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Proposed Registration Decision

PRD2025-16

Formic Acid and FENNOSURF 600-C

(publié aussi en français)

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Overview

Proposed registration decision for formic acid

Health Canada's Pest Management Regulatory Agency (PMRA), pursuant to subsection 28(1) of the *Pest Control Products Act*, is proposing registration for the sale and use of FENNOSURF 600-T and FENNOSURF 600-C, belonging to Kemira Water Solutions, Inc., containing the active ingredient formic acid, for bacterial control in municipal wastewater treatment and the manufacturing process of paper and paperboard.

Formic acid is currently registered as a miticide for the control of varroa mites and tracheal mites and is used for the treatment of honey bee colonies. For details, see Proposed Re-evaluation Decision PRVD2022-15, *Formic Acid and Its Associated End-use Products*, and Re-evaluation Decision RVD2023-05, *Formic Acid and Its Associated End-use Products*.

An evaluation of available scientific information found that, under the approved conditions of use, the health and environmental risks and the value of the pest control products are acceptable.

This Overview describes the key points of the evaluation, while the Science evaluation provides detailed technical information on the human health, environmental and value assessments of formic acid and FENNOSURF 600-C.

What does Health Canada consider when making a registration decision?

The primary objective of the *Pest Control Products Act* is to prevent unacceptable risks to individuals and the environment from the use of pest control products. Health or environmental risk is considered acceptable¹ if there is reasonable certainty that no harm to human health, future generations or the environment will result from use or exposure to the product under its proposed conditions of registration. The Act also requires that products have value² when used according to the label directions. Conditions of registration may include precautionary measures on the product label to further reduce risk.

To reach its decisions, Health Canada's PMRA applies modern, rigorous risk-assessment methods and policies. These methods consider the unique characteristics of sensitive subpopulations in humans (for example, children). They also consider the unique characteristics of organisms in the environment. These methods and policies also consider the nature of the effects observed and the uncertainties when predicting the impact of pesticides. For more information on how Health Canada's PMRA regulates pesticides, the assessment process and risk-reduction programs, please visit the Pesticides and pest management portion of Canada.ca.

¹ "Acceptable risks" as defined by subsection 2(2) of the *Pest Control Products Act*.

² "Value" as defined by subsection 2(1) of the *Pest Control Products Act*: "the product's actual or potential contribution to pest management, taking into account its conditions or proposed conditions of registration, and includes the product's (a) efficacy; (b) effect on host organisms in connection with which it is intended to be used; and (c) health, safety and environmental benefits and social and economic impact."

Before making a final registration decision on formic acid and FENNOSURF 600-C, Health Canada's PMRA will consider any written comments received from the public directly related to the proposed decision in this consultation document.³ Health Canada will then publish a Registration Decision⁴ on formic acid and FENNOSURF 600-C, which will include the decision, the reasons for it, a summary of comments received on the proposed registration decision and Health Canada's response to these comments.

For more details on the information presented in this Overview, please refer to the Science evaluation of this consultation document.

What is formic acid?

Formic acid is a naturally occurring substance found in animals (for example, venom of ants and bees), and in plants (for example, stinging nettles). Synthetic formic acid is used world-wide for a variety of commercial uses, such as a preservative and antibacterial agent in livestock feed, a chemical intermediate in the production of various pharmaceuticals, in the tanning process for leather, and as an ingredient in commercial cleaning products.

The end-use product, FENNOSURF 600-C, containing 75% formic acid, is proposed for use with a partner end-use product containing 35% hydrogen peroxide. These products are to be used exclusively together as precursors in the production of performic acid (PFA) for bacterial control in municipal wastewater treatment and paper and paperboard manufacturing processes. Performic acid is an oxidative microbicide that functions by oxidizing organic components of microorganisms. The oxidation process denatures proteins, disrupts cell wall permeability, and oxidizes sulfhydryl and sulphur bonds in proteins, enzymes, and other metabolites, causing death of the microorganism.

Health considerations

Can approved uses of formic acid affect human health?

Formic acid is unlikely to affect human health when used according to label directions.

Potential exposure to formic acid may occur via the dermal and inhalation routes when transferring, handling, and loading the product.

Toxicology studies in laboratory animals describe potential health effects from varying levels of exposure to a chemical and identify the dose where no effects are observed. When assessing health risks, two key factors are considered: the levels where no health effects occur and the levels to which people may be exposed. The levels used to assess risks are established to protect the most sensitive human population (for example, children and nursing mothers).

³ "Consultation statement" as required by subsection 28(2) of the *Pest Control Products Act*.

⁴ "Decision statement" as required by subsection 28(5) of the *Pest Control Products Act*.

As such, sex and gender are taken into account in the risk assessment. Only uses for which the exposure is well below levels that cause no effects in animal testing are considered acceptable for registration.

Toxicology data, waivers based on corrosivity of the substance, and publicly available information were considered for formic acid. Formic acid is moderately acutely toxic via the oral route of exposure, highly acutely toxic via the inhalation route of exposure, corrosive to both the skin and eyes, and is a potential skin sensitizer.

When rats and mice were exposed to formic acid by the inhalation route, respiratory and olfactory epithelium irritation was noted. Mortality was also observed in mice at the highest dose tested (HDT).

Oral administration of sodium formate, the sodium salt of formic acid, in pregnant rats and rabbits did not result in maternal or fetal toxicity.

Formic acid is not expected to be mutagenic or clastogenic.

Toxicology studies and waivers due to substance corrosivity were used to inform the toxicology profile of FENNOSURF 600-C. Consequently, this end-use product is of slight acute oral toxicity, low acute inhalation toxicity, corrosive to both the eyes and skin, and is a potential skin sensitizer.

Residues in food and drinking water

Dietary risks from food and drinking water are acceptable.

There are no proposed food or feed uses for the end-use product. Consequently, dietary exposure from the proposed uses is not expected in food commodities.

While treated water may be released to rivers, lakes, or other surface water bodies, concentrations of formic acid and PFA are expected to decrease rapidly in the environment; therefore, dietary exposure from drinking water is expected to be negligible, and a dietary risk assessment was not required.

Occupational risks from handling FENNOSURF 600-C

Occupational risks are acceptable when FENNOSURF 600-C is used according to the label directions, which include protective measures.

FENNOSURF 600-C is used only concurrently with an end-use product containing hydrogen peroxide to generate PFA in situ within a closed system. Workers connect the feeder hoses from separate sealed high-density polyethylene (HDPE) totes or bulk tankers containing either FENNOSURF 600-C or the hydrogen peroxide end-use product to the Kemira Dispensing Device, which is a closed metered system that mixes the two precursor products. During loading, the potential routes of exposure are inhalation and dermal. There is no exposure expected during mixing and application, as these processes occur within a closed system. The label of the end-use product includes precautionary statements instructing workers to ensure that air concentrations of formic acid in the workplace do not exceed exposure levels established by occupational health

and safety authorities in their jurisdiction, and that if values do exceed those levels, they are to wear National Institute for Occupational Safety and Health (NIOSH)-approved respiratory protection.

