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Re-evaluation Decision

RVD2023-06

Pyrethrins and Its Associated End-use Products

Final Decision

(publié aussi en français)

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Re-evaluation decision for pyrethrins and associated end-use products

Under the authority of the *Pest Control Products Act*, all registered pesticides must be re-evaluated by Health Canada's Pest Management Regulatory Agency (PMRA), on behalf of the Minister of Health, to ensure that they continue to have acceptable risk to human health and the environment and have acceptable value. The re-evaluation considers available data and information¹ from pesticide registrants, published scientific reports, existing assessments, other governments, and international regulatory authorities, as well as comments received during public consultations. Health Canada applies internationally accepted current risk assessment methods as well as risk management approaches and policies. More details, on the legislative framework, risk assessment and risk management approach, are provided under Evaluation Approach of this document.

Pyrethrins are botanical insecticides derived from the dried flowers of the Chrysanthemum plant and are registered for use on a wide range of sites, including horticultural crops and ornamental plants (outdoors and in greenhouses), pastures, indoor ornamental houseplants, livestock, companion animals, structural sites (indoor and outdoor), clothing, and stored grains. Currently registered products containing pyrethrins can be found in the [Pesticide Product Information Database](#) and in Appendix I.

The Proposed Re-evaluation Decision PRVD2020-08, *Pyrethrins and associated end-use products*² containing the evaluation of pyrethrins and proposed decision was published 17 September 2020 for a 90-day consultation period. An additional 75 days for consultation was provided in response to requests from stakeholders to accommodate time constraints imposed by pandemic measures; the consultation period ended on 01 March 2021.

A request for data under section 19 of the *Pest Control Products Act* to confirm that application rates and use directions on product labels were consistent with the rates used in the health risk assessments was also issued on the day of publication of PRVD2020-08. The deadline for the required data was also extended to 1 March 2021 in response to requests from registrants and stakeholders. The data were used to inform a revised use pattern analysis which confirmed use sites, crops, formulations, application equipment, rates, container sizes, active ingredient concentration, number of applications and application intervals. The revised use pattern is considered for the updated science evaluations for human health and the environment.

PRVD2020-08 proposed continued registration for most uses provided the additional proposed risk mitigation measures are in place. The proposed risk mitigation measures included increased personal protective equipment (PPE), limit on the amount of active ingredient handled per day for commercial-class products; a 2-hour re-entry interval after indoor residential applications; precautionary statements to protect pollinators and the environment; and spray buffer zones.

¹ Information Note – *Determining Study Acceptability for use in Pesticide Risk Assessments*

² “Consultation statement” as required by Subsection 28(2) of the *Pest Control Products Act*.

The uses proposed to be cancelled included uses on stored grains; domestic-class indoor aerosol space sprays; domestic-class total release foggers; application using a mechanically pressurized handheld sprayer for mists, aerosols, and fogs for residential handlers; and claims related to killing lice on non-host sites.

Health Canada received comments and information relating to the health, environmental and value assessments during the public consultation period conducted in accordance with section 28 of the *Pest Control Products Act*. Commenters are listed in Appendix II. These comments are summarized in Appendix III along with the responses by Health Canada. These comments and new data/information resulted in revisions to the occupational and environmental risk assessments (see Science Evaluation Update) and resulted in changes to the proposed re-evaluation decision as described in PRVD2020-08.

A reference list of information used as the basis for the proposed re-evaluation decision is included in PRVD2020-08, and further information used in the re-evaluation decision is listed in Appendix IX of this document. Therefore, the complete reference list of all information used in this final re-evaluation decision includes both the information set out in PRVD2020-08 and the information set out in Appendix IX of this document.

This document presents the final re-evaluation decision³ for the re-evaluation of pyrethrins, including the required amendments (risk mitigation measures) to protect human health and the environment, as well as label amendments required to bring labels to current standards. All products containing pyrethrins that are registered in Canada are subject to this re-evaluation decision.

Re-evaluation decision for pyrethrins

Health Canada has completed the re-evaluation of pyrethrins. Under the authority of the *Pest Control Products Act*, Health Canada has determined that continued registration of most uses of pyrethrins is acceptable. An evaluation of available scientific information found that some uses of pyrethrin products meet current standards for protection of human health and the environment and have acceptable value when used according to revised conditions of registration which includes new mitigation measures. The following uses of pyrethrins are cancelled since health risks or value were not shown to be acceptable when used according to the current conditions of registration, or when additional mitigation is considered:

- Post-harvest use on bulk or bagged stored grains
- Domestic-class pressurized products used in metered-release devices
- Domestic-class pressurized product application using total release foggers (including lock-valve mechanism)
- Domestic handler applications using handheld and stationary foggers

³ “Decision statement” as required by subsection 28(5) of the *Pest Control Products Act*.

- Space spray uses on liquid domestic-class product labels
- Indoor structural broadcast applications to control flies and mosquitoes in livestock and poultry housing and facilities.
- Claims related to killing lice on mattresses, bedding, furniture, and garments.

The following uses are cancelled due to lack of data:

- Crops not specifically identified on commercial-class product labels i.e., removal of general crop terms such as “vegetables.” This is also applicable for domestic-class products.
 - Food uses on domestic-class labels will be updated to include only the specific crop uses that are supported on commercial-class agricultural labels.

Label amendments, as summarized below and listed in Appendix IV, are required.

Risk mitigation measures

Registered pesticide product labels include specific directions for use. Directions include risk mitigation measures to protect human health and the environment and must be followed by law. The required amendments, including revised/updated label statements and/or mitigation measures, as a result of the re-evaluation of pyrethrins, are summarized below. Refer to Appendix IV for details.

Human health

To minimize dietary risk to Canadians, the following risk reduction measures are required:

- Cancel the postharvest use of pyrethrins on bulked or bagged stored grains
- Revocation of the maximum residue limit (MRL) of 3 ppm on raw cereals, to reduce dietary exposure from residues in cereal grains
- Establish a rotational plant back interval (PBI) of 30 days for all crops other than the ones for which pyrethrins are registered for use

To protect workers using or entering treated sites following application of commercial-class products, the following risk reduction measures are required:

- Increased PPE
- Limit the amount of product handled per day
- Limit to the application rate for outdoor fogging (mosquito abatement), indoor broadcast surface sprays, and metered release devices
- Restricted-entry intervals (REIs) for agricultural sites
- Re-entry intervals for non-agricultural/structural sites
- Additional label statements for commercial-class products used as structural pest control products as per the 2020 PMRA Guidance Document, *Structural Pest Control Products: Label Updates*

To protect consumers and bystanders (including children) who may be using the product or entering treated sites, the following risk reduction measures are required:

- Limit the commercial-class product application rates for outdoor fogging (mosquito abatement), indoor broadcast surface sprays, and metered release devices
- Limit the domestic-class application rate for indoor space sprays applied using pressurized products
- Re-entry intervals required following commercial application in residential areas
- Cancellation of domestic-class products used in metered release devices
- Prohibit the use of handheld and stationary fogging/misting equipment on liquid domestic-class labels
- Cancellation of domestic-class pressurized products used as total release foggers (including lock-valve mechanisms)
- Prohibit space spray uses on domestic-class liquid product labels
- Additional label statements for domestic- and commercial-class products used as structural pest control products as per the 2020 PMRA Guidance Document, *Structural Pest Control Products: Label Updates*

To protect pets treated with sprays or shampoos containing pyrethrins:

- Label statements to inform consumers as to the possible side effects that may be expected in their pets following use
- Label statements to prohibit the use of other companion animal products with the same active ingredient(s)

Environment

Risk mitigation:

To protect the environment, the following risk-reduction measures are required:

- Environmental hazard statements for bees, beneficial insects and aquatic organisms.
- Statements prohibiting application to highly attractive crops to bees during the blooming period and for other crops when bees are foraging.
- To protect aquatic habitats, spray buffer zones are required.
- Precautionary label statements for sites with characteristics that may be conducive to runoff and when heavy rain is forecast are required.
- A revised maximum application rate for outdoor fogging (mosquito abatement).

Value

- Cancellation of label claims related to killing lice on mattresses, bedding, furniture, and garments.

Label improvements to meet current standards:

Health

- Label statements for domestic- and commercial-class products used as structural pest control products are required to be updated as per the 2020 PMRA Guidance Document, *Structural Pest Control Products: Label Updates*
- Label statements for domestic-class products used on companion animals are required to be updated as per DIR2002-01, *Canadian Label Improvements for Pesticides used on Companion Animals*

Implementation of the re-evaluation decision

Regulatory Directive DIR2018-01, *Policy on Cancellations and Amendments Following Re-evaluation and Special Review* provides general timelines for implementation of post-market decisions.

When a re-evaluation or special review decision requires cancellation of pest control products, consistent with Health Canada's *Information Note: update on implementation of post-market decisions* (2021), Health Canada will immediately cancel pest control product registrations on the date of a decision made under paragraph 21(2)(b) of the *Pest Control Products Act*. If there are no serious and imminent risks to human health or the environment, Health Canada will allow for a phase-out period consistent with the Cancellation Policy and will impose any conditions necessary for carrying out the purposes of the *Pest Control Products Act* under the authority of paragraph 21(5)(a) of the *Pest Control Products Act*.

Health considerations

Risks to human health from exposure to a pesticide are estimated by comparing potential exposures with the most relevant endpoint from toxicology studies, with standard protection factors incorporated to further protect human health, including the most sensitive population. These factors provide an inherent level of protection from exposures that could result in adverse effects to human health. Furthermore, Health Canada applies additional protection factors if warranted by the hazard profile of the pesticide or by the quality and completeness of the underlying data. When risks of concern are identified in the human health exposure scenarios, it does not necessarily mean that exposure will result in adverse effects, but mitigation measures to reduce potential risks would be required.

For pyrethrins/synthetic pyrethroid products co-formulated with piperonyl butoxide, 234 human incident reports involving 48 products were received between 2007 and 2022 and were considered to be possibly related to the reported product when used according to the label. For the majority of human health incidents, reported symptoms included respiratory effects (such as cough, nasal congestion, and respiratory irritation), skin or eye irritation, tingling mouth or skin, nausea, dizziness, or headache. These effects were associated mostly with domestic class products used in indoor sites, and were mainly minor in severity, were of short duration and resolved quickly without medical treatment. For these domestic-class indoor products associated with human incidents, as well as registered domestic products with similar formulations and use

pattern the required label amendments must be implemented no later than 18 months after the publication date of this re-evaluation decision (Appendix I, Table 1). For domestic-class indoor products that have been cancelled (Appendix I, Table 2), product cancellations are in effect as of the date of this decision document with an 18-month phase-out period. During this 18 month phase-out period, continued possession, handling, storage, and use of existing stock in Canada at the time of cancellation of these products (Appendix I, Table 2) will be authorized under paragraph 21(5)(a) of the *Pest Control Products Act*.

For the products requiring amendments listed in Appendix I, Table 3, label amendments must be implemented no later than 24 months after the publication date of this re-evaluation decision⁴. Products listed in Appendix I, Table 4 are cancelled as of the date of this decision with a 3-year phase-out period authorized under paragraph 21(5)(a) of the *Pest Control Products Act*. During this 3-year phase-out period, continued possession, handling, storage, and use of existing stock in Canada at the time of cancellation of these products (Appendix I, Table 4) will be authorized under paragraph 21(5)(a) of the *Pest Control Products Act*. In addition, for the products subject to cancellation in Appendix I, Table 4 there are no serious and imminent risks identified or expected during the phase out period.

This approach prioritizes the implementation of mitigation measures for products associated with human incident reports as well as the cancellation of products that are similar in use. This will facilitate the practical and orderly implementation of mitigation measures through label amendments and cancellations.

Potential and relative health risks for products containing pyrethrins are acceptable during these implementation periods for label amendments.

Environmental considerations

To comply with this decision, the required amendments (mitigation measures and label updates) to protect the environment must be implemented on product labels no later than 24 months after the publication date of this re-evaluation decision. The risks identified are considered acceptable because they are not expected to cause irreversible harm over the label implementation period. Potential effects of pyrethrins include a localized reduction in aquatic organism and pollinator abundance. Affected populations have the potential to recover following implementation of the additional restrictions, which will reduce overall exposure. Recovery is expected because risks to these non-target organisms are geographically limited to areas where these pyrethrins products are applied and areas adjacent to application sites. The presence of unaffected non-target organisms in areas where pyrethrins products are not being used will further facilitate recovery since unaffected organisms can move back into areas where effects may have occurred. Overall, the risk to these organisms is acceptable over the time period required to implement the mitigation measures.

⁴ The 24-month timeline is consistent with the guidance for label amendments on other companion animal products types (in other words, spot-on type products – see 2019 PMRA Guidance Document, Label Improvements for Spot-on Pesticides Used on Companion Animals).

Next steps

To comply with this decision, the required pest control product amendments and cancellations must be made within the timelines described in this section. This decision is applicable to all products containing pyrethrins, see Appendix I for details.

Amendments to product registrations

- 1) **For pest control products listed in Appendix I, Table 1:** The required amendments (risk mitigation measures and label updates) to domestic-class products with indoor uses identified in Appendix I, Table 1 must be implemented no later than 18-months after the final decision publication. Accordingly, both registrants and retailers will have up to 18-months from the date of this decision document to transition to selling the product with the newly amended labels. Similarly, users will also have the same 18-month period from the date of this decision document to transition to using the newly amended labels, which will be available on the Public Registry.
- 2) **For pest control products listed in Appendix I, Table 3:** Any remaining products, not described above, requiring label amendments (risk mitigation measures and label updates) (Appendix I, Table 3) must be implemented no later than 24 months after the publication date of this decision document. Accordingly, both registrants and retailers will have up to 24 months from the date of this decision document to transition to selling the product with the newly amended labels. Similarly, users will also have the same 24-month period from the date of this decision document to transition to using the newly amended labels, which will be available on the Public Registry.

Cancellation of product registrations

- 1) **For pest control products listed in Appendix I, Table 2:** As of the date of this decision document, some domestic-class products with indoor uses are cancelled pursuant to paragraph 20(1)(b) of the *Pest Control Products Act* (Appendix I, Table 2). An 18-month phase-out period is established to deplete existing stocks in Canada.

During this phase-out period, continued possession, handling, storage, and use of existing stock in Canada of these products will be authorized under paragraph 21(5)(a) of the *Pest Control Products Act* as per the schedule below:

- Authorized for sale (of existing stocks in Canada) by registrant six (6) months from the date of decision, followed by;
- Authorized for sale by retailer/distributor (if applicable) six (6) months from the last date of sale by registrant, followed by; and
- Authorized for use six (6) months from the last date of sale by retailer/distributor.

- 2) **For pest control products listed in Appendix I, Table 4:** As of the date of this decision document, some products, not described above, are cancelled pursuant to paragraph 20(1)(b) of the *Pest Control Products Act* (Appendix I, Table 4) with a 3-year phase-out period to deplete existing stocks in Canada.

During this period, continued possession, handling, storage, and use of existing stock in Canada of these products will be authorized under paragraph 21(5)(a) of the *Pest Control Products Act* as per the schedule below:

- Authorized for sale (of existing stocks in Canada) by registrant one (1) year from the date of decision, followed by;
- Authorized for sale by retailer/distributor (if applicable) one (1) year from the last date of sale by registrant, followed by; and
- Authorized for use one (1) year from the last date of sale by retailer/distributor.

Products that have a phase-out period will be listed as “Phase-out” in the Public Registry for the duration of their authorization. During the phase-out period, importing or manufacturing of cancelled pest control products containing pyrethrins in Canada is prohibited (Appendix I, Tables 2 and 4). In addition, registrants are required to continue to comply with sales and incident reporting obligations (relating to all pest control products containing pyrethrins) during the phase-out period for the pest control products in Appendix I, Tables 2 and 4.

Other information

Any person may file a notice of objection⁵ regarding this decision on pyrethrins and its associated end-use products within 60 days from the date of publication of this Re-evaluation Decision. For more information regarding the basis for objecting (which must be based on scientific grounds), please refer to the Pesticides section of the Canada.ca website (Request a Reconsideration of Decision) or contact PMRA’s Pest Management Information Service.

The relevant confidential test data on which the decision is based (as referenced in PRVD2020-08 and in the Appendix IX section of this document) are available for public inspection, upon application, in the PMRA’s Reading Room. For more information, please contact PMRA’s [Pest Management Information Service](#).

⁵ As per subsection 35(1) of the *Pest Control Products Act*.

Evaluation approach

Legislative framework

The Minister of Health's primary objective under the *Pest Control Products Act* (or the Act) subsection 4(1) is to prevent unacceptable risks to individuals and the environment from the use of pest control products.

As noted in the preamble of the Act, it is in the national interest that the attainment of the objectives of the federal regulatory system continue to be pursued through a scientifically-based national registration system that addresses risks to human health, the environment and value both before and after registration and applies to the regulation of pest control products throughout Canada; and that pest control products with acceptable risk and value be registered for use only if it is shown that their use would be efficacious and if conditions of registration can be established to prevent unacceptable risks to human health and the environment.

For the purposes of the Act, the health or environmental risks of a pest control product are acceptable if there is reasonable certainty that no harm to human health, future generations or the environment will result from exposure to or use of the product, taking into account its conditions of registration as per subsection 2(2) of the *Pest Control Products Act*.

