylamino)ethanol and diethanolamine	-	UVCBs	DSL
129783-46-6	Borate(1-), tetrafluoro-, hydrogen, reaction products with 2-(ethylthio)ethanol	-	UVCBs	DSL

Abbreviations: NA, not applicable; DSL, *Domestic Substances List*; R-ICL, *Revised In Commerce List*; UVCB, substance of unknown or variable composition, complex reaction products or biological materials.
[a] Substance found to meet categorization criteria (ECCC, HC [modified 2017]).
[b] This substance did not meet categorization criteria but was prioritized through other mechanisms (ECCC, HC [modified 2017]).
[c] Substance of commercial importance.
[d] Hydrate of a substance on DSL.