Postapplication exposure to formic acid and PFA may occur when uncoupling the feeder hoses, removing spent end-use product containers, or handling treated paper; however, this is expected to be negligible based on the short half-lives of the two chemicals. Additionally, the feeder hoses are automatically flushed with water after each PFA generation, and worker exposure is expected to be appropriately mitigated through wearing the required personal protective equipment (PPE), monitoring of exposure levels and observing precautionary statements.

Overall, occupational risks to workers are acceptable when the precautionary statements on the labels, which include PPE requirements, are followed.

Risks in residential and other non-occupational environments

Estimated risk for residential and other non-occupational exposure is acceptable.

There are no residential uses for FENNOSURF 600-C, as it is a commercial class product. Bystander exposure is not expected to be of concern from the use of FENNOSURF 600-C because the application occurs in a closed system in industrial settings and the label of the end-use product includes precautionary statements instructing that air concentrations of formic acid in the workplace must not exceed exposure levels established by occupational health and safety authorities in their jurisdiction. Consequently, the health risks to bystanders from the use of FENNOSURF 600-C are acceptable.

Environmental considerations

What happens when formic acid is introduced into the environment?

When users follow label directions, the environmental risks associated with formic acid are acceptable.

The use pattern of FENNOSURF 600-C is unlikely to lead to the release of formic acid or PFA to land. Thus, the risk to plants and animals on land is minimal. Formic acid and PFA may be released to rivers, lakes, or other water bodies in the environment when effluent is released from wastewater treatment plants and paper and paperboard manufacturing plants. Concentrations of formic acid and PFA in treated water are expected to decrease when treated water mixes with environmental waters. Also, bacteria are expected to break down formic acid and PFA quickly in the environment. The risk to plants and animals in water is acceptable when users follow the label directions, which include the required key risk-reduction measures.

Value considerations

What is the value of FENNOSURF 600-C?

FENNOSURF 600-C is a precursor of PFA, which is proposed to be used for bacterial control in the treatment of municipal wastewater and in the manufacturing process of paper and paperboard.

The registration of FENNOSURF 600-C as a precursor of PFA will expand the list of options available for the treatment of municipal wastewater and industrial fluids. Performic acid serves as an alternative to chemicals such as chlorine and peracetic acid, which can leave unwanted byproduct residue in the treated water and, given their slow degradation, can cause potential harm to aquatic ecosystems.

Measures to minimize risk

Labels of registered pesticide products include specific instructions for use. Directions include risk-reduction measures to protect human health and the environment. These directions must be followed by law.

The key risk-reduction measures being proposed on the labels of FENNOSURF 600-T and FENNOSURF 600-C to address the potential risks identified in this assessment are as follows.

Key risk-reduction measures

Human health

The following signal words and hazard statements are required on both the technical grade active ingredient and end-use product labels: “DANGER”, “POISON”, “CORROSIVE TO EYES AND SKIN”, and “POTENTIAL SKIN SENSITIZER”.

Standard precautionary statements are also required on the labels to inform users that the products may be fatal if swallowed or inhaled (technical grade active ingredient) or harmful if swallowed (end-use product), corrosive/e to the eyes and skin, and to warn of the potential for sensitization.

For FENNOSURF 600-C, workers are required to wear goggles or a face shield, coveralls over a long-sleeved shirt, long pants, chemical-resistant gloves, socks and chemical-resistant footwear while transferring/handling/loading the product. Postapplication workers must also wear appropriate PPE.

To limit user and bystander exposure, the end-use product label requires the following precautionary statement: “Ensure that formic acid air concentrations in the workplace do not exceed the exposure levels established by occupational health and safety authorities in your jurisdiction. If values are unknown, or exceed these levels, wear NIOSH-approved respiratory protection.”

Environment

Statements informing users of toxicity to aquatic organisms and that they must follow any Canadian laws related to the release of wastewaters to the environment (for example, the *Fisheries Act*) are required on the end-use product label.

Next steps

Before making a final registration decision on formic acid and FENNOSURF 600-C, Health Canada's PMRA will consider any written comments received from the public that are directly related to this proposed decision, such as comments directed to the science evaluation, in response to this consultation document up to 30 days from the date of publication of this document (by 4 January 2026). If more time is required to provide comments, a request for an extension of up to 15 days can be made. Your request must be submitted in writing to the PMRA's Publications Section (pmra.publications-arla@hc-sc.gc.ca) within the 30-day consultation period.

Please forward all comments to PMRA Publications, through the Public Engagement Portal (Public Engagement Portal forms – Consultation Comment). Health Canada will then publish a Registration Decision, which will include its decision, the reasons for it, a summary of comments received on the proposed decision and Health Canada's response to these comments.

Other information

When Health Canada's PMRA makes its registration decision, it will publish a Registration Decision on formic acid and FENNOSURF 600-C (based on the Science evaluation Section of this consultation document). In addition, the test data referenced in this consultation document will be available for public inspection, upon application, in the PMRA's Reading Room. For more information or if you have questions, please contact the PMRA's Pest Management Information Service.

Science evaluation

Formic acid and FENNOSURF 600-C

1.0 The active ingredient, its properties and uses

1.1 Identity of the active ingredient

Active substance Formic acid

Function Slimicide

Chemical name:

1. International Union of Pure and Applied Chemistry (IUPAC) Formic acid

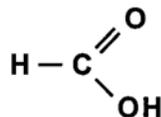
2. Chemical Abstracts Service (CAS) Formic acid

CAS number 64-18-6

Molecular formula CO_2H_2

Molecular weight 46.03

Structural formula



Purity of the active ingredient 95.97%

1.2 Physical and chemical properties of the active ingredient and end-use product

Technical product — FENNOSURF 600-T

Property	Result
Colour and physical state	Colourless clear liquid
Odour	Pungent odour
Melting range	8.3°C
Boiling point or range	100.8°C
Density	1.22 g/mL at 20°C
Vapour pressure at 20°C	4.473 kPa
Ultraviolet (UV)-visible spectrum	$\lambda_{\text{max}} = 206 \text{ nm}$, $\epsilon = 44.4 \text{ L}\cdot\text{mol}^{-1}\cdot\text{cm}^{-1}$
Solubility in water at 20°C	Miscible with water
Solubility in organic solvents	Miscible in any ratio with 1,4-dioxane, N,N-dimethylformamide, and dichloromethane at 20°C and 30°C

Property	Result
<i>n</i> -Octanol-water partition coefficient (K_{ow})	Not available (known to be miscible with both octanol and water)
Dissociation constant (pK_a)	3.74
Stability (temperature, metal)	Known to be corrosive to metals; the rate of the decomposition increases with temperature.