Risk for human health and the environment, and value are defined under the Act subsection 2(1) as follows:

Health risk, in respect of a pest control product, means the possibility of harm to human health resulting from exposure to or use of the product, taking into account its conditions or proposed conditions of registration.

Environmental risk, in respect of a pest control product, means the possibility of harm to the environment, including its biological diversity, resulting from exposure to or use of the product, taking into account its conditions or proposed conditions of registration

Value, in respect of a pest control product, means 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.

When evaluating the health and environmental risks of a pesticide and determining whether those risks are acceptable, Subsection 19(2) of the *Pest Control Products Act* requires Health Canada to apply a scientifically-based approach. The science-based approach to assessing pesticides considers both the toxicity and the level of exposure of a pesticide in order to fully characterize risk.

Risk and value assessment framework

Health Canada uses a comprehensive body of modern scientific methods and evidence to determine the nature as well as the magnitude of potential risks posed by pesticides. This approach allows for the protection of human health and the environment through the application of appropriate and effective risk management strategies, consistent with the purpose described in the preambular text set out above.

Health Canada's approach to risk and value assessment is outlined in *A Framework for Risk Assessment and Risk Management of Pest Control Products*.⁶ A high-level overview is provided below.

i) Assessing potential health risks

With respect to the evaluation and management of potential health risks, Health Canada's risk assessments follow a structured, predictable process that is consistent with international approaches and the Health Canada Decision-Making Framework for Identifying, Assessing, and Managing Health Risks.⁷

The evaluation of potential health risks begins with a consideration of the toxicological profile of a pesticide to establish reference doses at which no adverse effect is expected and against which the expected exposure is assessed. This includes, where appropriate, the use of uncertainty (protection) factors to provide additional protection that accounts for the variation in sensitivity among members of human population and the uncertainty in extrapolating animal test data to humans. Under certain conditions, the *Pest Control Products Act* requires the use of another factor to provide additional protection to pregnant women, infants, and children. Other uncertainty factors, such as a database deficiency factor, are considered in specific cases. More details related to the application of the uncertainty factors are provided in Science Policy Note SPN2008-01.⁸

Assessments estimate potential health risks to defined populations⁹ under specific exposure conditions. They are conducted in the context of the registered conditions of use, such as the use of a pesticide on a particular field crop using specified application rates, methods and equipment. Potential exposure scenarios consider exposures during and after application of the pesticide in occupational or residential settings, food and drinking water exposure, or exposure when interacting with treated pets.

⁶ PMRA Guidance Document, *A Framework for Risk Assessment and Risk Management of Pest Control Products*

⁷ *Health Canada Decision-Making Framework for Identifying, Assessing, and Managing Health Risks* - August 1, 2000

⁸ Science Policy Note: *The Application of Uncertainty Factors and the Pest Control Products Act Factor in the Human Health Risk Assessment of Pesticides*

⁹ Consideration of Sex and Gender in Pesticide Risk Assessment

Also considered are the anticipated durations (short-, intermediate- or long-term) and routes of exposure (oral, inhalation, or skin contact). In addition, an assessment of health risks must consider available information on aggregate exposure and cumulative effects.

ii) Assessing risks to the environment

With respect to the evaluation of environmental risks, Health Canada's environmental risk assessments follow a structured, tiered approach to determine the likelihood that exposure to a pesticide can cause adverse effects on individual organisms, populations, or ecological systems. This involves screening assessments starting with simple methods, conservative exposure scenarios and sensitive toxicity effects metrics, then moving on, where required, to more refined assessments that can include exposure modelling, monitoring data, results from field or mesocosm studies, and probabilistic risk assessment methods.

The environmental assessment considers both the exposure (environmental fate, chemistry, and behaviour, along with the application rates and methods) and hazard (toxic effects on organisms) of a pesticide. The exposure assessment examines the movement of the pesticide in soil, water, sediments and air, as well as the potential for uptake by plants or animals and transfer through the food web. The possibility for the pesticide to move into sensitive environmental compartments such as groundwater or lakes and rivers, as well as the potential for atmospheric transport, is also examined. The hazard assessment examines effects on a large number of internationally recognized indicator species of plants and animals (terrestrial organisms include invertebrates such as bees, beneficial arthropods, and earthworms, birds, mammals, plants; aquatic organisms include invertebrates, amphibians, fish, plants and algae), and includes considering effects on biodiversity and the food chain. Acute and chronic effects endpoints are derived from laboratory and field studies that characterize the toxic response and the dose–effect relationship of the pesticide.

The characterization of environmental risk requires the integration of information on environmental exposure and effects to identify which, if any, organisms or environmental compartments may be at risk, as well as any uncertainties in characterizing the risk.

iii) Value assessment

Value assessments consist of two components: an assessment of the performance of a pest control product and its benefits.

During re-evaluation, value is examined under current conditions and in light of alternative pest control methods (both chemical and nonchemical) that may have been developed since the pesticide was first registered. An assessment of the benefits associated with the pesticide may also be conducted to demonstrate its value in the current context, and to identify potential alternatives.

Risk management

The outcomes of the assessments of risks to human health and the environment, and the assessment of value, form the basis for identifying risk management strategies. These include appropriate risk mitigation measures and are a key part of decision-making on whether health and environmental risks are acceptable. The development of risk management strategies take place within the context of the pesticide's conditions of registration. Conditions can relate to, among other things, the specific use (for example, application rates, timing, frequency and method of application), personal protective equipment, pre-harvest intervals, restricted entry intervals, buffer zones, spray drift and runoff mitigation measures, handling, manufacture, storage or distribution of a pesticide. If feasible conditions of use that have acceptable risk and value cannot be identified, the pesticide use will not be eligible for registration or continued registration.

The selected risk management strategy is then implemented as part of the re-evaluation decision. The pesticide registration conditions include legally-binding use directions on the label. Any use in contravention of the label or other specified conditions is illegal under the *Pest Control Products Act*. Implementation of post-market decisions follow the framework articulated in the *Policy on Cancellations and Amendments Following Re-evaluation and Special Review*.¹⁰

Following a decision, continuous oversight activities such as post-market review, monitoring and surveillance, including incident reporting, all play an essential role to help ensure the continued acceptability of risks and value of registered pesticides.

¹⁰ PMRA Regulatory Directive DIR2018-01 *Policy on Cancellations and Amendments Following Re-evaluation and Special Review*

Science evaluation update

Based on the comments and additional information received during consultation, Health Canada revised the human health and environmental assessments.

1.0 Revised health risk assessment

1.1 Toxicology summary

A detailed review of the toxicology database for pyrethrins was summarized in the proposed re-evaluation decision for pyrethrins and associated end use products (PRVD2020-08). Comments and scientific rationales received during the consultation period for PRVD2020-08 specific to the toxicology assessment pertained to the points of departure supporting the dermal and inhalation reference values. No new toxicology studies or data were submitted during the consultation period. In response to the comments received, Health Canada re-visited the rat 13-week inhalation toxicity study in the context of the weight of evidence for the laryngeal microscopic lesions and updated the summary of the rat 13-week inhalation toxicity study. Health Canada also conducted an updated literature search for genotoxicity studies. Based on the comments received and the new information retrieved, the toxicology reference values and the cancer risk assessment approach for the pyrethrins outlined in PRVD2020-08 remain unchanged. Detailed responses to comments are presented in Appendix III.

1.2 Dietary exposure and risk assessment

In PRVD2020-08, it was determined that the food uses assessed in the dietary assessment would be limited to the crops and uses specifically identified on commercial-class pyrethrins labels, namely greenhouse peppers, blueberry, grape, raspberry, herbs, spices, pears, pinto, snap and wax beans, tomato, stored grains, the direct treatment of livestock, and the use in food handling establishments. Further, cancellation of the stored grain use and the requirement for a 12-month PBI was proposed.

The dietary risk assessment was revised to take into account the additional crop uses registered after PRVD2020-08 was prepared, specifically Low Growing Berry Subgroup (CG13-07G). Updates to product use information were provided to Health Canada during the consultation period, which resulted in revised drinking water estimated environmental concentrations (EECs). Based on the review of a confined rotational crop study submitted during the comment period, a revised PBI of 30 days for crops not listed on product labels is required.

The revised inputs that include additional crops in the revised use pattern analysis and revised EECs, did not result in a significant change to the dietary exposure assessments, which are consistent with those reported in Appendix III of PRVD2020-08 (Appendix V of this document). The results of the revised assessment demonstrated dietary risks to be acceptable with the acute dietary risks from food and drinking water being below 34% of the acute reference dose (ARfD), and the chronic dietary risks from food and drinking water being below 70% of the acceptable daily intake (ADI) for all population subgroups.

Label changes resulting from the dietary assessment are included in Appendix IV of this document. Changes to MRLs will be published in a PMRL document for consultation.

1.4 Occupational and non-occupational exposure and risk assessment

In PRVD2020-08, risks were not shown to be acceptable for domestic-class handheld foggers (including total release foggers) and indoor space sprays applied using pressurized products (not including metered release devices). These uses were proposed for cancellation. Risks were shown to be acceptable for all other uses with proposed mitigation measures such as limits on the application rates, increased PPE, restrictions on the amount of active ingredient handled per day, and re-entry intervals, including a 2-hour re-entry interval following commercial-class space spray applications using pressurized products in residential areas.

As outlined in PRVD2020-08, additional data were required under section 19 of the *Pest Control Products Act* to confirm that application rates and use directions on product labels are consistent with the rates used in the health risk assessments. As a result of the information received from registrants response to this data call-in, the occupational and non-occupational risk assessment of pyrethrins for the majority of uses was revised to reflect the clarifications to the currently registered use pattern, such as areas of use, crops, formulations, application equipment, rates, container sizes, pyrethrins concentrations, and application intervals (Appendix VI). In addition, comments and data specific to occupational and non-occupational exposure were received during the consultation period and considered in the revised risk assessment. This information was incorporated into the revised assessment to the extent possible. The data included an outdoor air monitoring study, which was used to assess the postapplication inhalation assessment for outdoor space spray application using pressurized products. The indoor space spray studies using pressurized products were also revisited based on comments received from registrants.

As a result of the comments and data, many of the outcomes of the occupational and non-occupational risk assessments and proposed mitigation in PRVD2020-08 have changed and the following uses are not acceptable for continued registration:

- Domestic-class pressurized product application using total release foggers (including lock-valve mechanism)
- Domestic handler applications using handheld and stationary fogging/misting equipment on liquid domestic-class products
- Space spray uses on liquid domestic-class product labels
- Indoor structural broadcast applications to control flies and mosquitoes in livestock and poultry housing and facilities. The rate on the only currently registered product exceeds the maximum allowable rate of 0.276 g a.i./m².
- Domestic-class products used in metered-release devices.

All remaining registered uses are acceptable for continued registration provided that the mitigation measures outlined in Appendix IV are followed.

Health Canada responses to specific comments are presented in Appendix III. Details of the revised occupational and non-occupational risk assessments are presented in Appendix VI.

1.5 Aggregate exposure and risk assessment

The aggregate exposure and risk assessment was updated to include those uses and scenarios for which route-specific risks were shown to be acceptable. Inhalation exposure from the use of pyrethrins in residential areas was aggregated with dietary exposure from food and drinking water.

Aggregate risks were shown to be acceptable for all currently registered uses, provided the use pattern changes and mitigation measures outlined in Appendix IV are followed. Details of the revised aggregate risk assessments are presented in Appendix VII.

1.6 Cumulative assessment

No new information was received during the consultation period related to cumulative risk. As noted in PRVD2020-08, the pyrethrins belong to the pyrethroid group of chemicals that have a common mechanism of toxicity related to their ability to interact with voltage-gated sodium channels leading to neurotoxicity. As per Science Policy Note SPN2018-02, *Cumulative Health Risk Assessment Framework*, upon completion of the re-evaluation of the individual chemicals in this group, cumulative risk will be assessed as a separate exercise, incorporating all relevant members of the common mechanism group(s).

1.7 Health incident reports

Subsequent to the publication of PRVD2020-08, Health Canada received 30 additional human incidents and 69 additional domestic animal incidents involving pyrethrins co-formulated with piperonyl butoxide and other active ingredients (for example, s-methoprene, permethrin). The adverse effect and exposure patterns noted in the current sub-set of incidents (in other words, from 19 November 2019 to 3 February 2022) is similar to the incident report review summarized in PRVD2020-08.

In general, pyrethrins incidents most commonly involved products registered for use on companion animals followed by products used at residential sites.

The review of incidents involving co-formulated pyrethrins spray or shampoo products for use on companion animals point to a concern for adverse effects in cats and dogs even when the products are used according to label directions. Therefore, the labels of all pyrethrins spray or shampoo products must be updated to inform the consumer of possible side effects in pets that can be expected following the use of these products. In addition, the labels must contain statements that contraindicate the use of other companion animal products with the same active ingredient as the pyrethrins spray (or shampoo) product and remove any label language that allows for the re-application of the product before the end of the effective control period. The label requirements (see Appendix IV) are similar to those outlined in the 2019 PMRA Guidance Document, *Label Improvements for Spot-on Pesticides Used on Companion Animals*. Furthermore, the product labels must be amended to reflect the statements outlined in DIR2002-01, *Canadian Label Improvements for Pesticides used on Companion Animals*, in order to address the deficiencies or inconsistencies noted in the precautionary and use direction statements across the various registered products.

The review of human and domestic animal incidents involving pyrethrins products registered for use at residential sites indicates a potential for incidental oral, inhalation and/or dermal exposure of people and pets to pyrethrins even when products are used according to the label directions. The current label language on pyrethrins products that were most frequently reported in incidents was found to be somewhat vague and non-specific (for example, products do not clearly specify or define the type of surface-directed treatment allowed). Therefore, mitigation measures, as outlined in Appendix IV include informing the consumer of the potential effects that can be expected following the use of pyrethrins products co-formulated with piperonyl butoxide or other active ingredients. Additionally, label amendments as outlined in the 2020 PMRA Guidance Document, *Structural Pest Control Products: Label Updates* are required for all domestic-class pyrethrins products, in order to reduce the potential for dermal and/or inhalation exposure of people and pets during the use of these products in enclosed areas.

2.0 Revised environmental risk assessment

Health Canada received comments related to the environmental risk assessment during the public consultation period for PRVD2020-08. Comments related to cranberry uses are addressed in Appendix III. As outlined in PRVD2020-08, additional data were required under section 19 of the *Pest Control Products Act* to confirm that application rates and use directions on product labels are consistent with the rates used in the environmental risk assessments. As a result of the information received from registrants' response to this data call-in related to application rates for mosquito control, the environmental risk assessment was updated. Details of the revised environmental risk assessment is presented in Appendix VIII.

Potential risks were identified for most organisms when pyrethrins are applied using a thermal aerosol generator for mosquito control to bushes, grass areas and/or other outdoor areas at a rate that represents a five-fold increase to that assessed in PRVD2020-08. The broad-based nature of this risk along with the relatively large risk quotients indicates that impacts may occur at an ecosystem level. Potential population-level risks resulting from a maximum of 24 applications per season at a rate of 176 g a.i./ha using a thermal aerosol generator with a minimum 7-day application interval are not shown to be acceptable. Therefore, the maximum rate of commercial-class outdoor mosquito fogging will be limited to the rate outlined in the revised health risk assessment (Appendix VI).

3.0 Value assessment

Comments received in response to PRVD2020-08 did not result in a change in the value assessment. Therefore, the value assessment and conclusions are consistent with PRVD2020-08.

4.0 Conclusion of science evaluation

Following PRVD2020-08, some of the health and environmental risk assessments were revised. As a result of public consultation, an inhalation toxicity study was revisited. An updated literature search was also conducted for genotoxicity studies. The toxicology reference values and the cancer risk assessment approach remain consistent with PRVD2020-08. The acute and chronic dietary risks are acceptable and consistent with PRVD2020-08. The occupational and non-occupational risk assessment, including residential exposure, was revised to include new use

sites, application equipment, rates, container sizes, active ingredient concentration, number of applications and application intervals. The revised risk assessments determined most uses are acceptable except for domestic-class total release foggers, domestic-class liquid application using handheld and stationary fogging/misting equipment, domestic-class metered-release devices, and domestic-class liquid space sprays. The aggregate risk assessment found all currently registered uses to be acceptable with the required mitigation measures. In addition, similar to what was proposed in PRVD2020-08, it is required that all labels of domestic class products contain best practice statements and label amendments.

The environmental risks were re-assessed based on maximum application rates received from the data call-in. The revised environmental risk assessment determined a maximum application rate for outdoor mosquito fogging applications was required and revised buffer zones. The environmental risks were determined to be acceptable when the revised label directions and required mitigation measures are applied.

Pyrethrins was determined to have value except for label claims related to killing lice on mattresses, bedding, furniture, and garments as noted in PRVD2020-08. The revised risk assessments, as noted above, will require mitigation that will have limited impact on the use pattern for some uses.

In conclusion, most uses of pyrethrins are acceptable for continued registration provided the risk mitigation measures outlined in this final decision are implemented.

List of abbreviations

♂	males
♀	females
↑	increased
↓	decreased
%	percent guarantee
ABMS	animal barn misting systems
AC	air concentration
ACH	air exchanges per hour
ADI	acceptable daily intake
AHPD	amount handled per day
a.i.	active ingredient
AP	amount applied
AR	application rate
ARfD	acute reference dose
ASL	airway surface liquid
ATPD	area treated per day
bw	body weight
bwg	body weight gain
C _o	initial concentration
CAPHRA	Council for the Advancement of Pyrethroid Human Risk Assessment
CC	crack and crevice
CCTM	candles, coils, torches, mats
CG	crop group
cm	centimeter
cm ²	centimeter squared
cm ³	centimeter cubed
CR	chemical resistant
DACO	data code
DFR	dislodgeable foliar residue
DNA	deoxyribonucleic acid
DR	deposited residue
DU	dust
EC	emulsifiable concentrate
EDE	estimated daily exposure
EEC	estimated environmental concentration
EFSA	European Food Safety Authority
ER	emission rate
ET	exposure time
F	fraction of chemical available in outdoor air
FD	fraction of residue that dissipates daily
ft	foot
FS	fraction available in uppermost centimeter of soil
g	gram
GH	greenhouse
GIgR	ingestion rate of dry pesticide formulation
ha	hectares

HH AB/MB	handheld airblast/mistblower
Hct	hematocrit
Hgb	hemoglobin
hr	hour
HtM	hand-to-mouth
IPM	integrated pest management
IR	inhalation rate
kg	kilogram(s)
kPa	kilopascal
L	litre(s)
LOAEC	lowest observed adverse effect concentration
LOAEL	lowest observed adverse effect level
LOQ	limit of quantification
m	meter
m ²	meters squared
m ³	meters cubed
mg	milligram(s)
mL	millilitre(s)
M/L/A	mixer/loader/applicator
MOE	margin of exposure
MPHG	mechanically pressurized handgun
MPHS	mechanically pressurized handheld sprayer for mists, aerosols, and fogs
MPHW	manually pressurized handwand
MRL	maximum residue limit
NDETF	Non-Dietary Exposure Task Force
NOAEC	no observed adverse effect concentration
NOAEL	no observed adverse effect level
NIOSH	National institute for Occupational Safety and Health
OASS	outdoor aerosol space spray
OFMS	outdoor fogging and misting systems
OtM	object-to-mouth
PBI	plant back interval
PCO	pest control operator
PHI	preharvest interval
PJV	Pyrethrins Joint Venture
PMRA	Pest Management Regulatory Agency
PMRL	proposed maximum residue limit
PP	pressurized product
PPE	personal protective equipment
PPID	pesticide product information database
PR	pulse rate
PRVD	Proposed Re-evaluation Decision
psi	pound per square inch
PYR	pyrethrins
Q	airflow through treated area
RBC	red blood cell
REI	restricted-entry interval
rel	relative

RTU	ready to use
SCE	sister chromatid exchange
SG	soluble granule
SN	solution
SOP	standard operating procedure
SR _t	soil residue on day 't'
t	postapplication day
TC	transfer coefficient
TR	transferable residue
TTR	turf transferable residue
TWA	time weighted average
UL	useful life of product
ULV	ultra low volume
URMULE	user requested minor use label expansion
USEPA	United States Environmental Protection Agency
V	volume of treated space
V _g	vaporization efficiency
WBC	white blood cell
WDG	water dispersible granule
wk	week
WHO	World Health Organization
µg	microgram(s)
µm	micrometer(s)