End-use product — FENNOSURF 600-C

Property	Result
Colour	Colourless to yellow
Odour	Pungent odour
Physical state	Liquid
Formulation type	Solution
Label concentration	75%
Container material and description	HDPE totes or HDPE-lined containers
Density	1.26 g/mL at 20°C
pH of 1% dispersion in water	1.6
Oxidizing or reducing action	Waived – This solution is not intended to come into contact with any common oxidizing or reducing agents. Following production, the solution is immediately packaged into HDPE containers for transportation to the use site. At the use site, it is transferred to a holding tank via a closed system.
Storage stability	The product was stable for 14 days when stored at 54°C in the HDPE containers.
Corrosion characteristics	No corrosion to the HDPE containers was observed after 2 weeks of storage at 54°C.
Explosibility	This solution is not potentially explosive.

1.3 Directions for use

FENNOSURF 600-C, containing 75% formic acid, is intended to be used as a precursor of PFA, which will be used for bacterial control in municipal wastewater treatment and the manufacturing process of paper and paperboard.

1.4 Mode of action

Performic acid is an oxidative microbicide that functions by oxidizing organic components of microorganisms. The oxidation process will denature proteins, disrupt cell wall permeability, and oxidize sulfhydryl and sulfur bonds in proteins, enzymes, and other metabolites, causing death of the microorganism.

2.0 Methods of analysis

2.1 Methods for analysis of the active ingredient

The methods provided for the analysis of the active ingredient and impurities in the technical product have been validated and assessed to be acceptable.

2.2 Method for formulation analysis

The method provided for the analysis of the active ingredient in the formulation has been validated and assessed to be acceptable for use as an enforcement analytical method.

2.3 Methods for residue analysis

No methods are required to quantify residues of formic acid because there are no proposed food uses.

3.0 Impact on human and animal health

3.1 Toxicology summary

A detailed review of toxicology information was conducted in support of the active ingredient, formic acid, and the end-use product, FENNOSURF 600-C. The data package for formic acid is considered acceptable to assess the toxic effects that may result from exposure to formic acid from the use of the associated end-use product.

The toxicological database for formic acid and FENNOSURF 600-C consists of publicly available information, toxicological studies (Appendix I, Tables 1 and 2), and science-based rationales to waive certain data requirements. These sources of information formed a weight of evidence that is considered sufficient to characterize the toxicity of the active ingredient for use in the associated end-use product.

Formic acid is moderately acutely toxic by the oral route of exposure. Due to its expected corrosivity owing to its pH, formic acid is classified as highly acutely toxic by the inhalation route of exposure. The data requirements for eye and skin irritation studies were also waived due to the corrosive nature of formic acid. Although a Buehler test on guinea pigs involving formic acid did not result in skin sensitization, reports suggest sensitization potential for formic acid in humans; thus, it was classified as a potential skin sensitizer.

In a 13-week inhalation study conducted by the National Toxicology Program, rats and mice were exposed to formic acid vapour by whole body exposure. Mortality was observed in mice at the HDT of 128 ppm. Body weight gains were significantly decreased in mice exposed to 64 and 128 ppm. Microscopic changes, including lesions such as respiratory epithelium squamous metaplasia and olfactory epithelium degeneration in rats and mice, ranged from minimal to mild in severity and were primarily observed in animals exposed to the HDT. Therefore, the no observed adverse effect concentration (NOAEC) for formic acid in both rats and mice was 64 ppm.

When sodium formate, the sodium salt of formic acid, was orally administered to pregnant rats and rabbits, no maternal or fetal toxicity was observed. The maternal and developmental no observed adverse effect level (NOAEL) was ≥ 945 mg/kg bw/day in rats and ≥ 1000 mg/kg bw/day in rabbits.

Bacterial mutation assays involving formic acid yielded negative results. Likewise, in vitro genotoxicity tests in mammalian cells were negative. Therefore, formic acid is not expected to be mutagenic or clastogenic.

Acute toxicology data and waivers based on the corrosivity of FENNOSURF 600-C were considered. This end-use product is of slight acute oral toxicity, and of low acute inhalation toxicity. The data requirements for eye and skin irritation and skin sensitization studies were also waived due to the corrosive nature of formic acid. FENNOSURF 600-C was classified as a potential skin sensitizer because reports suggest that formic acid may result in dermal sensitization in some individuals.

3.2 Occupational, residential and bystander exposure and risk assessment

3.2.1 Use description

FENNOSURF 600-C is proposed for use as a commercial class slimicide to treat municipal wastewater and paper and paperboard manufacturing process water. FENNOSURF 600-C is to be used only with another end-use product containing hydrogen peroxide to generate PFA *in situ* within a closed system.

Workers connect the feeder hoses from separate sealed HDPE totes or bulk tankers containing either FENNOSURF 600-C or the hydrogen peroxide end-use product to a closed, metered system called the Kemira Dispensing Device. The mixing is done within the Kemira Dispensing Device at a volumetric ratio of 1 L of FENNOSURF 600-C with 1 L of the end-use product containing hydrogen peroxide. The resulting PFA is dispensed into the process waters by a closed, metered system.

For a municipal wastewater treatment system, the generated PFA is to be applied at a rate of 10 ppm in the effluent. For paper and paperboard manufacturing, the generated PFA is to be applied at a rate of 10–20 ppm, depending on the oxidant demand of the given system.

3.2.2 Occupational exposure and risk assessment

Once every four days, workers connect the feeder hoses from the sealed containers of FENNOSURF 600-C and the hydrogen peroxide end-use product to the Kemira Dispensing Device. During loading, the potential routes of exposure are dermal and inhalation. There is no exposure expected during mixing and application, as these processes occur within a closed system.

To protect workers from exposure to FENNOSURF 600-C, workers are required to wear goggles or a face shield, coveralls over a long-sleeved shirt, long pants, chemical-resistant gloves, socks and chemical-resistant footwear while transferring/handling/loading the product.

Postapplication exposure of workers to formic acid and PFA from handling treated paper is expected to be negligible based on the short half-lives of formic acid and PFA. Postapplication exposure to formic acid and PFA from uncoupling the feeder hoses and removing spent containers is also expected to be negligible. The feeder hoses are automatically flushed with water after each PFA generation, and worker exposure is expected to be appropriately mitigated through the required PPE and observance of exposure levels and precautionary statements. The label of the end-use product includes precautionary statements instructing workers to ensure that air concentrations of formic acid in the workplace do not exceed exposure levels established by occupational health and safety authorities in their jurisdiction, and that if values do exceed those levels, they are to wear NIOSH-approved respiratory protection. Based on the information outlined in this section, risk from postapplication exposure to formic acid and PFA used in industrial settings is not expected to be of concern.

Overall, occupational risks to workers are acceptable when the precautionary statements on the labels, which include PPE requirements, are followed.

3.2.3 Residential and bystander exposure and risk

There are no residential uses for FENNOSURF 600-C. In addition, bystander exposure is not expected to be of concern because the application occurs in a closed system, formic acid and PFA have short half-lives, and exposure is expected to be appropriately mitigated through the observance of exposure levels and precautionary statements. Consequently, the health risks to bystanders from the use of FENNOSURF 600-C are acceptable.

3.3 Dietary exposure and risk assessment

3.3.1 Food

There are no proposed food or feed uses for the end-use product. Consequently, dietary exposure from the proposed uses is not expected in food commodities, and a dietary risk assessment was not required.