Appendix I Registered products containing pyrethrins in Canada¹

Table 1 Products containing pyrethrins requiring expedited (label) amendments (18-month implementation)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
9021	Domestic	Rolf C. Hagen Inc.	Living World Bird Bath for Caged Birds	Pressurized Product	PYR (0.09) PBU (0.18) MGK (0.30)
9749	Domestic	S.C. Johnson and Son, Limited	Raid House & Garden Bug Killer	Pressurized Product	PBU (1.21) PYR (0.25)
13074	Domestic	Premier Tech Brighton Ltd	Pro Professional Ant and Roach Pyrodust	Dust	PBU (1.0) PYR (0.2)
14633	Domestic	McLaughlin Gormley King Company	Pyroicide Ready-to-Use Liquid Insecticide	Solution	PBU (1.0) PYR (0.1)
15180	Domestic	McLaughlin Gormley King Company	Pyroicide Aqueous Garden Spray	Solution	PBU (0.2) PYR (0.02)
15181	Domestic	McLaughlin Gormley King Company	Pyroicide Aqueous Plant Spray Insecticide	Solution	PBU (0.2) PYR (0.02)
15488	Domestic	Puroguard Insecticides Ltee	Puroguard House & Garden Insecticide Dust	Dust	PBU (1.0) PYR (0.2)
16282	Domestic	Premier Tech Brighton Ltd	Pro Professional Aerosol Insecticide	Pressurized Product	PBU (4.0) PYR (0.5)
17953	Domestic	PLZ Corp.	K-G House & Garden Insect Killer I	Pressurized Product	PBU (0.8) PYR (0.2)
18074	Domestic	Puroguard Insecticides Ltee	Puroguard Insecticide	Solution	PBU (1.0) PYR (0.1)
18504	Domestic	PLZ Corp.	K-G House Plant Insecticide I	Pressurized Product	PBU (1.0) PYR (0.2)
19004	Domestic	Maheu & Maheu Inc.	Maheu & Maheu Insecticide Dust	Dust	PBU (1.0) PYR (0.2)
19460	Domestic	Woodstream Canada Corporation	Safer's Flea & Tick Spray/R.T.U	Solution	PYR (0.06) PBU (0.60)
19485	Domestic	PLZ Corp.	K-G Flying Insect Killer I	Pressurized Product	PBU (3.2) PYR (0.4)
19748	Domestic	McLaughlin Gormley King Company	Flying Insect Killer IB	Pressurized Product	PBU (1.93) PYR (0.4)
20359	Domestic	PLZ Corp.	K-G Flea & Tick Spray for Dogs & Cats IV	Pressurized Product	PYR (0.056) PFL (0.050)
20563	Domestic	Woodstream Canada Corporation	Safer's Trounce Yard & Garden Insecticide	Solution	PYR (0.01) SOC (1.0)
20564	Domestic	Woodstream Canada Corporation	Safer's Trounce Yard & Garden Insecticide Concentrate	Solution	PYR (0.2) SOC (20.0)
20565	Domestic	Woodstream Canada Corporation	Safer's Trounce Houseplant Insecticide	Solution	PYR (0.01) SOC (1.0)
20566	Domestic	Woodstream Canada Corporation	Safer's Houseplant Insecticide Concentrate	Solution	PYR (0.20) SOC (20)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
20720	Domestic	Woodstream Canada Corporation	Safer's Flea & Tick Spray (R.T.U.)	Solution	PYR (0.06) PBU (0.60)
20848	Domestic	Woodstream Canada Corporation	Safer's Attack Roach & Crawling Insect Killer	Dust	PBU (1.0) PYR (0.4) SIF (74.9)
21088	Domestic	S.C. Johnson and Son, Limited	Raid House & Garden Bug Killer Pressurized Spray	Pressurized Product	PBU (1.93) PYR (0.4)
21157	Domestic	PLZ Corp.	K-G Flea & Tick Quick Breaking Insecticide Foam for Dogs & Cats IV	Pressurized Product	PYR (0.056) PFL (0.050)
21277	Domestic	PLZ Corp.	K-G Botanic Plant Insect Spray	Pressurized Product	PYR (0.2)
21455	Domestic	PLZ Corp.	K-G Flea & Tick Spray for Dogs & Cats VII	Pressurized Product	PYR (0.106) PFL (0.050) PBU (0.100) MGK (0.168)
21629	Domestic	Rolf C. Hagen Inc.	Sergeant's Flea and Tick Spray for Dogs	Pressurized Product	PYR (0.056) PFL (0.050)
21630	Domestic	Rolf C. Hagen Inc.	Sergeant's Flea and Tick Spray for Cats	Pressurized Product	PYR (0.056) PFL (0.050)
22169	Domestic	S.C. Johnson and Son, Limited	Raid House & Garden Bug Killer Trigger Spray	Emulsifiable Concentrate	PBU (0.97) PYR (0.2)
22299	Domestic	Woodstream Canada Corporation	Safer's End-All II Miticide Insecticide Acaricide Concentrate	Solution	PYR (0.2) SOC (20)
22300	Domestic	Woodstream Canada Corporation	Safer's End-All II Miticide Insecticide Acaricide Ready-to Use	Solution	PYR (0.1) SOC (1.0)
23053	Domestic	Premier Tech Ltd.	Wilson Flower, Vegetable and Ornamental RTU BUG-X	Solution	PBU (0.2) PYR (0.02)
23061	Domestic	S.C. Johnson and Son, Limited	Raid Max House & Garden Bug Killer 2	Pressurized Product	PBU (1.01) PYR (0.25)
23185	Domestic	Premier Tech Ltd.	Green Earth Bio-Mist Garden Insect Killer	Solution	PBU (0.2) PYR (0.02)
23300	Domestic	Premier Tech Ltd.	Green Earth Bio-Mist Insect Killer	Solution	PBU (9.22) PYR (0.96)
23352	Domestic	Puroguard Insecticides Ltee	The Exterminator Insecticide Dust	Dust	PBU (1.0) PYR (0.2)
23356	Domestic	Puroguard Insecticides Ltee	The Exterminator PY-42	Solution	PBU (1.0) PYR (0.1)
23502	Domestic	PLZ Corp.	K-G Insecticide Pressurized Spray	Pressurized Product	PBU (5.0) PYR (0.5)
23602	Domestic	PLZ Corp.	K-G Crawling Insect Killer XII I	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
23627	Domestic	Acuity Holdings, Inc.	Konk Flea Killer Dog & Cat Spray	Pressurized Product	PYR (0.056) PFL (0.05)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
24201	Domestic	S.C. Johnson and Son, Limited	Raid Yard Guard I Bug Killer	Pressurized Product	PBU (0.97) PYR (0.176) NEO5 (0.081)
24211	Domestic	Woodstream Canada Corporation	Safer's Attack Houseplant & Garden Insecticide	Solution	PBU (0.2) PYR (0.02)
24330	Domestic	Vétoquinol N.-A. Inc.	Veto-Mist II Fly Killer Insecticide	Pressurized Product	PBU (10.0) PYR (1.75)
24428	Domestic	W.F. Young Inc.	Absorbine Flys-X Ready to Use Insecticide	Solution	PYR (0.1) PBU (1.0)
24784	Domestic	Farnam Companies, Inc.	Bronco Water-Base Equine Fly Spray	Solution	PYR (0.05) PFL (0.10) PBU (0.50)
24856	Domestic	Acuity Holdings, Inc.	Konk 499 Crawling Insect Killer	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
24864	Domestic	PLZ Corp.	K-G Multi Purpose Insecticide Spray II	Pressurized Product	PBU (1.0) PYR (0.25)
24892	Domestic	Acuity Holdings, Inc.	Konk 493 Insect Blaster Pressurized Spray	Pressurized Product	PBU (5.0) PYR (0.5)
24979	Domestic	Chasse-Moustique Buzz-Up	Buzz-Up! House & Garden Insect Killer	Pressurized Product	PBU (0.8) PYR (0.2)
25181	Domestic	S.C. Johnson and Son, Limited	OFF! Area Bug Spray (Yard & Deck)	Pressurized Product	PBU (0.97) PYR (0.176) NEO (0.081)
25333	Domestic	Woodstream Canada Corporation	Safer's Trounce Houseplant Insect Killer R	Pressurized Product	PYR (0.01) SOC (1.0)
25495	Domestic	Maheu & Maheu Inc.	Maheu & Maheu Flying Insect Killer	Pressurized Product	PBU (3.2) PYR (0.4)
26243	Domestic	W. Neudorff GMBH KG	Hyydroworxx Insecticide/Miticide Concentrate	Emulsifiable Concentrate	PYR (0.5)
26244	Domestic	W. Neudorff GMBH KG	NEU1161I RTU Insecticide/Miticide	Emulsifiable Concentrate	PYR (0.01)
26439	Domestic	PLZ Corp.	K-G Crawling Insect Killer VI	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
26586	Domestic	Woodstream Canada Corporation	Safer's End-All Insecticide/Miticide	Emulsifiable Concentrate	PYR (0.01)
26587	Domestic	Woodstream Canada Corporation	Safer's End-All Insecticide/Miticide Concentrate	Emulsifiable Concentrate	PYR (0.5)
26669	Domestic	Acuity Holdings, Inc.	Konk House & Garden Bug Killer	Pressurized Product	PBU (1.0) PYR (0.25)
26720	Domestic	Premier Tech Ltd.	Green Earth Homecare Flying and Crawling Insect Killer	Pressurized Product	PBU (0.8) PYR (0.2)
26909	Domestic	S.C. Johnson and Son, Limited	Raid EarthBlends Multi-Bug Killer	Pressurized Product	PBU (1.01) PYR (0.25)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
26952	Domestic	PLZ Corp.	Terand Crawling Insecticide	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
27175	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Go Green Doktor Doom Indoor/Outdoor Insecticide Spray	Pressurized Product	PBU (1.25) PYR (0.25)
27177	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Crawling Insect Killer	Pressurized Product	PBU (1.25) PYR (0.25)
27547	Domestic	Empack SprayTech Inc.	Blaze Flying Insect Killer	Pressurized Product	PBU (2.0) PYR (0.4)
27680	Domestic	UR-CAN INC.	Go Green Doktor Doom Botanics Plant Spray	Pressurized Product	PYR (0.20)
27945	Domestic	S.C. Johnson and Son, Limited	Raid EarthBlends Ant & Spider Bug Killer	Pressurized Product	PBU (1.01) PYR (0.25)
28265	Domestic	Les Produits de Contrôle Supérieur Inc./Superior Control Products Inc.	Superior Mr. Bug Ant, Cockroach & Earwig Killer Plus	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
28361	Domestic	W. Neudorff GMBH KG	NEU1161 Residual Pest Spray	Emulsifiable Concentrate	PYR (0.3)
28379	Domestic	Scotts Canada Ltd.	Ortho Bug B Gon Eco Insecticide Spray Ready-to-Use	Emulsifiable Concentrate	PYR (0.01)
28404	Domestic	Scotts Canada Ltd.	Ortho Bug B Gone Eco Insecticide Concentrate	Emulsifiable Concentrate	PYR (0.5)
28465	Domestic	Kuus Inc.	Knock Down X-Max Flying & Crawling Insect Killer (0.5 Pyrethrin from Chrysanthemum Flower Pyrethrum)	Pressurized Product	PBU (5.0) PYR (0.5)
28466	Domestic	Kuus Inc.	Knock Down Indoor and Plant Max Flying & Crawling Insect Killer (0.25 Pyrethrin from Chrysanthemum Flower Pyrethrum)	Pressurized Product	PBU (1.25) PYR (0.25)
28570	Domestic	W. Neudorff GMBH KG	NEU1161I with Applicator Insecticide/Miticide Concentrate	Emulsifiable Concentrate	PYR (0.5)
28614	Domestic	W. Neudorff GMBH KG	NEU1161I RTU with Quick Connect Sprayer Insecticide/Miticide	Emulsifiable Concentrate	PYR (0.01)
28615	Domestic	W. Neudorff GMBH KG	NEU1161LI RTU WITH PULL'N SPRAY APPLICATOR INSECTICIDE/MITICIDE	Emulsifiable Concentrate	PYR (0.01)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
28970	Domestic	Les Produits de Controle Superieur Inc / Superior Control Products Inc	Pro-Maxx The Garden & House Protector	Pressurized Product	PBU (1.0) PYR (0.25)
29045	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Multi-Purpose Insecticide Spray	Pressurized Product	PBU (1.25) PYR (0.25)
29046	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Go Green Doktor Doom Spider Mite Knockout I	Pressurized Product	PBU (0.8) PYR (0.2)
29047	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Professional Aerosol Insect Killer	Pressurized Product	PBU (4.0) PYR (0.5)
29163	Domestic	W. Neudorff GMBH KG	NEU1161 Aerosol Residual Pest Spray	Pressurized Product	PYR (0.3)
29322	Domestic	S.C. Johnson and Son, Limited	Raid Max Home Insect Killer	Pressurized Product	PBU (1.01) PYR (0.25)
29323	Domestic	S.C. Johnson and Son, Limited	Raid Spider Blaster Bug Killer 5	Pressurized Product	PBU (1.01) PYR (0.25)
29324	Domestic	S.C. Johnson and Son, Limited	Raid Max Flying Insect Killer 3	Pressurized Product	PBU (1.01) PYR (0.25)
29338	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Go-Green (Botanics) Indoor Plant Spray	Pressurized Product	PYR (0.20)
29339	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Sleep Tight Bed Bug Killer II	Pressurized Product	PBU (1.25) PYR (0.25)
29485	Domestic	Premier Tech Ltd.	Schultz Houseplant & Indoor Garden Insect Spray	Solution	PBU (0.2) PYR (0.02)
29521	Domestic	Can-Vet Animal Health Supplies Ltd.	Bugwacker 600	Pressurized Product	PBU (5.0) PYR (0.5)
29633	Domestic	Kuus Inc.	Knock Down Bed Bug Killer 0.25 Pyrethrins from Chrysanthemum Flower Pyrethrum	Pressurized Product	PBU (1.25) PYR (0.25)
29691	Domestic	Kuus Inc.	Knock Down Max House Plant Insect Killer (0.25 Pyrethrins from Chrysanthemum Flower Pyrethrum)	Pressurized Product	PBU (1.25) PYR (0.25)
29692	Domestic	Kuus Inc.	Knock Down Total Home & Indoor Garden Insect Killer	Pressurized Product	PBU (1.25) PYR (0.25)
29693	Domestic	Kuus Inc.	Knock Down Total Spider Mites Killer 0.25 Pyrethrins from Chrysanthemum Flower Pyrethrum	Pressurized Product	PBU (1.25) PYR (0.25)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
29759	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom "Go Green" Premium Quality Pyrethrin Insecticide Powder for Home and Garden	Dust	PBU (1.0) PYR (0.2)
29800	Domestic	Gardex Chemicals Ltd.	Gardex Py Dust-Bug Kill Maxx	Dust	PBU (1.0) PYR (0.2)
29882	Domestic	Woodstream Canada Corporation	Safer's End All Indoor Plant Insecticide	Solution	PYR (0.01) SOC (1.0)
29883	Domestic	Woodstream Canada Corporation	Safer's Trounce Greenhouse and Indoor Plant Insecticide	Solution	PYR (0.01) SOC (1.0)
29950	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Premium Quality #1 "No Flies on Us" Insect Destroyer	Pressurized Product	PBU (5.0) PYR (0.5)
29955	Domestic	Kuus Inc.	Protex Bed Bug Killer .25 Pyrethrin form Chrysanthemum Flower Pyrethrum	Pressurized Product	PBU (1.25) PYR (0.25)
29983	Domestic	Can-Vet Animal Health Supplies Ltd	Tick-End	Solution	PYR (0.06) PBU (0.6)
30032	Domestic	Kuus Inc.	Knock Down Professional KD120P Flying & Crawling Insect Killer	Pressurized Product	PBU (5.0) PYR (0.5)
30355	Domestic	S.C. Johnson and Son, Limited	Raid® Ant Roach & Earwig Bug Killer 19	Pressurized Product	PBU (0.48) PYR (0.2) CXF (0.05)
30356	Domestic	S.C. Johnson and Son, Limited	Raid® Spider Blaster Bug Killer 4	Pressurized Product	PBU (0.48) PYR (0.2) CXF (0.05)
30357	Domestic	S.C. Johnson and Son, Limited	Raid Max® Crawling Insect Bug Killer 3	Pressurized Product	PBU (0.48) PYR (0.2) CXF (0.05)
30368	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Go-Green Multipurpose Indoor Insect Control II	Pressurized Product	PBU (1.25) PYR (0.25)
30418	Domestic	UR-Can Inc.	Onguard PD5	Pressurized Product	PBU (5.0) PYR (0.5)
30439	Domestic	Kuus Inc.	Professional Knock Down Bedbug, Ant, Cockroach, Flea & Tick Insect Killer 0.25 Pyrethrins from Chrysanthemum Flower Pyrethrum	Pressurized Product	PBU (1.25) PYR (0.25)
30640	Domestic	S.C. Johnson and Son, Limited	Raid® Spider Blaster Bug Killer	Pressurized Product	PBU (0.48) PYR (0.2) CXF (0.05)
30641	Domestic	S.C. Johnson and Son, Limited	Raid Mosquito and Fly Killer 1	Pressurized Product	PBU (1.01) PYR (0.25)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
30855	Domestic	Kuus Inc.	Knock Down Pot-It House Plant & Garden Insect Killer (Botanical)	Pressurized Product	PYR (0.20)
30980	Domestic	Camco	Super Kill Flying and Crawling Insect Killer	Pressurized Product	PBU (3.2) PYR (0.4)
31049	Domestic	Business Helpers' Depot Inc.	EZ-Kill Jet & Coarse Spray Super Fast Stinging & Crawling Insect Killer (PNP)	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
31110	Domestic	Acuity Holdings, Inc.	Kong Bed Bug Killer	Pressurized Product	PBU (5.0) PYR (0.5)
31113	Domestic	Novella Brands Inc.	Blaze Pro Crawling Insect Destroyer	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
31143	Domestic	Kuus Inc.	Knock Down Dust Devil Crawling & Flying Insect Control & Killer Dust	Dust	PBU (1.0) PYR (0.2) SIF (74.0)
31200	Domestic	Kuus Inc.	Knock Down Botanical House Plant & Garden Insect Killer (0.25 pyrethrins from Chrysanthemum Flower Pyrethrum)	Pressurized Product	PYR (0.25)
31277	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Premium Quality #1 Ant Nest & Ant Killer	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
31295	Domestic	Kuus Inc.	Knock Down Eco Flying and Crawling Liquid Insect Killer (0.1 Pyrethrins from Chrysanthemum Flower Pyrethrum)	Solution	PBU (1.0) PYR (0.1)
31386	Domestic	PLZ Corp.	K-G Crawling Insect Killer XI – AF 2014	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
31387	Domestic	PLZ Corp.	K-G Quick Breaking Crawling Insecticide Foam I – AF 2014	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
31389	Domestic	PLZ Corp.	K-G Insecticide Foam Spray – AF 2014	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
31397	Domestic	Business Helpers' Depot Inc.	Gotcha Indoor/Outdoor Surface & Space Insecticide Spray	Pressurized Product	PBU (1.0) PYR (0.1)
31399	Domestic	Business Helpers' Depot Inc.	Fight Back Insecticide M-22	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
31401	Domestic	Business Helpers' Depot Inc.	Fight Back Barrier Spray for Flying & Crawling Insects 24-7 (PNP)	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
31402	Domestic	Business Helpers' Depot Inc.	Fight Back Blood Sucking Parasite Killer	Pressurized Product	PBU (1.5) PYR (0.3)
31413	Domestic	Kuus Inc.	Knock Down Greenhouse Plant & Flower Insect Killer (0.02 Pyrethrins from Chrysanthemum flower Pyrethrum)	Solution	PBU (0.2) PYR (0.02)
31549	Domestic	Wal-Mart Canada Inc.	Great Value Ant, Roach & Crawling Insect Killer	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
31550	Domestic	Wal-Mart Canada Inc.	Great Value Home Bug Barrier Insect Killer	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
31560	Domestic	Business Helpers' Depot Inc.	Fight Back Foam Spray Ant Killer 24/7 (PNP)	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
31561	Domestic	Novella Brands Inc.	Blaze Pro Crawling Insect Killer Spray	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
31565	Domestic	Novella Brands Inc.	Blaze Home Bug Shield Kills on Contact	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
31574	Domestic	Novella Brands Inc.	Blaze Pro Home Bug Shield Kills on Contact	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
31606	Domestic	Business Helpers' Depot Inc.	Gotcha™ Outdoor Yard Spray	Pressurized Product	PBU (1.0) PYR (0.1)
31614	Domestic	Rolf C. Hagen Inc.	Sentry Flea & Tick Spray For Dogs	Pressurized Product	PYR (0.056) PFL (0.050)
31628	Domestic	Rolf C. Hagen Inc.	Sentry Flea & Tick Spray For Cats	Pressurized Product	PYR (0.056) PFL (0.050)
31633	Domestic	Business Helpers' Depot Inc.	EZ-Kill "On-the-Spot" Ant Killer 24-7	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
31635	Domestic	Business Helpers' Depot Inc.	Gotcha Bed Bug Killer	Pressurized Product	PBU (1.0) PYR (0.1)
31638	Domestic	UR-Can Inc.	Eco-Guard Complete Insect Treatment	Pressurized Product	PBU (1.0) PYR (0.1)
31686	Domestic	Premier Tech Ltd.	Wilson One Shot Jet Foam Ant Killer Insecticide Spray	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
31704	Domestic	Camco	Super Kill II Roach & Ant Killer2	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
31841	Domestic	Premier Tech Ltd.	Wilson One Shot Mosquito & Flying Insect Spray	Pressurized Product	PBU (1.0) PYR (0.1)
31851	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Indoor Lice Killer	Pressurized Product	PBU (1.5) PYR (0.3)
31897	Domestic	S.C. Johnson and Son, Limited	Raid Bed Bug Killer	Pressurized Product	PBU (1.01) PYR (0.25)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
31907	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Supercharged Residual Foam Ant & Ant Nest Killer	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
31938	Domestic	Neogen Corporation	Prozap Shu-Fly	Pressurized Product	PBU (1.93) PYR (0.4)
31975	Domestic	Neogen Corporation	Prozap Defender RTU	Solution	PBU (1.0) PYR (0.1)
32035	Domestic	Premier Tech Ltd.	Wilson Crawl Out Crawling Insect Killer	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.24)
32095	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Insect Killer for Use on Fruit, Vegetables, Flowers and Ornamental Plants	Solution	PBU (0.2) PYR (0.02)
32113	Domestic	Novella Brands Inc.	Blaze Pro Ant Destroyer	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
32115	Domestic	Kuus Inc.	Knock Down Pot-It House Plant & Garden Insect Killer (Botanical) I	Pressurized Product	PYR (0.2)
32119	Domestic	Novella Brands Inc.	Blaze Pro Ant Nest Destroyer Foam	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
32129	Domestic	Scotts Canada Ltd.	Ortho® Ant B Gone Max® Ant Killer Foam	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
32223	Domestic	UR-Can Inc.	On Guard PNP Liquid Residual	Solution	PYR (0.05) PFL (0.20) MGK (0.25)
32331	Domestic	Extermination Info Conseil	C2 Insecticide Plus for Crawling Insect	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
32379	Domestic	Business Helpers' Depot Inc.	Gotcha Flying Insect Killer for Horse & Stable	Pressurized Product	PBU (1.0) PYR (0.1)
32434	Domestic	S.C. Johnson and Son, Limited	Raid Ant Roach & Earwig Inset Killer 2	Pressurized Product	PBU (1.01) PYR (0.25)
32435	Domestic	S.C. Johnson and Son, Limited	Raid Max Crawling Insect Bug Killer 4	Pressurized Product	PBU (1.01) PYR (0.25)
32436	Domestic	S.C. Johnson and Son, Limited	Raid Home Insect Killer 2	Pressurized Product	PBU (1.01) PYR (0.25)
32437	Domestic	S.C. Johnson and Son, Limited	Raid Spider Blaster Bug Killer 6	Pressurized Product	PBU (1.01) PYR (0.25)
32438	Domestic	S.C. Johnson and Son, Limited	Raid Max Flying Insect Killer 3	Pressurized Product	PBU (1.01) PYR (0.25)
32439	Domestic	Business Helpers' Depot Inc.	Gotcha Biting Tick Destroyer	Pressurized Product	PBU (0.84) PYR (0.087)
32482	Domestic	Business Helpers' Depot Inc.	Fight Back Original Bed Bug Killer	Pressurized Product	PBU (1.0) PYR (0.2)
32507	Domestic	Kuus Inc.	Knock Down Total Home & Indoor Garden Insect Killer	Pressurized Product	PBU (1.25) PYR (0.25)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
32617	Domestic	Acuity Holdings, Inc.	Konk Foam Insecticide II	Pressurized Product	PYR (0.05) PFL (0.2) MGK (0.25)
32618	Domestic	Acuity Holdings, Inc.	Konk Hornet & Wasp Jet Spray II	Pressurized Product	PYR (0.05) PFL (0.2) MGK (0.25)
32701	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Deer Tick Killer	Pressurized Product	PBU (0.84) PYR (0.087)
32706	Domestic	Maheu & Maheu Inc.	Maheu & Maheu Crawling Insect Killer II	Pressurized Product	PYR (0.05) PFL (0.2) MGK (0.25)
32748	Domestic	Groupe BMR Inc.	Eliminator Plus for Ants II	Pressurized Product	PYR (0.05) PFL (0.2) MGK (0.25)
32793	Domestic	Empack Spraytech Inc.	EmZone Pyroicide House and Garden Insect Killer	Pressurized Product	PBU (1.0) PYR (0.2)
32833	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Formula 420 Flower Power Insect Killer Concentrate	Emulsifiable Concentrate	PYR (0.5)
32834	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Formula 420 Flower Power Insect Killer RTU	Emulsifiable Concentrate	PYR (0.010)
32899	Domestic	PLZ Corp.	K-G Multi-Purpose Insect Killer RTU Spray	Pressurized Product	PBU (1.0) PYR (0.1)
32966	Domestic	S.C. Johnson and Son, Limited	Raid Max Bed Bug Killer	Pressurized Product	PBU (1.01) PYR (0.25)
33123	Domestic	Empack Spraytech Inc.	Emzone Fly Killer Insecticide	Pressurized Product	PBU (5.0) PYR (0.5)
33324	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Go Green Indoor Plant Insect Killer	Pressurized Product	PBU (1.25) PYR (0.25)
33393	Domestic	PLZ Corp.	K-G Lice and Bed Bug Killer	Pressurized Product	PBU (1.5) PYR (0.3)
33737	Domestic	Eco-Cop Inc.	Klenze 9 Insecticide	Solution	PYR (0.05) PFL (0.2) MGK (0.239)
33823	Domestic	Kuus Inc.	Knock Down® Equine Fly Spray	Solution	PYR (0.05) PFL (0.10) PBU (0.50)
34000	Domestic	Vétoquinol N.-A. Inc.	Enough!	Pressurized Product	PBU (5.0) PYR (0.5)
34069	Domestic	S.C. Johnson and Son, Limited	Raid Essentials Ant & Spider Killer	Pressurized Product	PBU (1.01) PYR (0.25)
34070	Domestic	S.C. Johnson and Son, Limited	Raid Essentials Flying Bug Killer	Pressurized Product	PBU (1.01) PYR (0.25)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
34071	Domestic	S.C. Johnson and Son, Limited	Raid Essentials Multi-Bug Killer	Pressurized Product	PBU (1.01) PYR (0.25)
34276	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Caterpillar Killer Plus Ready-to-Spray	Emulsifiable Concentrate	PYR (0.5)
34291	Domestic	Premier Tech Ltd.	Wilson Fly Out House & Indoor Garden Insect Killer	Pressurized Product	PBU (1.0) PYR (0.25)
34435	Domestic	Les Produits de Contrôle Supérieur Inc./Superior Control Products Inc.	Spider and Insect and Killer IV	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
34442	Domestic	Les Produits de Contrôle Supérieur Inc./Superior Control Products Inc.	Pro-Maxx Ant Destroyer III	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
34536	Domestic	S.C. Johnson and Son, Limited	Raid® Max Spider Blaster Bug Killer 2	Pressurized Product	PBU (1.01) PYR (0.25)

PYR = Pyrethrins, PBU = Piperonyl Butoxide, MGK = N-octyl bicycloheptene dicarboximide, PFL = Permethrin, SOC = potassium salts of fatty acids, SIF = silicon dioxide, NEO = tetramethrin, CXF = cyfluthrin

¹as of 1 January 2023, excluding discontinued products or products with a submission for discontinuation.