3.3.2 Drinking water

Water from wastewater treatment plants and paper and paperboard manufacturing plants treated with PFA may result in the release of formic acid and PFA to rivers, lakes, or other surface water bodies. Concentrations of formic acid and PFA are expected to decrease when treated water mixes with environmental waters. Bacteria are also expected to break down formic acid and PFA quickly in the environment. Furthermore, formic acid and PFA have short half-lives. Therefore, dietary exposure from drinking water is expected to be negligible. Consequently, health risks from residues of formic acid and PFA in drinking water are not of concern.

3.3.3 Acute and chronic dietary risks for sensitive subpopulations

When the end-use product is used as directed on the label, the health risk is acceptable for the general population, including infants and children.

3.4 Aggregate exposure and risk

Aggregate exposure is the total exposure to a single pesticide that may occur from food, drinking water, residential and other non-occupational sources, and from all known or plausible exposure routes (oral, dermal, and inhalation).

In an aggregate risk assessment, the combined potential risk associated with food, drinking water, and various residential exposure pathways is assessed. A major consideration is the likelihood of co-occurrence of exposures. Additionally, only exposures from routes that share common toxicological endpoints can be aggregated.

The use pattern of the end-use product is limited to the generation of PFA in a closed system in commercial facilities; thus, when used as directed on the label, non-occupational exposure to formic acid and PFA will be low. No food uses are proposed. While treated water may be released to rivers, lakes, or other surface water bodies, concentrations of formic acid and PFA are expected to decrease rapidly in the environment. Therefore, dietary exposure to formic acid and PFA from drinking water is expected to be negligible.

When the end-use product is used as labelled, there is reasonable certainty that no harm will result from aggregate exposure of residues from formic acid and PFA to the general population in Canada, including infants and children. This includes all anticipated dietary (food and drinking water) exposure, and all other non-occupational exposures (dermal and inhalation) for which there is reliable information.

3.5 Cumulative assessment

The *Pest Control Products Act* requires that the PMRA consider the cumulative non-occupational exposure to pesticides with a common mechanism of toxicity, based on the likelihood that people may be exposed to more than one of these pesticides at the same time. Accordingly, assessments of potential common mechanisms of toxicity with other pesticides were undertaken for formic acid.

Under the proposed condition of use, there is no anticipated residential or dietary exposure. Therefore, there is no requirement for a cumulative health risk assessment at this time.

3.6 Maximum residue limits

The specification of maximum residue limits for formic acid was not required for the proposed non-food use of formic acid.

3.7 Health incident reports

As of 9 July 2025, no human or domestic animal incidents involving formic acid had been submitted to the PMRA.

4.0 Impact on the environment

4.1 Fate and behaviour in the environment

The use of formic acid to produce PFA for disinfection of water in municipal wastewater treatment plants and paper and paperboard manufacturing facilities may result in the release of effluents containing both substances to the aquatic environment. Effluent is not expected to be released to the terrestrial environment. A summary of aquatic fate studies conducted using PFA is presented in Appendix I, Table 3.

Formic acid occurs naturally in plants and is a product of the microbial transformation of organic matter. It mixes easily with water, where it is likely to be present mostly in its negatively charged form, formate. Formate is expected to preferentially remain in the water column rather than partition to sediment or volatilize into the air. Rapid degradation of formic acid by microorganisms in municipal wastewater treatment plant effluent suggests that similarly rapid degradation will occur in environmental waters.

Performic acid is produced from the reaction between formic acid and hydrogen peroxide. The reaction is incomplete, resulting in the presence of all three chemicals in solution. Performic acid mixes easily with water and is also highly unstable in water. For example, hydrolysis of PFA occurs rapidly and can lead to the formation of formic acid and hydrogen peroxide.

Formic acid, formate, and PFA are unlikely to bioaccumulate in aquatic organisms.

4.2 Environmental risk characterization

An environmental risk assessment was conducted, as described in the PMRA Guidance Document, Health Canada's Approach to Environmental Risk Assessment for Pest Control Products, to estimate the potential for adverse effects on non-target species. Environmental exposure and ecotoxicology information were integrated by comparing estimated environmental concentrations (EECs) to effects-based values used to assess risk (effects metrics).

Effects metrics were calculated by adjusting ecotoxicity values with an uncertainty factor (UF) in order to account for potential differences in species sensitivity as well as varying protection goals (that is, protection at the community, population, or individual level). Acute and chronic ecotoxicological data for non-target organisms are summarized in Appendix I, Table 4; UFs and effects metrics are provided in Appendix I, Table 5. Estimated environmental concentrations for formic acid and PFA were calculated considering the product application rate, the stoichiometry for the chemical reaction required to produce PFA, the transformation of PFA into formic acid (for formic acid EECs only), and the dilution of treated effluent upon discharge into the environment. Details on the UFs and EECs are provided in the footnotes of Appendix I, Table 5.

Initially, a screening level risk assessment was performed for each substance. The screening level risk assessment used a simple and conservative exposure scenario. For a given effects metric, a risk quotient (RQ) was calculated by dividing the EEC by the effects metric. Each RQ was then compared to the level of concern (LOC).

If the screening level RQs were below the LOC for a given substance, the risk was considered acceptable and no further risk characterization was necessary. If any screening level RQs were equal to or greater than the LOC, a refined risk assessment considering additional and more realistic information was used to further characterize the risk.

4.2.1 Risks to terrestrial organisms

The risk to non-target terrestrial organisms from formic acid and PFA is acceptable due to the negligible terrestrial exposure expected from the proposed uses.

4.2.2 Risks to aquatic organisms

Due to the potential for aquatic exposure from the proposed uses, a screening level aquatic risk assessment was performed for formic acid and PFA (Appendix I, Table 5). Toxicity data were available for freshwater invertebrates, fish, and algae for formic acid (or ammonium formate) and PFA. The following conservative assumptions were made for the assessment:

- The concentration of PFA in treated effluent is the maximum labelled dosing concentration of 20 ppm (20 mg/L), corresponding to use in paper and paperboard manufacturing plants. Note that the maximum labelled dose in wastewater treatment plants is 10 ppm (10 mg/L).
- The concentration of formic acid in treated effluent is made up of 1) residual formic acid resulting from the incomplete chemical reaction that occurs when producing the maximum labelled dosing rate of PFA and 2) 100% transformation of PFA back into formic acid on a molar basis.
- Treated effluent is diluted by a factor of 10 upon mixing with environmental waters.
- There is no degradation of formic acid or PFA in environmental waters.

At the screening level, RQs were below the LOC of 1 for exposure of all assessed organisms to formic acid. Thus, the risk to aquatic organisms from the proposed use of formic acid is acceptable.