Table 2 Products Containing Pyrethrins Requiring Expedited Cancellation (18-month phase-out period)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
14969	Domestic	Medtech Products Inc.	R&C II Spray Insecticide	Pressurized Product	PBU (1.5) PYR (0.3)
24196	Domestic	Acuity Holdings, Inc.	Konk 418D Flying Insect Killer	Pressurized Product	PBU (10) PYR (1.8)
24495	Domestic	Acuity Holdings, Inc.	Kong 416D Flying Insect Killer	Pressurized Product	PBU (10) PYR (1.8)
28372	Domestic	Kuus Inc.	Knock Down X-Max Flying Insect Killer (D) (1.8 Pyrethrin from Chrysanthemum flower pyrethrum)	Pressurized Product	PBU (10) PYR (1.8)
28612	Domestic	PLZ Corp.	K-G Flying Insect Killer Metered III (1.8% PYR-Domestic)	Pressurized Product	PBU (10) PYR (1.8)
28858	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Metered Release Flying Insect Spray	Pressurized Product	PBU (10) PYR (1.8)
28912	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Go Green Doktor Doom Total Release Fogger	Pressurized Product	PBU (2.0) PYR (0.4)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (%. g/L)
28972	Domestic	Les Produits de Controle Superieur Inc/Superior Control Products Inc.	Super Mist for Control of Flies and Mosquitoes	Pressurized Product	PBU (10) PYR (1.8)
29150	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Metered Release BVT/CSA Flying Insect Spray	Pressurized Product	PBU (10) PYR (1.8)
29454	Domestic	PLZ Corp.	K-G Total Release Fumigator	Pressurized Product	PBU (2.0) PYR (0.4)
29923	Domestic	Les Produits de Controle Superieur Inc /Superior Control Products Inc.	The Fumigator II	Pressurized Product	PBU (2.0) PYR (0.4)
29977	Domestic	Kuus Inc.	Knockdown Total Release Fogger (or Fumigator)(0.4% Pyrethrin from Chrysanthemum Flower Pyrethrum)	Pressurized Product	PBU (2.0) PYR (0.4)
30604	Domestic	Auro Pro Solutions, Inc	Zone Guard, Pro Flying Insect Killer-D 1.80%	Pressurized Product	PBU (10) PYR (1.8)
30753	Domestic	Kuus Inc.	Knock Down Professional Total Release Fumigator (Fogger)	Pressurized Product	PBU (2.0) PYR (0.4)
30774	Domestic	Auro Pro Solutions, Inc.	Zone Guard, Domestic Pro Flying Insect Killer 1.8%	Pressurized Product	PBU (10) PYR (1.8)
31161	Domestic	Kuus Inc.	Knock Down Pot-It Plant & Garden Total Release Fumigator (or Fogger) (0.4% Pyrethrins from Chrysanthemum Flower)	Pressurized Product	PBU (2.0) PYR (0.4)
31412	Domestic	Kuus Inc.	Knock Down Greenhouse Vegetable Insect Killer (0.02% Pyrethrin from Chrysanthemum Flower Pyrethrum)	Solution	PBU (0.20) PYR (0.02)
31599	Domestic	Novella Brands Inc.	Kombat Lice Killer for the Home	Pressurized Product	PBU (1.5) PYR (0.3)
32676	Domestic	Acuity Holdings Inc.	Konk Complete Release Fogger	Pressurized Product	PBU (2.0) PYR (0.4)
33698	Domestic	PLZ Corp.	K-G Total Release Fogger-WB	Pressurized Product	PBU (2.0) PYR (0.4)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
33707	Domestic	Can-Vet Animal Health Supplies Ltd.	Bugwacker III Insect Killer	Pressurized Product	PBU (10) PYR (1.8)
33939	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Total Release Fogger II	Pressurized Product	PBU (2.0) PYR (0.4)
34212	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Formula 420 Hydroponic Fogger	Pressurized Product	PBU (2.0) PYR (0.4)
34692	Domestic	Kuss Inc.	Knockdown Total Release Fumigator-Water Based	Pressurized Product	PBU (2.0) PYR (0.4)

PYR = Pyrethrins, PBU = Piperonyl Butoxide

¹As of 1 January 2023, excluding discontinued products or products with a submission for discontinuation