At the screening level, RQs for exposure of all assessed organisms to PFA exceeded the LOC and ranged from 4.7 to 12. For use in wastewater treatment plants, where the maximum dose of PFA is half of that in paper and paperboard manufacturing plants, the resulting RQs would consequently be halved to range from 2.4 to 6. These RQs are likely conservative for the majority of settings where effluent is released to environmental waters. This is because:

- Dilution factor data for water bodies receiving wastewater treatment plant effluent suggest that in most situations, the dilution factor will be greater than 10. According to recent data from Environment and Climate Change Canada, among wastewater treatment plants with identified watercourse dilution factors, 20% have a dilution factor of less than 10, 35% have a dilution factor between 10 and 100, and 45% have a dilution factor greater than 100 (PMRA No. 3685863). A dilution factor of 100 would result in a maximum RQ of 1.2.
- Exposure at the estimated levels may occur at the immediate release point of the effluent but is expected to decrease quickly due to the short half-life of PFA.

- The *Pulp and Paper Effluent Regulations* (SOR/92-269, last amended on 26 September 2018) and *Wastewater Systems Effluent Regulations* (SOR/2012-139, last amended on 27 May 2024) under the *Fisheries Act* aim in part to prevent the discharge of effluent that is acutely toxic to fish. While the available data indicate that fish are not the most sensitive organisms to PFA, compliance with the regulations still likely results in release of lower-risk effluents. Recent reports from Environment and Climate Change Canada (PMRA No. 3685858 and 3685862) indicate a relatively high degree of compliance with acute toxicity requirements. There were no failures at 88% of tested wastewater systems in 2018 or in 98.7% of tests with pulp and paper mill effluents in 2022.

The relatively low screening level RQs and the considerations previously described in this section indicate that the risk to aquatic organisms from exposure to PFA in treated effluent is acceptable when users follow FENNOSURF 600-C label directions. Required risk reduction measures include environmental label statements that advise users of the toxicity to aquatic organisms and inform users that they must follow any applicable Canadian legislation governing the release of effluents to the environment (for example, the *Fisheries Act*, which includes the pursuant regulations previously noted in this section).

4.2.3 Incident reports

As of 9 July 2025, ten environmental incidents involving formic acid had been submitted to the PMRA. These incidents were related to the use of formic acid to control varroa mites in beehives and/or application to cranberry fields where hives were located and are not related to the proposed use pattern. Therefore, they were not considered further for risk assessment.

5.0 Value

In the paper and paperboard industry, the most common pest problems are bacteria and fungi that form slime on the machinery in industrial circuits, causing potential breakdown and costly repairs. In municipal wastewater, the pests consist of bacteria, fungi, viruses, and spores.

Several microbicides containing a variety of active ingredients are registered to treat water in industrial processes. FENNOSURF 600-C and its partner hydrogen peroxide product are a new combination of end-use products resulting in the production of PFA, which is proposed to be used for bacterial control in municipal wastewater and fluids in paper and paperboard industries, where the paper or paperboard may come into contact with food. The two end-use products are already registered by the United States Environmental Protection Agency (USEPA) with claims against fungi, algae, and bacteria.

The registrant submitted efficacy data from onsite studies in municipal wastewater facilities and paper mill plants. In the wastewater study, results demonstrated that among the three tested doses, only the HDT, 10 ppm of PFA, was able to achieve a 3-log reduction of relevant bacteria (total bacteria, enterobacteria, *E. coli*, and coliform) after both 5 and 30 minutes of exposure.

Results from the paper mill study demonstrated that 9.5% PFA was able to achieve a ≥ 3 -log reduction after 60 minutes using a dose of 10 ppm in two challenging sampling areas. A dose of 20 ppm was able to achieve this result within 5 minutes in both samples. Lower rates of 2 and 5 ppm were ineffective in obtaining a 3-log reduction across any exposure time tested.

Supported uses are summarized in Appendix I, Table 6.

6.0 Pest Control Product Policy considerations

6.1 Toxic Substances Management Policy considerations

The Toxic Substances Management Policy (TSMP) is a federal government policy developed to provide direction on the management of substances of concern that are released into the environment. The TSMP calls for the virtual elimination of Track 1 substances, in other words, those that meet all four criteria outlined in the policy: persistent (in air, soil, water and/or sediment), bio-accumulative, primarily a result of human activity and toxic as defined by the *Canadian Environmental Protection Act*. The *Pest Control Products Act* requires that the TSMP be given effect in evaluating the risks of a product.

Health Canada's assessment of formic acid in accordance with the PMRA Regulatory Directive DIR99-03⁵ and evaluation against the Track 1 criteria is presented in PRDD2004-05, *Formic Acid/NOD Formic Acid Pad and Mite-Away II Formic Acid Pad*. Health Canada reached the conclusion that formic acid does not meet all of the TSMP Track 1 criteria, and is not expected to form any transformation products that meet all of the TSMP Track 1 criteria.

6.2 Formulants and contaminants of health or environmental concern

During the review process, contaminants in the active ingredient as well as formulants and contaminants in the end-use products are compared against Parts 1 and 3 of the *List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern*.⁶ The list is used as described in the PMRA Science Policy Note SPN2020-01⁷ and is based on existing policies and regulations, including the *Toxic Substance Management Policy* and *Formulants Policy*,⁸ and taking into consideration the *Ozone-depleting Substances and Halocarbon Alternatives Regulations* under the *Canadian Environmental Protection Act, 1999*, (substances designated under the *Montreal Protocol*).

⁵ DIR99-03, *The Pest Management Regulatory Agency's Strategy for Implementing the Toxic Substances Management Policy*

⁶ SI/2005-114, last amended on June 24, 2020. See Justice Laws website, Consolidated Regulations, *List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern*.

⁷ PMRA's Science Policy Note SPN2020-01, *Policy on the List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern under paragraph 43(5)(b) of the Pest Control Products Act*.

⁸ DIR2006-02, *Formulants Policy and Implementation Guidance Document*.

The PMRA has reached the conclusion that FENNOSURF 600-T and its end-use product, FENNOSURF 600-C, do not contain any formulants or contaminants identified in the *List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern*.

The use of formulants in registered pest control products is assessed on an ongoing basis through PMRA formulant initiatives and Regulatory Directive DIR2006-02.

7.0 Proposed regulatory decision

Health Canada's PMRA, pursuant to subsection 28(1) of the *Pest Control Products Act*, is proposing registration for the sale and use of FENNOSURF 600-T and FENNOSURF 600-C, containing the technical grade active ingredient formic acid, for the treatment of municipal wastewater and fluids in the manufacturing process of paper and paperboard.

An evaluation of available scientific information found that, under the approved conditions of use, the health and environmental risks and the value of the pest control products are acceptable.

List of abbreviations

♀	female
♂	male
ϵ	molar absorption coefficient
λ_{\max}	wavelength of maximum absorption
=	equal to
>	greater than
\geq	greater than, or equal to
%	percent
#	number
°C	degree Celsius
bw	body weight
CAS	Chemical Abstracts Service
CHO	Chinese hamster ovary
cm	centimetres
CSO	combined sewer overflow
DIR	Regulatory Directive
EC ₅₀	effective concentration on 50% of the population
EEC	estimated environmental concentration
E _b C ₅₀	effective concentration resulting in 50% reduction of biomass
E _r C ₅₀	effective concentration resulting in 50% reduction of growth rate
E _y C ₅₀	effective concentration resulting in 50% reduction of yield
g	gram
HDPE	high-density polyethylene
HDT	highest dose tested
IUPAC	International Union of Pure and Applied Chemistry
kg	kilogram
K_{ow}	<i>n</i> -octanol-water partition coefficient
kPa	kilopascal
L	litre
LC ₅₀	lethal concentration on 50% of the population
LD ₅₀	lethal dose 50%
LOC	level of concern
LOEC	lowest observed effect concentration
mg	milligram
mL	millilitre
mol	mole
MRID	US Master Record Identification Number
NIOSH	National Institute for Occupational Safety and Health
nm	nanometres
NOAEC	no observed adverse effect concentration
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
OECD	Organisation for Economic Co-operation and Development
PFA	performic acid
p <i>K</i> _a	dissociation constant
PMRA	Pest Management Regulatory Agency

PPE	personal protective equipment
ppm	parts per million
PRDD	Proposed Regulatory Decision Document
PRVD	Proposed Re-evaluation Decision Document
RQ	risk quotient
RVD	Re-evaluation Decision Document
SI	Statutory Instrument
SPN	Science Policy Note
SOR	Statutory Orders and Regulations
TSMP	Toxic Substances Management Policy
UF	uncertainty factor
USEPA	United States Environmental Protection Agency
UV	ultraviolet

Appendix I Tables

Table 1 Toxicity profile of formic acid

Study type/Animal/PMRA No.	Study results
Special studies	
Prenatal developmental toxicity Wistar rats PMRA No. 3185742	Maternal and developmental NOAEL \geq 945 mg/kg bw/day (HDT) No evidence of sensitivity of the young.
Prenatal developmental toxicity Himalayan rabbits PMRA No. 3185744	Maternal and developmental NOAEL \geq 1000 mg/kg bw/day (HDT) No evidence of sensitivity of the young.
In vitro mammalian cell assay CHO cells PMRA No. 3185746	Negative. Not mutagenic.

Table 2 Toxicity profile of FENNOSURF 600-C

Study type/Animal/PMRA No.	Study results
Acute toxicity studies	
Acute Oral LD ₅₀ Rat (♀) PMRA No. 3185633	LD ₅₀ = 1098 mg/kg bw Slightly acutely toxic.
Acute Inhalation LC ₅₀ Rat (♂, ♀) PMRA No. 3185634	LC ₅₀ = 2.32 mg/L Low acute toxicity.

Table 3 Summaries of submitted performic acid (PFA) fate studies

Process	Test material	Experimental parameters	Key results	PMRA No.
Hydrolysis	PFA	73 mg/L in deionized water pH 7, 23°C Duration: 26 hours	Half-life: 28 minutes No PFA detected after 5 hours. Formic acid (no other carbon-containing products formed during test), hydrogen peroxide concentrations increased	3185639

Process	Test material	Experimental parameters	Key results	PMRA No.
			<p>as PFA dissipated.</p> <p>Test conducted at much higher concentration than proposed maximum residual (20 mg/L).</p> <p>Classification: Qualitative</p>	
Biotransformation	PFA	<p>0 (control) to 100 mg/L in paper machine circulation water incubated at 45°C</p> <p>Duration: 3 hours</p>	<p>Half-life: Approximately 5 minutes</p> <p>PFA levels below background within 20 minutes of dosing.</p> <p>Dosing range includes proposed maximum residual in paper process water (20 mg/L).</p> <p>Classification: Qualitative</p>	3185638
Biotransformation	PFA	<p>1 mg/L in ultra-high quality filtered water (control) and in wastewater treatment plant effluents from Finland</p> <p>Temperature not reported</p> <p>Duration: 120 hours</p>	<p>PFA levels decreased by approximately 50% within 30 minutes, with slower decrease afterwards to background levels by 48 hours.</p> <p>Dosing was lower than proposed maximum residual for wastewater (10 mg/L).</p> <p>Classification: Qualitative</p>	3185641

Process	Test material	Experimental parameters	Key results	PMRA No.
Biotransformation	PFA	1 to 7.5 mg/L in combined sewer overflow (CSO) waters taken at different times during a CSO event near Copenhagen, Denmark Temperature not reported Duration: 2 hours	PFA levels decreased by more than 50% within 20 minutes, and dissipated almost completely by 2 hours. Maximum dosing was slightly lower than proposed maximum residual for wastewater (10 mg/L). Classification: Qualitative	3185626

Table 4 Effects of formic acid and performic acid (PFA) on aquatic organisms

Organism	Exposure	Test substance ¹	Endpoint value	Degree of toxicity ²	PMRA No.
Water flea (<i>Daphnia magna</i>)	48-hour acute	Ammonium formate (97% purity)	EC ₅₀ = 258 mg formic acid/L	Practically non-toxic	3185751
		PFA solution (9.5%)	LC ₅₀ = 0.52 mg PFA/L	Highly toxic	3249785
		PFA solution (produced from formic acid (85%) and hydrogen peroxide (50%))	EC ₅₀ = 0.85 mg PFA/L	Highly toxic	3249791
	21-day chronic	Formic acid (99.4% purity)	NOEC ≥ 100 mg formic acid/L LOEC > 100 mg formic acid/L No significant effects on reproduction, weight, or length at any test concentration.	-	3185753
Water flea (<i>Ceriodaphnia dubia</i>)	48-hour acute	PFA solution (9.5%)	LC ₅₀ = 0.43 mg PFA/L	Highly toxic	3249786
			LC ₅₀ = 0.41 mg PFA/L		3249787

Organism	Exposure	Test substance ¹	Endpoint value	Degree of toxicity ²	PMRA No.
Rainbow trout (<i>Oncorhynchus mykiss</i>)	96-hour acute	Formic acid (85.6% purity)	LC ₅₀ > 100 mg formic acid/L	Practically non-toxic	3185754
Zebra fish (<i>Danio rerio</i>)	96-hour acute	Ammonium formate (97% purity)	LC ₅₀ = 92 mg formic acid/L	Slightly toxic	3185755
Fathead minnow (<i>Pimephales promelas</i>)	48-hour acute	PFA solution (9.5%)	LC ₅₀ = 3.03 mg PFA/L	Moderately toxic	3249789
Green alga (<i>Raphidocelis subcapitata</i>)	72-hour acute	Ammonium formate (97% purity)	E _y C ₅₀ = 211 mg formic acid/L E _b C ₅₀ = 227 mg formic acid/L E _r C ₅₀ = 878 mg formic acid/L	Practically non-toxic	3185758
	72-hour acute	PFA solution (same as in <i>D. magna</i> test, PMRA No. 3249791)	E _r C ₅₀ = 0.34 mg PFA/L	Highly toxic	3249791
Aquatic vascular plant	Data requirement waived due to: - Low toxicity to other freshwater organisms (formic acid); and - Rapid degradation in the environment (both formic acid and PFA).				3196772 3249792

¹ Ammonium formate as test substance: Endpoints were calculated to reflect the level of formic acid in the test substance using a molar ratio of 0.73 (46.03 g/mol formic acid/63.056 g/mol ammonium formate). Performic acid as test substance: Due to its instability, PFA was generated on-site for immediate use by reacting formic acid and hydrogen peroxide with sulfuric acid as catalyst, resulting in test solutions containing all four of these substances.