Table 3 Products containing pyrethrins requiring (label) amendments (24-month implementation timeline)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
6109	Commercial	Gardex Chemicals Ltd	Gardex Industrial Insecticide 50-7	Solution	PYR (0.13) PBU (1.27)
9371	Commercial	Gardex Chemicals Ltd	Gardex Pyrethrin Spray 5-25	Emulsifiable Concentrate	PYR (0.5) PBU (2.5)
11540	Commercial	Premier Tech Brighton Ltd.	Pro Professional 3610 Ultra-Low Volume Insecticide	Solution	PYR (3.0) PBU (4.8) MGK (10.0)
11684	Commercial	Gardex Chemicals Ltd	Gardex Pyrethrin Emulsifiable Concentrate 1%	Emulsifiable Concentrate	PYR (1.0) PBU (8.0)
11855	Commercial	Gardex Chemicals Ltd	Gardex Industrial Micro Spray Concentrate	Emulsifiable Concentrate	PYR (3.0) PBU (6.0) MGK (10.0)
13378	Commercial	Mclaughlin Gormley King Company	Pyroicide Fogging Formula 7067 For ULV Mosquito Adulticiding	Solution	PYR (5.00) PBU (24.00)
13779	Commercial	Mclaughlin Gormley King Company	Pyroicide 300	Solution	PYR (3.00) PBU (5.76) MGK (9.57)
14399	Commercial	Poulin's Pest Control	Poulin's C Plus C Insecticide	Solution	PYR (0.16) PBU (1.53)
15162	Commercial	Mclaughlin Gormley King Company	Multi-Purpose Pyroicide Commercial Insecticide	Emulsifiable Concentrate	PYR (1.0) PBU (10.0)
15255	Commercial	Bayer Cropscience Inc	Drione Insecticide Dust	Dust or Powder	SIL (40.0) PYR (1.0) PBU (9.7)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
15330	Commercial	Premier Tech Brighton Ltd.	Pro Professional 110 Ultra-Low Volume Insecticide	Solution	PYR (1.0) PBU (8.0)
18201	Commercial	Gardex Chemicals Ltd.	Gardex Bugkill Pressurized Spray	Pressurized Product	PYR (0.5) PBU (4.0)
18840	Commercial	PLZ Corp.	K-G Hi-Pressure Fumigator	Pressurized Product	PYR (0.40) PBU (2.00)
20094	Commercial	PLZ Corp.	K-G Milk Room & Cattle Spray II	Pressurized Product	PYR (0.50) PBU (5.00)
20098	Commercial	PLZ Corp.	K-G Milk Room & Cattle Spray I	Pressurized Product	PYR (0.50) PBU (4.8)
20384	Commercial	Mclaughlin Gormley King Company	Flying & Crawling Insect Killer I	Pressurized Product	PYR (0.5) PBU (3.84)
20385	Commercial	Mclaughlin Gormley King Company	Flying & Crawling Insect Killer II	Pressurized Product	PYR (0.5) PBU (4.00)
20424	Commercial	Vétoquinol N.-A. Inc.	Disvap IV Insecticide Solution	Solution	PYR (0.1) PBU (1.0)
20463	Commercial	Acuity Holdings, Inc.	Konk 409 Flying Insect Killer	Pressurized Product	PYR (0.975) PBU (1.950) MGK (3.210)
20499	Commercial	Acuity Holdings, Inc.	Konk 408 Flying Insect Killer	Pressurized Product	PYR (0.975) PBU (1.950) MGK (3.210)
21004	Commercial	Mclaughlin Gormley King Company	Pyroicide Concentrate 7369	Solution	PYR (3.00) PBU (28.8)
22563	Commercial	Can-Vet Animal Health Supplies Ltd	Bugwacker Fogging Solution Insecticide	Solution	PYR (0.15) PBU (1.5)
22661	Commercial	PLZ Corp.	Terand Wasp & Hornet Killer	Pressurized Product	PYR (0.050) PBU (0.100) MGK (0.166) BAY (0.500)
22846	Commercial	PLZ Corp.	K-G Flying Insect Killer X	Pressurized Product	PYR (0.50) PBU (5.00)
23020	Commercial	Mclaughlin Gormley King Company	Evercide Intermediate 2507	Emulsifiable Concentrate or Emulsion	PYR (5.00) PFL (10.00) MGK (9.57)
23433	Commercial	Can-Vet Animal Health Supplies Ltd	Bugwacker Tall Insecticide	Pressurized Product	PYR (0.5) PBU (4.0)
23884	Commercial	PLZ Corp.	Spray-Pak Industrial & Dairy Insecticide Pressurized Spray	Pressurized Product	PYR (0.50) PBU (3.84)
24159	Commercial	Can-Vet Animal Health Supplies Ltd	Can Vet Barn & Dairy Fly Shield	Solution	PYR (0.1) PBU (1.0)
24244	Commercial	PLZ Corp.	K-G Milk Room & Cattle Spray III	Pressurized Product	PYR (0.30) PBU (2.4)
24249	Commercial	PLZ Corp.	K-G Flying Insect Killer XII	Pressurized Product	PYR (0.30) PBU (2.40)
24251	Commercial	PLZ Corp.	K-G Flying Insect Killer XI	Pressurized Product	PYR (0.5) PBU (5.00)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
24254	Commercial	PLZ Corp.	K-G Flying Insect Killer XIII	Pressurized Product	PYR (0.30) PBU (2.40)
24363	Commercial	Woodstream Canada Corporation	Safer's Trounce Insecticide Concentrate	Solution	SOC (20.0) PYR (0.2)
24435	Commercial	Acuity Holdings, Inc.	Konker Commercial & Farm Insect Killer	Pressurized Product	PYR (0.30) PBU (2.40)
24436	Commercial	Acuity Holdings, Inc.	Konk Too Farm & Livestock Insect Killer	Pressurized Product	PYR (0.50) PBU (4.00)
24437	Commercial	Acuity Holdings, Inc.	Konk Pro Commercial & Farm Insect Killer	Pressurized Product	PYR (0.50) PBU (5.00)
24711	Commercial	PLZ Corp.	K-G Insecticide II	Pressurized Product	PYR (1.00) PBU (2.00) MGK (3.33)
24729	Commercial	Mclaughlin Gormley King Company	Pyrocide Pressurized Multi-Purpose Spray 7416	Pressurized Product	PYR (0.50) PBU (4.80)
24875	Commercial	Acuity Holdings, Inc.	Konk 407 Insecticide Spray with Pyrethrin	Pressurized Product	PYR (1.00) PBU (2.0) MGK (3.33)
24927	Commercial	Mclaughlin Gormley King Company	Evergreen Emulsifiable 60-6	Emulsifiable Concentrate or Emulsion	PYR (6.00) PBU (60.00)
25364	Commercial	Poulin's Pest Control	Poulin's Liquid Insecticide	Solution	PYR (0.430) PBU (4.10)
25936	Commercial	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom "Mini" Fumigator Total Release	Pressurized Product	PYR (0.40) PBU (2.08)
26261	Commercial	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Hi-Pressure Fumigator	Pressurized Product	PYR (0.40) PBU (2.00)
26460	Commercial	Neogen Corporation	Turbocide Gold With Pyrocide	Solution	PYR (4.03) PBU (30.97)
27220	Commercial	Basf Canada Inc.	Prescription Treatment Brand P.I. Contact Insecticide	Pressurized Product	PYR (0.5) PBU (4)
27678	Commercial	Acuity Holdings, Inc.	Konk 403 Total Release Fumigator	Pressurized Product	PYR (0.40) PBU (2.00)
28244	Commercial	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Professional 3% Pyrethrin Knockdown Farm Buildings Insect Killer	Emulsifiable Concentrate or Emulsion	PYR (3) PBU (28.8)
28248	Commercial	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom "Commercial Grade Knockdown Concentrate" Mosquito Adulticiding For ULV Fogging Systems	Solution	PYR (5) PBU (24)
28371	Commercial	Kuus Inc.	Knock Down X-Max Farm and Livestock Insect Killer (0.6 Pyrethrin From Chrysanthemum Flower Pyrethrum)	Pressurized Product	PYR (0.60) PBU (4.00)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
28402	Commercial	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom 6% Pyrethrin Knockdown Insect Killer	Emulsifiable Concentrate or Emulsion	PYR (6) PBU (60)
28462	Commercial	Kuus Inc.	Knock Down Max Farm and Livestock Insect Killer (0.3 Pyrethrin From Chrysanthemum Flower)	Pressurized Product	PYR (0.30) PBU (2.40)
28584	Commercial	Kuus Inc.	Knock Down Max Flying Insect Killer (1.0 Pyrethrin From Chrysanthemum Flower Pyrethrum)	Pressurized Product	PYR (0.975) PBU (1.950) MGK (3.21)
28792	Commercial	PLZ Corp.	K-G Flying Insect Killer Metered II (0.975% Pyr-Commercial)	Pressurized Product	PYR (0.975) PBU (1.95) MGK (3.21)
29042	Commercial	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Maximum Strength Livestock & Buildings Insect Eliminator	Pressurized Product	PYR (0.50) PBU (5.00)
29044	Commercial	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Extra Strength Farm & Livestock Insect Eliminator	Pressurized Product	PYR (0.6) PBU (4.0)
29687	Commercial	Kuus Inc.	Knock Down Max Bed Bug & Flea Killer	Pressurized Product	PYR (0.60) PBU (4.0)
29728	Commercial	Kuus Inc.	Knockdown Total Release Fumigator-C	Pressurized Product	PYR (0.4) PBU (2.0)
30031	Commercial	Kuus Inc.	Knock Down Professional KD241P Food Processing Plants & Institutional Insect Killer (0.6% Pyrethrin from Chrysanthemum Flower Pyrethrum)	Pressurized Product	PYR (0.6) PBU (4.0)
30164	Commercial	Mclaughlin Gormley King Company	Pyganic Crop Protection Ec 1.4 II	Emulsifiable Concentrate or Emulsion	PYR (1.4)
30421	Commercial	Ur-Can Inc.	Onguard PC5	Pressurized Product	PYR (0.5) PBU (5.0)
30749	Commercial	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom 4 Zero Nine C	Pressurized Product	PYR (0.975) PBU (1.95) MGK (3.21)
30752	Commercial	Kuus Inc.	Knock Down Farm and Livestock Insect Killer (0.5% Pyrethrins From Chrysanthemum Flower Pyrethrum)	Pressurized Product	PYR (0.5) PBU (4.8)
30766	Commercial	Aura Pro Solutions, Inc	Zone Guard, Commercial Flying Insect Killer 1-C	Pressurized Product	PYR (0.975) PBU (1.95) MGK (3.21)
30805	Commercial	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Professional Quality	Pressurized Product	PYR (1.00) PBU (2.00) MGK (3.33)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
			Insecticide 1% Pyrethrin Spray		
30806	Commercial	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Protech Premium 3610 Insect Killer	Solution	PYR (3.00) PBU (5.76) MGK (10.00)
31036	Commercial	Ur-Can Inc.	On Guard PC-5/2	Solution	PYR (0.5) PBU (2.0)
31059	Commercial	Kuus Inc.	Knock Down Pro-154 Rtu Farm & Barn Flying Insect Killer	Solution	PYR (0.1) PBU (1.0)
31060	Commercial	Business Helpers' Depot Inc.	Surespray Pyrethrum Multi-Purpose Insect Spray	Emulsifiable Concentrate or Emulsion	PYR (6.00) PBU (60.0)
31111	Commercial	Acuity Holdings, Inc.	Konk Commercial Bed Bug Killer	Pressurized Product	PYR (0.5) PBU (5.0)
31121	Commercial	Business Helpers' Depot Inc.	Surespray Pyrethrin Insect Spray	Pressurized Product	PYR (0.5) PBU (5.0)
31338	Commercial	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Premium Quality #1 No Flies on Us Beef & Dairy Cattle-Farm, Industrial & Commercial Building Insect Killer	Pressurized Product	PYR (0.5) PBU (5.0)
31943	Commercial	Neogen Corporation	Prozap Annihilator-XP	Emulsifiable Concentrate or Emulsion	PYR (6.00) PBU (60.00)
31960	Commercial	Neogen Corporation	Prozap Ld 44z Dairy Bomb Aerosol Insecticide	Pressurized Product	PYR (0.50) PBU (4.80)
32339	Commercial	Kuus Inc.	Knock Down Pro 155 Farm, Barn & Livestock Insect Killer	Solution	PYR (0.1) PBU (1.0)
32850	Commercial	Ur-Can Inc.	Onguard PNP Pro Ready to Use Residual Liquid Insecticide	Solution	PYR (0.050) PFL (0.200) MGK (0.240)
32865	Commercial	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Lice Killer for Poultry Plus+	Pressurized Product	PYR (0.50) PBU (4.80)
33342	Commercial	W. Neudorff GmbH	Scorpio Ant Granule	Soluble Granules	PYR (0.175)
33732	Commercial	Eco-Cop Inc	Klenze 4 Insecticide	Solution	PYR (0.05) PFL (0.20) MGK (0.240)
33946	Commercial	Eco-Cop Inc.	Klenze 7 Insecticide	Solution	PYR (0.50) PBU (5.00)
34005	Commercial	Vétoquinol N.-A. Inc	Disvap Gold	Pressurized Product	PYR (0.50) PBU (5.00)
34029	Commercial	Eco-Cop Inc	Klenze 5 Insecticide	Solution	PYR (0.50) PBU (2.0)
34144	Commercial	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Protech Commercial Insect Killer	Solution	PYR (0.50) PBU (2.0)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
34524	Commercial	753146 Alberta Ltd. O/A Ultrason Industries	Doktor Doom Lice Killer for Livestock Plus (+)	Solution	PYR (5.0) PBU (0.5)
17400	Domestic	Wellmark International	VET-KEM Flea & Tick Shampoo for Dogs & Cats	Solution	PYR (0.05) PBU (0.5)
19209	Domestic	Wellmark International	Zodiac Flea & Tick Shampoo	Solution	PYR (0.05) PBU (0.50)
19752	Domestic	Blood Protection Co. (China) Ltd.	Kilmos Mosquito Coils	Solid	PYR (0.30)
19981	Domestic	PLZ Corp.	K-G Flea & Tick Shampoo for Dogs and Cats II	Pressurized Product	PYR (0.042) PBU (0.085) MGK (0.141)
20034	Domestic	Mclaughlin Gormley King Company	Pump Insecticide Spray IV	Solution	PYR (0.100) PBU (0.194) MGK (0.322)
20418	Domestic	Mclaughlin Gormley King Company	Flea & Tick Pet Shampoo for Dogs and Cats	Solution	PYR (0.045) PBU (0.086) MGK (0.140)
20562	Domestic	Woodstream Canada Corporation	Safer's Vegetable Garden Insecticide	Solution	SOC (1.0) PYR (0.01)
21078	Domestic	PLZ Corp.	K-G Flea & Tick Quick Breaking Insecticide Foam for Dogs & Cats V	Pressurized Product	PYR (0.100) PBU (0.200) MGK (0.36)
21206	Domestic	Wellmark International	Vet-Kem Ovitrol Plus for Dogs & Cats (With Precor)	Solution	PYR (0.20) PBU (0.37) MPR (0.27) MGK (0.62)
21744	Domestic	Wellmark International	Zodiac Flea & Tick Spray for Dogs & Cats	Solution	PYR (0.20) PBU (0.37) MPR (0.27) MGK (0.62)
21889	Domestic	PLZ Corp.	K-G Flea & Tick Spray for Dogs & Cats IX	Pressurized Product	PYR (0.100) PBU (0.200) MGK (0.336)
22426	Domestic	Mclaughlin Gormley King Company	Evercide Flea & Tick Spray 2412	Pressurized Product	PYR (0.112) PFL (0.100)
22591	Domestic	Mclaughlin Gormley King Company	Evercide Flea & Tick Pet Spray 2412	Pressurized Product	PYR (0.056) PFL (0.050)
22678	Domestic	Wellmark International	Vet-Kem Ovitrol Mousse	Pressurized Product	PYR (0.4) PBU (5.0) MPR (0.5)
22808	Domestic	PLZ Corp.	Spray-Pak Garden & Patio Fogger	Pressurized Product	PYR (0.20) PBU (1.0)
22808.01	Domestic	Kuus Inc.	Mosquito Shield Backyard Bug Control Outdoor Fogger	Pressurized Product	PYR (0.20) PBU (1.0)
22808.03	Domestic	Canadian Tire Corp. Ltd.	Muskol Patio & Deck Fogger	Pressurized Product	PYR (0.20) PBU (1.0)
22916	Domestic	Wellmark International	Zodiac Mousse	Pressurized Product	PYR (0.4) PBU (5.0) MPR (0.5)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
23013	Domestic	Rolf C. Hagen Inc.	Sentry Flea Killer & Mosquito Repellent Spray for Dogs	Solution	PYR (0.075) PFL (0.052) PBU (0.150) MGK (0.250)
23047	Domestic	Woodstream Canada Corporation	Safer's Entire Flea & Tick Spray	Solution	SOC (1.0) PYR (0.01)
23067	Domestic	PLZ Corp.	K-G Flea & Tick Shampoo for Dogs & Cats III	Pressurized Product	PYR (0.30) PBU (2.40)
23073	Domestic	PLZ Corp.	K-G Flea & Tick Quick Breaking Ins. Foam for Dogs & Cats VIII	Pressurized Product	PYR (0.30) PBU (2.40)
23316	Domestic	Bio-Derm Laboratories Inc.	Bio-Groom Ear Mite Treatment	Solution	PYR (0.15) PBU (1.20)
23593	Domestic	Neogen Corporation	Ecto-Soothe Plus Emollient Oatmeal Pesticidal Shampoo	Emulsifiable Concentrate or Emulsion	PYR (0.15) PBU (1.5) MGK (0.50)
23692	Domestic	Wellmark International	Ovex Pump Spray for Dogs and Cats	Solution	PYR (0.20) PBU (0.37) MPR (0.10) MGK (0.61)
24375	Domestic	Vétoquinol N.-A. Inc.	Veto Equin Water Base Insecticide for Horses	Emulsifiable Concentrate or Emulsion	PYR (0.11) PBU (1.11)
24427	Domestic	W.F. Young Inc.	Absorbine Ultrashield EX Insecticide & Repellent	Solution	PYR (0.10) PFL (0.50) PBU (1.00)
25902	Domestic	Rolf C. Hagen Inc.	Sergeant's Skip-Flea & Tick Shampoo for Dogs	Solution	PYR (0.05) PBU (0.50)
25903	Domestic	Rolf C. Hagen Inc.	Sergeant's Skip-Flea & Tick Shampoo for Cats	Solution	PYR (0.05) PBU (0.50)
26133	Domestic	Hartz Canada Inc.	Hartz Ultraguard Rid Flea & Tick Shampoo for Dogs	Solution	PYR (0.045) PBU (0.086) MGK (0.142)
26266	Domestic	PLZ Corp.	K-G Hornet & Wasp Killer V	Pressurized Product	PYR (0.050) PFL (0.200) MGK (0.250)
26413	Domestic	Wellmark International	Zodiac Double Action Flea & Tick Shampoo For Dogs & Cats	Solution	PYR (0.15) PBU (1.50) MPR (0.10)
26608	Domestic	Wellmark International	Vet-Kem Ovitrol Plus Flea & Tick Shampoo	Solution	PYR (0.15) PBU (1.50) MPR (0.10)
27187	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Wasp & Hornet Insecticide	Pressurized Product	PYR (0.3) PBU (2.4)
28044	Domestic	PLZ Corp.	Better Than Hornet & Wasp Killer	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
28382	Domestic	Wellmark International	Zodiac Dual Action Flea & Tick Spray for Cats & Kittens	Solution	PYR (0.20) PBU (0.37) MPR (0.27) MGK (0.62)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
28415	Domestic	Can-Vet Animal Health Supplies Ltd	Can-Vet Mustang Fly Shield	Solution	PYR (0.05) PFL (0.1) PBU (0.5)
28493	Domestic	Can-Vet Animal Health Supplies Ltd	Can-Vet Kentucky Fly Shield II for Horses	Solution	PYR (0.1) PBU (1.0)
28529	Domestic	Can-Vet Animal Health Supplies Ltd	Extenda Shield	Solution	PYR (0.10) PFL (0.50) PBU (1.0)
28680	Domestic	Woodstream Canada Corporation	Safer's Trounce Hose-End Lawn & Turf Insecticide	Solution	SOC (20) PYR (0.2)
28681	Domestic	Woodstream Canada Corporation	Safer's Trounce Lawn & Turf Insecticide	Solution	SOC (20.0) PYR (0.2)
28702	Domestic	Can-Vet Animal Health Supplies Ltd	Can-Vet Power Shield	Solution	PYR (0.1) PFL (0.5) PBU (1.0)
29184	Domestic	Farnam Companies, Inc.	Repel-XP	Solution	PYR (0.41) PBU (0.9657)
29365	Domestic	Dentec Safety Specialists Inc.	Skeetsafe Wasp & Hornet Killer	Pressurized Product	PYR (0.05) PFL (0.2) MGK (0.25)
29935	Domestic	W.F. Young Inc.	Absorbine Ultrashield Ex Insecticide & Repellent Continuous Spray	Pressurized Product	PYR (0.1) PFL (0.5) PBU (1.0)
29957	Domestic	Pyranha Inc.	Pony XP	Solution	PYR (0.05) PFL (0.104) PBU (0.5)
29988	Domestic	W.F. Young Inc.	Absorbine® Ultrashield® Ex Easy Swipe	Solution	PYR (0.10) PFL (0.5) PBU (1.0)
30006	Domestic	Woodstream Canada Corporation	Safer's Trounce Patio and Walkway Insecticide	Solution	SOC (1.0) PYR (0.01)
30064	Domestic	Woodstream Canada Corporation	Safer's Trounce for Turf Mosquito And Tick Insecticide	Solution	SOC (20) PYR (0.20)
30637	Domestic	Kuus Inc.	Knock Down Flea & Tick Killer for Dogs & Cats	Solution	PYR (0.10) PBU (0.194) MGK (0.336)
30724	Domestic	Kuus Inc.	Knock Down Hornet & Wasp Killer II (0.05% Pyrethrin from Chrysanthemum Flower Pyrethrum)	Pressurized Product	PYR (0.050) PBU (0.10) MGK (0.167) BAY (0.50)
30837	Domestic	Kuus Inc.	Knock Down Crawling Insect Killer II (.05% Pyrethrin From Chrysanthemum Flower Pyrethrum)	Pressurized Product	PYR (0.050) PBU (0.10) MGK (0.167) BAY (0.50)
31025	Domestic	Business Helpers' Depot Inc.	Ez-Kill Super Fast (BOV) Stinging Insect Killer (PNP)	Pressurized Product	PYR (0.05) PFL (0.20) MGK(0.25)
31071	Domestic	Novella Brands Inc.	Blaze Pro Wasp & Hornet Destroyer	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.250)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
31096	Domestic	Kuus Inc.	Knock Down Hornet & Wasp Foam Blaster Killer with Pyrethrins From Chrysanthemum Flower Pyrethrum	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
31134	Domestic	Kuus Inc.	Mosquito Shield Mosquito Coils .30% Pyrethrin from Chrysanthemum Flower Pyrethrum	Solid	PYR (0.30)
31144	Domestic	Esprea Animal Products, Inc.	Flea And Tick Dog and Cat Shampoo	Solution	PYR (0.045) PBU (0.086) MGK (0.150)
31149	Domestic	Esprea Animal Products, Inc.	Flea And Tick Pet Shampoo for Dogs and Cats	Solution	PYR (0.045) PBU (0.086) MGK (0.150)
31180	Domestic	Kuus Inc.	Knock Down Professional Hornet & Wasp Foam Blaster Killer with Pyrethrins From Chrysanthemum Flower Pyrethrum	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
31279	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Premium Quality #1 Wasp & Hornet Nest Killer	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.250)
31388	Domestic	PLZ Corp.	K-G Hornet & Wasp Foam Insecticide Spray III – AF 2014	Pressurized Product	PYR (0.050) PFL (0.200) MGK (0.250)
31398	Domestic	Business Helpers' Depot Inc.	Fight Back Insecticide M-18	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.250)
31466	Domestic	Business Helpers' Depot Inc.	Klenze	Pressurized Product	PYR (0.042) PBU (0.081) MGK (0.141)
31476	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Maximum Strength, Premium Quality #1, "No Ticks & Fleas on Us" Dog & Cat Tick And Flea Killer Shampoo With Coconut Oil	Pressurized Product	PYR (0.3) PBU (2.4)
31477	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Maximum Strength Premium Quality #1 "No Ticks & Fleas on Us®" Quick Breaking Foam Tick & Flea Killer	Pressurized Product	PYR (0.3) PBU (2.485)
31605	Domestic	Business Helpers' Depot Inc.	Sure Spray Flea & Tick Spray For Dogs & Cats	Pressurized Product	PYR (0.1) PBU (1.0)
31616	Domestic	Rolf C. Hagen Inc.	Sentry Flea & Tick Shampoo for Dogs	Solution	PYR (0.045) PBU (0.086) MGK (0.15)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
31617	Domestic	Rolf C. Hagen Inc.	Sentry Flea & Tick Shampoo for Cats	Solution	PYR (0.045) PBU (0.086) MGK (0.14)
31630	Domestic	Business Helpers' Depot Inc.	Gotcha Hornet & Wasp Killer	Pressurized Product	PYR (0.1) PBU (1.0)
31634	Domestic	Business Helpers' Depot Inc.	Fight Back Jet Foam Spray Stinging Insect Killer - 24/7 (PNP)	Pressurized Product	PYR (0.05) PFL (0.2) MGK (0.250)
31752	Domestic	Business Helpers' Depot Inc.	Sureshot Super Fast Stinging Insect Killer	Pressurized Product	PYR (0.050) PFL (0.200) MGK (0.25)
31804	Domestic	Business Helpers' Depot Inc.	Fight Back Foaming Spray Outdoor Insect Killer - 24/7 (PNP)	Pressurized Product	PYR (0.05) PFL (0.2) MGK (0.25)
31939	Domestic	Neogen Corporation	Prozap Pet Guard	Solution	PYR (0.10) PBU (0.194) MGK (0.336)
31940	Domestic	Neogen Corporation	Prozap Pet Guard Flea & Tick Shampoo	Solution	PYR (0.045) PBU (0.086) MGK (0.15)
32070	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	New Doktor Doom Supercharged Jet Foam Wasp & Hornet Killer	Pressurized Product	PYR (0.05) PFL (0.2) MGK (0.250)
32110	Domestic	Scotts Canada Ltd.	Ortho® Wasp B Gon Max Wasp Killer Foam	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.250)
32142	Domestic	Scotts Canada Ltd.	Ortho® Wasp B Gon Max Wasp Killer Spray	Pressurized Product	PYR (0.050) PFL (0.200) MGK (0.250)
32190	Domestic	Mclaughlin Gormley King Company	MGK Formula 3098	Solid	PYR (0.60)
32352	Domestic	Pic Corp.	Pic Mosquito Repellent Coils	Solid	PYR (0.60)
32480	Domestic	Business Helpers' Depot Inc.	Fight Back Hornet & Wasp Killer Double Shot Jet & Fogger Sprays	Pressurized Product	PYR (0.20) PBU (1.00)
32481	Domestic	Business Helpers' Depot Inc.	Fight Back Patio & Yard Fogger	Pressurized Product	PYR (0.20) PBU (1.00)
32697	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Tick & Flea Killer Spray for Cats & Dogs	Pressurized Product	PYR (0.1) PBU (1.0)
32705	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Yard & Patio Fogging Insect Killer	Pressurized Product	PYR (0.2) PBU (1.00)
32707	Domestic	Maheu & Maheu Inc.	Maheu&Maheu Hornet & Wasp Foam Insecticide II	Pressurized Product	PYR (0.050) PFL (0.200) MGK (0.250)
32743	Domestic	Groupe BMR Inc.	Eliminator Plus Hornet & Wasp Foam Insecticide II	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
33034	Domestic	Scotts Canada Ltd.	Ortho® Mosquito B Gon Max Flying Insect Killer Area Spray	Pressurized Product	PYR (0.20) PBU (1.00)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
33270	Domestic	Dollarama L.P.	Rama 10 Mosquito Repellent Coils	Solid	PYR (0.60)
33607	Domestic	Canadian Tire Corp. Ltd.	Muskol Mosquito Coils	Solid	PYR (0.6)
33343	Domestic	W. Neudorff GmbH Kg	Family Matters Ant Killer Granules	Soluble Granules	PYR (0.175)
33511	Domestic	Scotts Canada Ltd.	Ortho® Ant B Gon® Max Ant Killer Granules	Soluble Granules	PYR (0.175)
33674	Domestic	Can-Vet Animal Health Supplies Ltd	Tick End for Horses	Solution	PYR (0.33) PBU (0.77)
33682	Domestic	Can-Vet Animal Health Supplies Ltd	Power Shield Fly and Tick Spray for Horses	Solution	PYR (0.33) PFL (0.50) PBU (0.77)
33683	Domestic	Can-Vet Animal Health Supplies Ltd	Extenda Shield Fly and Tick Spray for Horses	Solution	PYR (0.33) PFL (0.50) PBU (0.77)
33749	Domestic	Scotts Canada Ltd.	Ortho® Mosquito B Gon Max Flying Insect Killer Area Spray I	Pressurized Product	PYR (0.20) PBU (1.00)
33992	Domestic	Eco-Cop Inc.	Klenze 15 Insecticide for Horses	Solution	PYR (0.10) PFL (0.50) PBU (1.00)
34289	Domestic	Premier Tech Ltd.	Wilson Long Shot Wasp Out Wasp & Hornet Killer	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
34290	Domestic	Premier Tech Ltd.	Wilson Wasp Out Jet Foam Insecticide Wasp & Hornet	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
34425	Domestic	Mclaughlin Gormley King Company	MGK Formula 3098 Sticks	Solid	PYR (0.60)
34434	Domestic	Les Produits De Controle Superieur Inc/Superior Control Products Inc	Super Hunter Hornet & Wasp Foam Insecticide III	Pressurized Product	PYR (0.05) PFL (0.20) MGK (0.25)
34523	Domestic	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom Premium Insect Killer for Use on Horses	Solution	PYR (0.10) PFL (0.50) PBU (1.0)
25872	Technical Grade Active Ingredient	Botanical Resources Australia Pty Ltd	Py-T-20 Pale Refined Pyrethrins	Solution	PYR (20)
28940	Technical Grade Active Ingredient	Mclaughlin Gormley King Company	MGK Refined Pyrethrum Concentrate 54%	Solution	PYR (54.00)
29678	Technical Grade Active Ingredient	Botanical Resources Australia Pty Ltd	Py-T-50 Pale Refined Pyrethrins	Solution	PYR (51)
29956	Technical Grade Active Ingredient	Mclaughlin Gormley King Company	VBC PY 20% Extract	Solution	PYR (20)
31787	Technical Grade Active Ingredient	Mclaughlin Gormley King Company	Pyganic® Refined Technical	Liquid	PYR (49.20)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
32044	Technical Grade Active Ingredient	Wellmark International	Wellmark PY 51% Technical	Solution	PYR (51.0)
33566	Technical Grade Active Ingredient	Horizon Sopyrwa	Sopyrwa Refined Pyrethrum Concentrate	Solution	PYR (52)
18296	Manufacturing Concentrate	Mclaughlin Gormley King Company	Premium Pyroicide 175	Solution	PYR (20)
18302	Manufacturing Concentrate	Mclaughlin Gormley King Company	Purified Pyrethrum Extract 20% Insecticide	Solution	PYR (20.0)
18528	Manufacturing Concentrate	Mclaughlin Gormley King Company	Pyroicide 30-3 S.E. Insecticide Concentrate	Emulsifiable Concentrate or Emulsion	PYR (3.00) PBU (30.00)
19615	Manufacturing Concentrate	Mclaughlin Gormley King Company	Pyroicide Intermediate 5192	Solution	PYR (9.00) PBU (17.28) MGK (28.72)
19616	Manufacturing Concentrate	Mclaughlin Gormley King Company	Pyroicide Intermediate 75-OF	Solution	PYR (7.50) PBU (72.43)
19632	Manufacturing Concentrate	Mclaughlin Gormley King Company	Pyroicide Intermediate 54	Solution	PYR (5.00) PBU (38.63)
19641	Manufacturing Concentrate	Mclaughlin Gormley King Company	Pyroicide Intermediate 57	Solution	PYR (10.00) PBU (48.29)
19833	Manufacturing Concentrate	Mclaughlin Gormley King Company	Pyroicide Concentrate 7352	Emulsifiable Concentrate or Emulsion	PYR (3.00) PBU (28.80)
19889	Manufacturing Concentrate	Mclaughlin Gormley King Company	Pyroicide Booster Concentrate K	Solution	PYR (5.00) PBU (48.00)
19891	Manufacturing Concentrate	Mclaughlin Gormley King Company	Evercide Intermediate 2417	Emulsifiable Concentrate or Emulsion	PYR (1.67) PFL (6.68) MGK (7.99)
21000	Manufacturing Concentrate	Mclaughlin Gormley King Company	Evercide Intermediate 2412	Emulsifiable Concentrate or Emulsion	PYR (2.24) PFL (2.016)
21314	Manufacturing Concentrate	Mclaughlin Gormley King Company	Pyroicide (5.0-0.5) E.C. Insecticide	Emulsifiable Concentrate or Emulsion	PYR (0.50) PBU (5.0)
22165	Manufacturing Concentrate	Mclaughlin Gormley King Company	Pyroicide W-B 20-4 Insecticide	Solution	PYR (4.0) PBU (20.0)
22419	Manufacturing Concentrate	Mclaughlin Gormley King Company	Pyroicide & Dri-Die Dust Base Insecticide	Dust or Powder	SIL (40.00) PYR (2.0) PBU (20.00)
23158	Manufacturing Concentrate	Mclaughlin Gormley King Company	Evercide Intermediate 2179	Solution	PYR (6.250) PFL (25.000) MGK (29.91)
23906	Manufacturing Concentrate	Wellmark International	Pyroicide Intermediate 7045	Solution	PYR (0.59) PBU (1.18) MGK (1.97)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
					BAY (5.89)
24382	Manufacturing Concentrate	Mclaughlin Gormley King Company	Pyroicide Intermediate 7415	Emulsifiable Concentrate or Emulsion	PYR (5.00) PBU (48.00)
30020	Manufacturing Concentrate	Mclaughlin Gormley King Company	Pyroicide® Concentrate 7440	Emulsifiable Concentrate or Emulsion	PYR (3.00) PBU (28.8)
31788	Manufacturing Concentrate	Mclaughlin Gormley King Company	Pyganic® MUP 20	Solution	PYR (20.00)