² USEPA classification, where applicable.

Table 5 Screening level risk quotients for aquatic organisms

Organism	Exposure	Effects metric ¹	EEC ²	RQ ³	LOC ⁴ exceeded?
Formic acid					
Water flea (<i>D. magna</i>)	48-hour acute	EC ₅₀ /2 = 129 mg/L	8.34 mg/L	0.06	No
	21-day chronic	NOEC ≥ 100 mg/L	8.34 mg/L	≤ 0.08	No
Rainbow trout (<i>O. mykiss</i>)	96-hour acute	LC ₅₀ /10 > 10 mg/L	8.34 mg/L	< 0.83	No
Zebra fish	96-hour	LC ₅₀ /10 = 9.2 mg/L	8.34 mg/L	0.91	No

Organism	Exposure	Effects metric ¹	EEC ²	RQ ³	LOC ⁴ exceeded?
(<i>D. rerio</i>)	acute				
Green alga (<i>R. subcapitata</i>)	72-hour acute	E _y C _{50/2} = 106 mg/L	8.34 mg/L	0.08	No
Performic acid (PFA)					
Water flea (<i>D. magna</i>)	48-hour acute	LC _{50/2} = 0.26 mg/L	2.0 mg/L	7.7	Yes
		EC _{50/2} = 0.43 mg/L	2.0 mg/L	4.7	Yes
Water flea (<i>C. dubia</i>)	48-hour acute	LC _{50/2} = 0.22 mg/L	2.0 mg/L	9.3	Yes
		LC _{50/2} = 0.21 mg/L	2.0 mg/L	9.7	Yes
Fathead minnow (<i>P. promelas</i>)	48-hour acute	LC _{50/10} = 0.30 mg/L	2.0 mg/L	6.6	Yes
Green alga (<i>R. subcapitata</i>)	72-hour acute	E _r C _{50/2} = 0.17 mg/L	2.0 mg/L	12	Yes

¹ The effects metric is the toxicity endpoint divided by an uncertainty factor. The uncertainty factor is 2 for acute invertebrate and algae endpoints, 10 for acute fish endpoints, and 1 for chronic endpoints.

² EEC: Estimated Environmental Concentration = estimated concentration in treated effluent ÷ dilution factor of 10. Performic acid: Estimated concentration in treated effluent is the maximum dosing level specified in the proposed label directions (20 mg/L, corresponding to pulp and paper mills). Formic acid: According to the stoichiometry for the reaction to produce a ~9.5% PFA solution from FENNOSURF 600-C and its partner hydrogen peroxide end-use product, formic acid should be present at 3.43 times the concentration of PFA (PMRA No. 3249852): $3.43 \times 20 \text{ mg/L} = 68.6 \text{ mg/L}$. The exact stoichiometry of PFA transformation reactions is unknown; for the purposes of risk assessment, it is assumed that 100% of the PFA transforms into formic acid on a molar basis. Using a conversion factor of 0.74 (46 g/mol formic acid ÷ 62 g/mol PFA), 20 mg/L of PFA transforms into 14.8 mg/L of formic acid. Thus, the total estimated concentration of formic acid in the treated effluent is 83.4 mg/L (68.6 mg/L + 14.8 mg/L). A dilution factor of 10 is typically used in PMRA assessments at the screening level.

³ RQ: Risk Quotient = EEC/effects metric

⁴ LOC: Level of Concern = 1

Table 6 List of supported uses

Items	Proposed label claim	Supported use claim
Efficacy claims	For microbial control in the manufacture of paper and paperboard and for the treatment of municipal wastewater Use the generated PFA solution to control bacteria in influent and process water used in the manufacture of paper and paperboard that may come into contact with food.	For bacterial control in the manufacture of paper and paperboard and for the treatment of municipal wastewater Use the generated PFA solution to control bacteria in influent and process water used in the manufacture of paper and paperboard. Use the generated PFA solution to control bacteria in sewage and wastewater effluent associated with

Items	Proposed label claim	Supported use claim
	Use the generated PFA solution to treat sewage and wastewater effluent associated with public and private wastewater treatment facilities.	public and private wastewater treatment facilities.
Application rates	Paper manufacturing use 5–20 ppm PFA Municipal wastewater treatment systems 1–10 ppm PFA	Paper manufacturing use 10–20 ppm PFA Municipal wastewater treatment systems 10 ppm PFA
Application methods	To produce PFA, the precursors FENNOSURF 600-C (75% formic acid) and its partner hydrogen peroxide end-use product (35% hydrogen peroxide) is proposed to be mixed at a 1:1 ratio. This mixing will result in a final concentration of 9.5% PFA solution.	Accepted as proposed.

References

A. List of studies/Information submitted by registrant

1.0 Chemistry

PMRA Document Number	Reference
3185627	2020, Product Chemistry Study (Group A) for Fennosurf 600, DACO: 3.2, 3.2.1,3.2.2,3.2.3,3.3.1 CBI
3185629	2020, Formic Acid Assay Analysis (Fennosurf 600) by Ion Chromatography under GLP, DACO: 3.4,3.4.1 CBI
3185630	2020, Accelerated Storage Stability of Formic Acid (Fennosurf 600) per OPPTS 830.6317 Under GLP, DACO: 3.5.10,3.5.5 CBI
3185631	2019, Fennosurf 600: Physical and Chemical Characteristics: Odor, pH, Viscosity, and Density/Relative Density, DACO: 3.5.3,3.5.6,3.5.7,3.5.9 CBI
3185718	Reutemann, W., and Kieczka, H., 2000, Formic Acid - Chemistry Overview, in Ullmann's Encyclopedia of Industrial Chemistry, Weinheim (Germany): Wiley-VCH Verlag GmbH & Co. KGaA, DACO: 2.0,2.14.1,2.14.10, 2.14.11,2.14.12, 2.14.13,2.14.15,2.14.2,2.14.3,2.14.4,2.14.5,2.14.6,2.14.7, 2.14.8,2.14.9
3185719	2020, Manufacturing Process of Technical Grade Formic Acid, DACO: 2.11, 2.11.1,2.11.2,2.11.3,2.11.4 CBI
3185720	2020, Formic Acid Assay Analysis (Technical) by Ion Chromatography under GLP, DACO: 2.13.1,2.13.2,2.13.3 CBI
3185722	2007, Spectroscopic Characterization and Determination of Physico-Chemical Properties of "Formic Acid", DACO: 2.14.4 CBI
3196755	2021, Physical State, DACO: 3.5.2 CBI
3196756	2021, Formulation Type, DACO: 3.5.4 CBI
3196757	2021, Oxidizing or Reducing Action, DACO: 3.5.8 CBI
3196758	2021, Flammability, DACO: 3.5.11 CBI
3196759	2021, Explodability, DACO: 3.5.12 CBI
3196760	2021, Miscibility, DACO: 3.5.13 CBI
3196761	2021, Corrosion Characteristics, DACO: 3.5.14 CBI
3196762	2021, Dielectric Breakdown Voltage, DACO: 3.5.15 CBI
3267726	2021, Addendum to MRID 51227413: Updated Formulation Process Information and Discussion of Impurities for Fennosurf 600-C, DACO: 3.2 CBI
3267727	2019, Test Method Validation for Assay of Formic Acid by Ion Chromatography under GLP, DACO: 3.4.1 CBI
3486038	2023, Impurity Method Qualification for Formic Acid Technical Grade Active Ingredient, DACO: 2.13.1

- 3486039 2023, Five Batch Analysis of Formic Acid Formulated Products Under GLP, DACO: 2.13.3 CBI
- 3580339 2024, Five Batch Analysis of Formic Acid Formulated Products Under GLP - IO# 11206761 - Revised, DACO: 2.13.4,2.14 CBI

2.0 Human and animal health

PMRA Document Number	Reference
3185632	2020, Human Health Assessment for Fennosurf 600, DACO: 4.1,4.6.2,4.6.4, 4.6.5,4.6.6
3185633	2019, Fennosurf 600: Acute Oral Toxicity - Up-And-Down Procedure in Rats, DACO: 4.6.1
3185634	2019, Fennosurf 600: Acute Inhalation Study in Rats, DACO: 4.6.3
3185635	2020, Fennosurf 600-C Occupational Exposure - Use Description Scenario, DACO: 5.2
3185723	2020, Acute Oral Toxicity Data Review Template, DACO: 4.2.1
3185728	2002, Formic Acid Buehler Test in Guinea Pigs, DACO: 4.2.6
3185729	2016, Dermal Sensation (Guinea Pig) Review Template, DACO: 4.2.6
3185742	2005, Sodium Formate - Prenatal Developmental Toxicity Study in Wistar Rats Oral Administration (Gavage), DACO: 4.5.2
3185744	2008, Natriumformiat (Sodium Formate) Prenatal Developmental Toxicity Study in Himalayan Rabbits Oral Administration (Gavage), DACO: 4.5.3
3185746	2002, In Vitro Gene Mutation Test with Formic Acid in CHO Cells, DACO: 4.5.5
3185748	1989, Evaluation of Clastogenicity of Formic Acid, Acetic Acid and Lactic Acid on Cultured Mammalian Cells, DACO: 4.5.6
3185760	1985, Acute Oral Toxicity of Formic Acid 99% in Rats, DACO: 4.2.1
3185761	Thompson, M., 1992, NTP Technical Report on the Toxicity Studies of Formic Acid (CAS No. 64-18-6) Administered by Inhalation to F344/N Rats and B6C3F ₁ Mice, Toxicity Report Series, 19:1-D3, DACO: 4.3.6
3191610	2021, Primary Eye Irritation Data Waiver Request, DACO: 4.6.4
3191611	2021, Primary Dermal Irritation Data Waiver Request, DACO: 4.6.5

3.0 Environment

PMRA Document Number	Reference
3185626	Chhetri, R.K., et al., 2015, Full Scale Evaluation of Combined Sewer Overflows Disinfection Using Performic Acid in a Sea-Outfall Pipe, Chemical Engineering Journal, 270:133-139, DACO: 12.5.10
3185636	Environment and Climate Change Canada and Health Canada, 2017, Screening Assessment Formic Acid and Formates Substance Group, DACO: 5.2,8.1

3185637	2020, Non-Target Organism Assessment for Fenno Surf 600, DACO: 8.1
3185638	2007, MB Control R&D - Test Results: Experiments on the Speed of Degradation of Performic Acid (PFA) in Paper Machine Water, DACO: 8.6
3185639	2014, Determination of the Half-Life of Performic Acid According to OECD Guideline, DACO: 8.6
3185641	2006, Degradation of Performic and Peracetic Acid in Waters, DACO: 8.6
3185751	2005, <i>Daphnia magna</i> , Acute Immobilization Test, DACO: 9.3.2
3185753	2007, Formic Acid Determination of the Chronic Effect on the Reproduction of the Water Flea <i>Daphnia magna</i> Straus, DACO: 9.3.3
3185754	2020, Formic Acid TGAI: A 96-Hour Flow-Through Acute Toxicity Test with the Rainbow Trout (<i>Oncorhynchus mykiss</i>), DACO: 9.5.2.1
3185755	2005, Fish, Acute Toxicity Test Acute Toxicity of Ammonium Formate to Zebra Fish (<i>Danio rerio</i>), DACO: 9.5.2.3
3185758	2005, Alga, Growth Inhibition Test Effect of Ammonium Formate on the Growth of <i>Pseudokirchneriella subcapitata</i> , DACO: 9.8.2
3196772	2021, Aquatic Vascular Plants Waiver Request, DACO: 9.8.5
3249781	1988, Test Report on a Study of Biodegradability in the Modified OECD Screening Test - Formic Acid - Translation, DACO: 12.5.8
3249782	2021, Rationale for Measuring PAA Residuals as a Surrogate for PFA Concentrations, DACO: 8.6
3249785	2020, Toxicity Test Results - PFA Acute <i>Daphnia magna</i> , DACO: 9.3.2
3249786	2020, Toxicity Test Results - PFA Acute <i>Ceriodaphnia dubia</i> , DACO: 9.3.2
3249787	2020, Toxicity Test Results - PFA Acute <i>Ceriodaphnia dubia</i> , DACO: 9.3.2
3249789	2020, Toxicity Test Results - PFA Acute <i>Pimephales promelas</i> (Fathead Minnow), DACO: 9.5.2.3
3249791	Chhetri, R.K., et al., 2019, Acute Toxicity and Risk Evaluation of the CSO Disinfectants Performic Acid, Peracetic Acid, Chlorine Dioxide and Their By-Products Hydrogen and Chlorite, The Science of the Total Environment, 677:1-8, DACO: 9.8.2
3249792	2021, Waiver Rationale with Caveat for Acute Toxicity with Aquatic Vascular Plants, DACO: 9.8.5
3249793	2021, Waiver Rationale for the Monitoring/In-Situ Study at a Wastewater Treatment Plant and a Papermaking Facility, DACO: 9.9
3249852	2021, Performic Acid Two Concentrations, DACO: 10.6 CBI

4.0 Value

PMRA Document Number	Reference
3185617	2020, Description of Pest Problem, DACO: 10.2.2
3249845	2018, Performic Acid 9.5% (PFA) Research Trial: A Twelve-Week Study of PFA Batch Efficacy Tests on Two Municipal Waste Waters, DACO: 10.2.3.2

- 3485634 2021, Microbial Control in Paper Manufacture, DACO: 10.2.3.2
 3485637 2018, Canada Trials Victoriaville and Longueuil July to Sept 2018, DACO: 10.2.3.2

B. Additional information considered

i) Published information

1.0 Human and animal health

PMRA Document Number	Reference
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1.0 Environment

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