PYR = Pyrethrins, PBU = Piperonyl Butoxide, MGK = N-octyl bicycloheptene dicarboximide, SIL = silica aerogel, BAY = propoxur, PFL = Permethrin, SOC = potassium salts of fatty acids, MGD = di-n-propyl isocinchomeronate, SIF = silicon dioxide, MPR = S-methoprene, NEO = tetramethrin, CXF = cyfluthrin

¹as of 1 January 2023, excluding discontinued products or products with a submission for discontinuation.

Table 4 Products containing pyrethrins cancelled as a result of re-evaluation (3-year phase-out period)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
17591	Commercial	Acuity Holdings, Inc.	Ko 14 Flying Insect Killer	Pressurized Product	PYR (1.80) PBU (10.0)
17592	Commercial	Acuity Holdings, Inc.	Konk 418 Flying Insect Killer	Pressurized Product	PYR (1.80) PBU (10.00)
18348	Commercial	Gardex Chemicals Ltd.	Guard Mist Insecticide	Pressurized Product	PYR (1.8) PBU (10)
19685	Commercial	Gardex Chemicals Ltd.	Guard Mist 1 Pyrethrins Insecticide	Pressurized Product	PYR (1.8) PBU (10.0)
20390	Commercial	Mclaughlin Gormley King Company	Flying Insect Killer II (Metered Pressurized Spray)	Pressurized Product	PYR (1.80) PBU (9.60)
23029	Commercial	Vétoquinol N.-A. Inc.	Disvap V Barn Insecticide	Emulsifiable Concentrate or Emulsion	PYR (0.1) PFL (0.1) PBU (1.0)
24151	Commercial	Acuity Holdings, Inc.	Konk 416 Flying Insect Killer	Pressurized Product	PYR (1.80) PBU (10.00)
28373	Commercial	Kuus Inc.	Knock Down X-Max Flying Insect Killer (1.8 Pyrethrin From Chrysanthemum Flower Pyrethrum)	Pressurized Product	PYR (1.8) PBU (10.0)
28691	Commercial	PLZ Corp.	Flying Insect Killer Metered I (1.8% PYR-Commercial)	Pressurized Product	PYR (1.8) PBU (10.0)
30605	Commercial	Aura Pro Solutions, Inc	Zone Guard, Pro Flying Insect Killer 1.80%	Pressurized Product	PYR (1.80) PBU (10.00)
30616	Commercial	FMC Corporation	Purge III Insecticide	Pressurized Product	PYR (0.975) PBU (1.950) MGK (3.050)
30772	Commercial	Aura Pro Solutions, Inc	Zone Guard, Commercial Pro Flying Insect Killer-C 1.80%	Pressurized Product	PYR (1.8) PBU (10.0)

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (% , g/L)
31056	Commercial	753146 Alberta Ltd. O/A Ultrasol Industries	Doktor Doom BYT 4 Eighteen Flying Insect Killer-Commercial	Pressurized Product	PYR (1.8) PBU (10.0)
19829	Domestic	Woodstream Canada Corporation	Safer's Tomato & Vegetable Insecticide RTU	Solution	PYR (0.02) PBU (0.20)

PYR = Pyrethrins, PBU = Piperonyl Butoxide, MGK = N-octyl bicycloheptene dicarboximide

¹as of 1 January 2023, excluding discontinued products or products with a submission for discontinuation

Appendix II List of commenters to PRVD2020-08

List of commenters' affiliations for comments submitted in response to PRVD2020-08

Category	Commenter
Registrant	PLZ Corp.
	KUUS Inc.
	Maheu & Maheu
	McLaughlin Gormley King Co., Inc. (MGK)
	SC Johnson
	Scotts Canada
Stakeholder	Quebec Cranberry Growers Association (APCQ)
	Canada Pest Management Association (CPMA)
	Ministere de l'Agriculture, des Pecheries et de l'Alimentation du Quebec (MAPAQ)
Task Force	Council for the Advancement of Pyrethroid Human Risk Assessment (CAHRA)
	Pyrethrins Joint Venture (PJV)

Appendix III Comments and responses

Health Canada received 14 written comments during the public consultation for the pyrethrins proposed re-evaluation decision. Commenters' affiliations are listed in Appendix II. These comments were considered during the final decision phase of this re-evaluation. Summarized comments and Health Canada's responses to them are provided below.

1.0 Comments related to the health risk assessment

1.1 Comments related to toxicology

1.1.1 Comment related to the dermal reference values

One registrant stated that a dermal risk assessment is not required, given that no adverse toxicological effects were observed up to the limit dose of 1000 mg/kg bw/day in the rabbit 21-day dermal toxicity study¹¹ conducted with pyrethrum extract, dermal margins of exposure (MOEs) exceeded the target MOE for all postapplication scenarios, and a dermal risk assessment for the pyrethrins was not required by the USEPA. The registrant considered Health Canada's use of the dermal no observed adverse effect level (NOAEL) of 1000 mg/kg bw/day for the purposes of MOE derivation to be misleading and inappropriate.

Health Canada response:

Health Canada uses contemporary risk assessment methodologies that are based on sound science, agency policies and practices, and are recognized globally by our pesticide regulatory partners. Notwithstanding the similarities in approach, it is not uncommon for regulatory bodies to differ with regards to study selection, requirements to refine assessments, or for them to have unique regulatory policies. When repeat-dose dermal toxicity studies demonstrate the absence of systemic toxicity at the limit dose of 1000 mg/kg bw/day, it is standard practice for Health Canada to use this limit dose as a point of departure for dermal risk assessment, provided that there is no concern for other endpoints in the toxicology database, such as developmental or reproductive effects, that were not assessed in the dermal toxicity study. In rare circumstances, the selection of a reference value for assessing risks from dermal exposure may not be warranted, but only if minimal to no toxicity is demonstrated at or near the limit dose of testing in the suite of studies that make up a robust toxicology database. However, this is not the case for the pyrethrins. Therefore, the dermal NOAEL of 1000 mg/kg bw/day derived from the 21-day rabbit dermal toxicity study will be retained as the point of departure for the assessment of short-, intermediate- and long-term risk from dermal exposure to pyrethrins.

¹¹ 1992. 21-Day repeated dose dermal toxicity study with Pyrethrum extract in rabbits. DACO 4.3.5. (PRVD2020-08; PMRA# 1829246).

1.1.2 Comments related to the inhalation reference values

One registrant disagreed with the selection by Health Canada of the lowest observed adverse effect level (LOAEL) of 2.6 mg/kg bw/day (lowest observed adverse effect concentration (LOAEC) of 0.01 mg/L) from the rat 13-week inhalation toxicity study¹² as the critical point of departure for the assessment of inhalation risk, for the following reasons outlined by the registrant:

- 1) The respiratory tract lesions were the result of non-specific irritation under the conditions of exposure in the nose-only exposure chamber.
- 2) The inhalation exposure regimen in rats of six hours per day, five days per week for 13 weeks is not relevant to the exposure pattern of the general population. Therefore, the response of the rat respiratory tract, which reflects continued exposure over an extended period of time, is not relevant for the assessment of inhalation risk from “shorter, more sporadic exposures (Mowat et al., 2017)”.¹³
- 3) The respiratory tract lesions in rats were increased in severity at the highest concentration, and were associated with inflammatory injury. Since there was no inflammation in the respiratory tract in rats at the mid- and low-concentrations of pyrethrum extract, the respiratory tract lesions observed at the low- and mid-concentrations are considered to be adaptive and non-adverse.
- 4) Final risk mitigation measures related to potential inhalation health risks should be based on the outcome of research initiated by the Pyrethrins Joint Venture (PJV) and Piperonyl Butoxide Task Force II. These data will provide the basis for derivation of a refined inhalation point of departure and inhalation reference value which is relevant to humans (please see Response 1.1.3 for the response to comments related to the PJV and Piperonyl Butoxide Task Force II in vitro inhalation toxicity data).

Health Canada response:

- 1) The meaning of the registrant’s statement that the respiratory tract lesions in treated rats in the 13-week inhalation toxicity were the result of non-specific irritation under the conditions of exposure in the nose-only exposure chamber is unclear, particularly given that treated rats were administered pyrethrum extract via whole-body inhalation exposure and a nose-only inhalation exposure apparatus was not used. The nature of the lesions, and the factors considered by Health Canada with respect to their adversity, are further addressed in the response under point 3) below.

¹² 1992. A subchronic (3-month) inhalation toxicity study of pyrethrum extract in the rat via whole-body exposures. DACO 4.3.6. (PRVD2020-08; PMRA# 1829248, 1829250).

¹³ Mowat V., Alexander D.J. and Pilling A.M. 2017. A Comparison of Rodent and Nonrodent Laryngeal and Tracheal Bifurcation Sensitivities in Inhalation Toxicity Studies and Their Relevance for Human Exposure. *Toxicologic Pathology*, 45(1): 216-222.

- 2) The exposure regimen in the in vivo rat 13-week inhalation toxicity study is not designed to mimic the extent and duration of human inhalation exposures in the general population; these factors are considered in the exposure component of the risk assessment. The test guideline is designed to model worker inhalation exposures and can also be used to assess residential inhalation exposures. After assessing the hazard in relevant toxicity studies, human health risk estimates are derived based on reasonable predicted exposure estimates. These predicted exposure estimates take into consideration the product used, its physical/chemical properties, its application methods, rates, and dilutions, and the estimated number of hours per day, days per week, and weeks per year a person would be exposed. The selection of the portal of entry effects in the respiratory tract as the endpoint for deriving the point of departure for the pyrethrins inhalation risk assessment is considered to be protective of any systemic effects that may occur at higher concentrations and is consistent with Health Canada's current practices.

The registrant asserted that the microscopic changes noted in the larynx at the lower concentration levels were of limited relevance to the human health inhalation risk assessment for the pyrethrins. To support this conclusion, the registrant cited¹⁴ a publication summarizing 52 inhalation toxicity studies, organized as 26 cases with each case comprising a pair of studies where the same test material was administered to a rodent and non-rodent species. This publication compiled the data to determine if rodents demonstrated greater susceptibility to xenobiotic-induced laryngeal effects as compared to non-rodents. After reviewing the 26 pairs of studies, laryngeal changes were present with much higher frequency in the rodent (rats and mice) than non-rodent (dogs and monkeys) species, leading the study authors to suggest that, with all other factors remaining similar, the larynx of the rodent may be more sensitive than that of the non-rodent to irritant exposure. Although the study authors reported that study methods were similar across the paired studies in regard to exposure parameters (dose level, daily length of exposure and study duration), it was noted that a greater number of sections for the larynx were examined in rodents (five to seven) compared to non-rodents (two) in the summarized studies, potentially biasing towards higher detection of laryngeal findings in the rodent species included in this study. The study author stated that anatomically and histologically, the human larynx resembles that of the non-rodent more closely than the rodent and therefore, more emphasis should be placed on any specific findings in non-rodent animal models than in rodent models when assessing potential health effects of inhaled chemicals. However, given the above-noted limitation with this publication, and the fact that repeat-dose inhalation toxicity data are only available in the rodent for the pyrethrins, the laryngeal effects observed in the rat 13-week inhalation toxicity conducted with the pyrethrins cannot be dismissed.

- 3) As indicated in PRVD2020-08, for the assessment of short-, intermediate- and long-term inhalation risk the LOAEC of 0.01 mg/L from the rat 13-week inhalation toxicity study was selected as the point of departure by Health Canada. This LOAEC, which was the lowest concentration tested in the study, was in agreement with that derived by the USEPA (PMRA# 3267104, 3267105) and was based on a concentration-related increase in the

¹⁴ Mowat V., Alexander D.J. and Pilling A.M. 2017. A Comparison of Rodent and Nonrodent Laryngeal and Tracheal Bifurcation Sensitivities in Inhalation Toxicity Studies and Their Relevance for Human Exposure. *Toxicologic Pathology*, 45(1): 216-222.

incidence and severity of microscopic lesions in the seromucosal glands at the base of the epiglottis in the ventral larynx in both sexes, relative to controls, without effects in other tissues or organ systems. Health Canada re-visited the rat 13-week inhalation toxicity study in the context of the weight of evidence for the laryngeal lesions. An updated summary of this study is presented in Table 1. Health Canada considers the lesions in the laryngeal seromucosal glands at the LOAEC of 0.01 mg/L and above to be treatment-related and adverse based on the following weight of evidence:

The microscopic lesions in the submucosal seromucosal glands at the base of the epiglottis in the ventral larynx, which were observed at all concentrations tested, were concentration-related in incidence and severity, were diffuse (noted in mucous secretory cells and ciliated/non-ciliated epithelial cells), and were observed in both sexes and in most treated animals, but were rarely observed in untreated controls. The lesions at the LOAEC included slight to moderate hypertrophy and hyperplasia in mucous cells, slight to moderate squamous/squamoid hyperplasia and metaplasia in ciliated and non-ciliated pseudostratified columnar epithelial cells, and minimal to slight keratosis arising from the squamous/squamoid metaplastic epithelium. The study author stated that “in most of the animals from the exposure groups the metaplastic epithelium had a prominent layer of keratin; based on an assessment of both incidence and severity this tended to show an increased dose-related response”. Subacute and chronic inflammation of the laryngeal mucosa indicative of irritation were observed in most treated and untreated animals in this study, but demonstrated a concentration-related increase in severity in treated animals (from minimal to moderate), relative to untreated controls.

With increasing concentrations of pyrethrum extract above the LOAEC, there was progression of the lesions in the larynx and other respiratory effects. These included additional macroscopic and microscopic lesions in the laryngeal supraglottis and signs of respiratory distress at all concentrations above the LOAEC, and microscopic lesions in the nasal and lung mucosal epithelium, lung discolouration, and mortality at the highest concentration tested. It is noteworthy that respiratory signs including cough, respiratory irritation, and in rare cases, respiratory distress, were also noted in human incident reports. The USEPA (PMRA# 3267103, 3267106) acknowledged anecdotal evidence of an association between the pyrethrins and the pyrethroids and asthma and respiratory allergies, is currently reviewing available evidence, and will publish their report when finalized. Health Canada will review the results of the USEPA’s final report when it becomes available.

The commenter suggested that the histopathological lesions noted at the lowest concentration tested were adaptive and not adverse since they were not accompanied by inflammation. At a workshop organized by the European Society of Toxicologic Pathology to evaluate laryngeal lesions, it was agreed that minimal to slight focal squamous metaplasia on its own is not adverse. However, there was consensus that moderate, diffuse metaplasia at various levels of the larynx, as well as squamous hyperplasia and keratinization can lead to functional disorders of the respiratory tract, and are thus considered adverse (PMRA# 3279521). The lesions in mucous secretory cells (hyperplasia) and epithelial cells (hyperplasia, metaplasia, keratosis) of the ventral laryngeal seromucosal glands at the LOAEC of 0.01 mg/L and above are therefore considered to be adverse, and may lead to effects on phonation, regulation of airflow between the pharynx

and trachea, glottal closure and protection of the lower airways, coughing, airway surface liquid (ASL) composition and volume, microbial resistance, and mucocilliary clearance resulting in inflammatory exudation, respiratory obstruction and death (PMRA# 324216). Evidence of concentration-related hyperplasia, metaplasia and keratosis arising from the epithelium of multiple mucus-producing sites within the larynx and other respiratory tissues in the 13-week inhalation toxicity study clearly demonstrates that the pyrethrins produce adverse effects in respiratory mucosal tissues in the rat.

Information concerning the effects of long-term inhalation exposure, including the potential for chronic irritation and regenerative proliferation, is lacking for the pyrethrins, and although pyrethrum extract did not demonstrate genotoxic potential in guideline in vitro assays, no adequate in vivo genotoxicity studies were identified. A literature search conducted by Health Canada subsequent to the publication of PRVD2020-08 identified a study that incorporated results from an in vitro sister chromatid exchange (SCE) assay and an assessment of oxidative DNA damage in human lymphocytes (Table 2). In contrast to the results from the guideline SCE assay that was previously assessed in PRVD2020-08, this newly identified in vitro study reported an increase in SCEs as well as evidence of oxidative DNA damage, an endpoint that was not assessed in registrant-supplied guideline studies. However, no in vivo genotoxicity studies were identified in the literature.

Severe toxicant-induced squamous cell hyperplasia, metaplasia and keratosis in the laryngeal epithelium have been associated with the development of laryngeal squamous cell carcinomas in rodents and humans (PMRA# 3279521, 3242169). In an effort to harmonize the various classification systems and morphological criteria, the World Health Organization (WHO; PMRA# 3242164) proposed a 2-grade classification system with morphological criteria for defining the risk of progression of precursor lesions to malignancy: low-grade dysplasia (low potential to progress to malignancy) and high-grade dysplasia (preneoplastic). Based on the architectural and cytological criteria for the classification of laryngeal precursor lesions reported by WHO (PMRA# 3242164), the squamous/squamoid hyperplasia and metaplasia, and keratosis arising from the metaplastic epithelium of the seromucosal glands in rats treated with pyrethrum extract in the 13-week inhalation toxicity study are considered to be low-grade dysplasia, and thus have low malignant potential.

There remains some uncertainty concerning the genotoxic potential of the pyrethrins in view of the limited evidence of DNA damage in vitro in the literature and the lack of in vivo genotoxicity studies, as well as regarding the potential for progression of effects in the respiratory tract due to the lack of a chronic inhalation toxicity study. However, given that the histopathological lesions in the rat laryngeal seromucosal glands in the 13-week inhalation toxicity study have low potential to progress to malignancy, and an additional threefold factor was applied to the risk assessment in consideration of the potential for increased toxicity with long-term inhalation exposure (resulting in an overall target MOE of 1000 for long-term inhalation exposures), there is low concern for the newly identified findings in the published in vitro genotoxicity study.

Overall, given that the hyperplasia, metaplasia and keratosis in the rat laryngeal seromucosal glands at the LOAEC of 0.01 mg/L have the potential to cause adverse effects on respiration and laryngeal function, and may progress to more severe lesions, they are considered to be treatment-related and adverse. Therefore, no change to the point of departure or uncertainty factors applied for the inhalation risk assessment is warranted. In summary, Health Canada will retain the LOAEC of 0.01 mg/L selected as the point of departure for inhalation risk assessment based on hyperplasia, metaplasia and keratosis in the laryngeal seromucosal glands of rats administered the lowest concentration of pyrethrum extract in a rat 13-week inhalation toxicity study.

For **short-term inhalation risk assessment**, the target MOE is 300 based on the application of a threefold uncertainty factor to address residual uncertainty relating to potential sensitivity of the young to neurotoxicity and lack of a no observed adverse effect concentration (NOAEC). A separate threefold uncertainty factor for lack of a NOAEC in the critical study was considered overly conservative for the short-term scenario, given that the endpoint was derived from a 13-week inhalation study (typically considered an intermediate-term duration exposure), and that lesion development and progression are generally duration-dependent for portal of entry effects. For **intermediate-term inhalation risk assessment**, the target MOE is 1000 based on the application of a threefold uncertainty factor to address residual uncertainty relating to potential sensitivity of the young to neurotoxicity and another threefold uncertainty factor for lack of a NOAEC. For **long-term inhalation risk assessment**, the target MOE is 1000 based on the application of a threefold uncertainty factor to address residual uncertainty related to potential sensitivity of the young to neurotoxicity and another threefold uncertainty factor for lack of a NOAEC and for potential increased toxicity with increased duration of exposure for portal of entry effects.

In conclusion, there is no change to Health Canada's inhalation reference values for the pyrethrins at this time.

- 4) Please see Response 1.1.3 for the response to comments related to the research conducted by the PJV and Piperonyl Butoxide Task Force II.

Table 1 Updated summary of the rat 13-week inhalation toxicity study conducted with pyrethrum extract

(To include additional detail; there were no changes to effect levels reported in PRVD2020-08)

Study/Species	Results/Effects
13-Week Inhalation Toxicity – Whole Body CD Rat PMRA# 1829248, 1829250, 1829251, 1829257	NOAEC not established (♂/♀) LOAEC = 0.01 mg/L (2.6/2.7 mg/kg bw/day) (♂/♀) ≥0.01 mg/L (2.6/2.7 mg/kg bw/day) (♂/♀): ↑ incidence and severity of microscopic lesions in the seromucosal glands at the base of the epiglottis in the ventral larynx: slight to moderate hypertrophy and hyperplasia in the mucous cells, slight to moderate squamous/squamoid

Study/Species	Results/Effects
	<p>metaplasia/hyperplasia in ciliated/non-ciliated pseudostratified columnar epithelial cells, minimal to slight keratosis in the squamous/squamoid metaplastic epithelium in the ventral seromucosal glands (♂/♀)</p> <p>≥0.03 mg/L (7.7/8.1 mg/kg bw/day) (♂/♀): minimal to moderate hyperplasia and minimal to slight keratosis of the nonkeratinized stratified squamous epithelium normally found in the surface of the supraglottis (♂/♀); matted coat (♂)</p> <p>≥0.1 mg/L (26/27 mg/kg bw/day) (♂/♀): ↓ bw, ↓ bwg (♂/♀); matted coat, transient tremors and lacrimation, labored breathing, dry rales, moist rales, cysts within the metaplastic epithelium of the seromucosal glands at the base of the epiglottis in the ventral larynx in 1 animal, ↑ rel kidney wt (♀)</p> <p>0.36 mg/L (90/94 mg/kg bw/day) (♂/♀): hunched posture, hyperactivity, yellow anogenital stains, dried yellow material on face, ↓ Hgb and Hct, ↑ liver wt, ↑ lung wt, cysts within the layer of metaplastic epithelium of the seromucosal glands at the base of the epiglottis in the ventral larynx, histopathological changes in the larynx including eosinophilic material in lumen, moderate to severe squamous/squamoid hyperplasia and metaplasia of the cuboidal/columnar epithelium in the ventral laryngeal diverticulum and minimal to slight keratosis arising from the metaplastic epithelium in the ventral diverticulum, histopathological changes in the nasal mucosa (inflammation, squamous cell hyperplasia, squamous/squamoid metaplasia, keratosis), hypertrophy/hyperplasia in the lung epithelium of the terminal bronchioles (♂/♀); mortality (day 15) in 1 animal with laboured breathing, labored breathing, dry rales, moist rales, transient lacrimation, ↓ RBC, ↓ total protein and globulin, discoloration in lungs, ↑ rel lung wt (♂); ↑ creatine, ↑ glucose, ↑ WBC (♀)</p>

Table 2 Genotoxicity study identified subsequent to the publication of PRVD2020-08

In vitro genotoxicity studies	
Study/Species	Results/Effects
<p>Sister Chromatid Exchange and Oxidative DNA Damage</p> <p>Human Lymphocytes from 5 Healthy Adult Male Volunteers (non-smokers, non-alcoholics)</p> <p>0, 25, 50 or 100 µg/mL (without activation)</p> <p>PMRA# 3242165</p>	<p>Supplemental</p> <p>≥25 µg/mL: concentration-related ↑ in oxidative DNA damage (p<0.05)</p> <p>≥50 µg/mL: ↑ SCE (p<0.05)</p> <p>Cytotoxic at 100 µg/mL</p> <p>Limitations: Lack of positive controls.</p>

1.1.3 Comments Related to the Research Conducted by the CAPHRA Task Force and the Pyrethrins Joint Venture and Piperonyl Butoxide Task Force II

The registrants, the Council for the Advancement of Pyrethroid Human Risk Assessment (CAPHRA) Task Force, and the PJV and Piperonyl Butoxide Task Force II indicated that the human health risk assessment of the pyrethrins should be based on the outcome of the research generated by CAPHRA related to the sensitivity of the young, and the research generated jointly by the PJV and Piperonyl Butoxide Task Force II related to the inhalation point of departure.

Health Canada response:

Since the work undertaken by CAPHRA to address the potential sensitivity of the young to the pyrethroids are relevant to the pyrethrins and all pyrethroids, Health Canada is reviewing the studies under separate cover. To date there is no indication of increased health risks related to this information based on a preliminary review; however, should any concerns be identified, Health Canada will take the appropriate regulatory action.

During the public consultation period the PJV and Piperonyl Butoxide Task Force II indicated to Health Canada that there were new studies close to completion that address the inhalation toxicity of the pyrethrins, and requested that Health Canada incorporate these new studies into the re-evaluation decision for the pyrethrins. Health Canada agreed to accept the submission of the new studies if provided by an agreed upon deadline. Despite providing deadline extensions, the studies were not provided by the final deadline to be reviewed and incorporated into this final re-evaluation decision. Therefore, the new studies generated jointly by the Pyrethrins Joint Venture and Piperonyl Butoxide Task Force II will be reviewed through a pre-market submission. The outcome of the pre-market review will be applied to relevant products.

In conclusion, there are no changes to Health Canada's human health risk assessment of the pyrethrins at this time with regards to the CAPHRA Task Force data, or the PJV and Piperonyl Butoxide Task Force II data.

1.2 Comments related to dietary exposure

1.2.1 Comments on required residue chemistry data

A registrant commented that they understand that the lack of residue chemistry data may lead to some uses not being assessed, but are disappointed that most of the domestic food uses for pyrethrins are proposed to be cancelled. The registrant is unclear on exactly which data is missing to the Health Canada to assess domestic-class products.

Health Canada response:

In order for food uses to be assessed, residue chemistry data according to Health Canada's Updated Residue Chemistry Guidelines (2022 PMRA Guidance Document) or OECD guidelines need to be submitted to Health Canada. Petitioners interested in registering additional food uses should contact Health Canada for a pre-submission consultation.

1.2.2 Comments on cancellation of direct use on grain but continued use on grain storage and processing facilities

A registrant commented on the proposal to cancel the use of pyrethrins on stored grains. Although they understand the proposed cancellation does not include the treatment of facilities or empty storage areas, such as flour mills, grain elevators, cereal processing plants, and feed mills, they requested confirmation that these uses were maintained.

Health Canada response:

The cancellation of the stored grain use will not affect other registered uses such as the treatment of grain processing facilities, empty storage areas, flour mills, grain elevators, cereal processing plants and feed mills.

1.2.3 Comments on the use of pyrethrins on low bush berries (crop subgroup 13-07G)

A provincial stakeholder commented that the crop subgroup 13-07G was added to the product label for Pyganic Crop Protection EC 1.4 II (registration number 30164) in the spring of 2020 but was not considered in PRVD2020-08. The registrant requested that Health Canada confirm that the registration of Pyganic Crop Protection EC 1.4 II will be maintained for crop subgroup 13-07G and will be included in the dietary assessment.

Health Canada response:

The use of pyrethrins on low bush berries (CG 13-07G) was registered on the Pyganic Crop Protection EC 1.4 II label prior to the publication of PRVD2020-08 but after the risk assessment was completed. Health Canada confirms that presently, pyrethrins is registered to be used on low bush berries and that those uses are included in the present updated dietary assessment.

1.2.4 Comments on the use of pyrethrins on cranberries

A provincial stakeholder requested clarification on the registration status for the use of pyrethrins in cranberry production. It was noted that a User Requested Minor Use Label Expansion (URMULE) for cranberries was recently registered but not included in PRVD2020-08. The stakeholder requests that cranberries be added to the summary tables in Appendix I of PRVD2020-08 and therefore that the use be maintained.

Health Canada response:

The registration of pyrethrins for use on cranberries proceeded prior to the publication of PRVD2020-08 but after the risk assessment was completed. Health Canada confirms that presently, pyrethrins is registered to be used on cranberries and that this use was included in the updated dietary assessment.

1.2.5 Comments and data provided on rotational crops and plant back intervals

A registrant commented on the proposed decision to establish a PBI of 12 months for all crops other than the ones for which pyrethrins are registered for use, based on a lack of data. The registrant indicated that a proprietary study was available and committed to submit the study for evaluation.

Health Canada response:

Health Canada reviewed the submitted confined rotational crop study (PMRA# 3206900) that was performed with pyrethrin I on lettuce, radish and wheat. The results of the study review showed that pyrethrin I was not detected in any crop sample (lettuce – immature leaf, leafy lettuce, radish – top and roots, wheat – grain, hay, forage and straw) at the PBIs of 30 and 120 days. Based on the results, the proposed 12-month PBI was revised and a PBI of 30 days will be established for crops not listed on the label.

1.3 Comments related to occupational and residential exposure

1.3.1 Comments concerning the use of handheld equipment

Concern was noted by some user groups and registrants that the use of mechanically-pressurized handheld ultra-low volume (ULV) and mechanically-pressurized handheld sprayer application equipment were proposed for cancellation in PRVD2020-08. These user groups indicated that prohibiting this equipment limits the available alternatives for effective pest control in warehouses and food processing facilities.

Health Canada Response:

No commercial hand-held equipment was proposed for cancellation in PRVD2020-08. This includes mechanically- and manually-pressurized equipment used for ULV, mist, aerosol and fogging applications. Risks were shown to be acceptable with mitigation measures such as PPE and limiting the amount handled. In the revised risk assessment, as summarized in Appendix VI, risks continue to be acceptable for applicators using these types of equipment and they will not be prohibited, provided the mitigation measures in Appendix IV are implemented.

1.3.2 Comments noting the registration of drug products containing pyrethrins

Comments were received from user groups and registrants noting that there are Health Canada approved lice shampoos containing pyrethrins. The commenters noted that it was unclear why Health Canada judges these products to be safe while some surface and space sprays were not safe even when PPE were used and treated rooms were empty.

Health Canada response:

Health Canada assesses drug and pesticide products registered for sale in Canada to ensure that they can be used safely by Canadians. Exposure and risk for a person applying a shampoo for the treatment of a parasite are different than the exposure and risks for a person applying a pesticide daily to large warehouses to treat insects. In the assessment for pesticides, Health Canada also considers the risk for persons entering treated areas who may not be aware they were recently

treated or have access to the pesticide product label. As exposure scenarios for these products differ, as does the legislation under which they are regulated, it is not appropriate to directly compare them.

As summarized in Appendix VI, this updated assessment has demonstrated that most currently registered products and uses for pyrethrins are acceptable for continued registration, including dust and pressurized products applied as a space spray, provided that the mitigation measures in Appendix IV are followed.

1.3.3 Comments regarding prohibiting or limiting domestic-class products

The commenters expressed concern that many products, particularly domestic-class products, were proposed for cancellation or required limitations around their continued registration in PRVD2020-08. These product types include: dust products, indoor aerosol space spray application, outdoor/backyard sprays, total release foggers and application to animals. The commenters requested that Health Canada revisit these decisions and provided proposed mitigation measures which include limiting container sizes and net contents, adjusting valve apertures to reduce volume sprayed per time, and providing more detailed description of the application process to reduce applicator exposure.

Health Canada response:

Health Canada updated the risk assessments to incorporate the use pattern information and data submitted to Health Canada during the comment period, as summarized in Appendix VI. As a result, most domestic-class product cancellations and mitigation measures proposed in PRVD2020-08 are no longer required. Domestic-class dust products, as well as indoor and outdoor space sprays using pressurized products are acceptable for continued registration, provided the mitigation measures in Appendix IV are implemented.

For pressurized products used as total release foggers and liquid products applied as a space spray, the risk assessments were refined to the extent possible using the data available to Health Canada. However, inhalation risks from exposure to aerosols (droplets) present in the air after application continue to not be acceptable, even for the lowest registered application rates. As discussed in PRVD2020-08, Health Canada does not establish risk-based re-entry intervals for domestic-class products. Therefore, all domestic-class total release fogger pressurized products will be cancelled. In addition, space spray uses for liquid domestic-class products will be cancelled. Refer to Appendix VI for more information.

1.3.4 Comment regarding indoor aerosol space spray postapplication assessments

The commenter expressed concern over the proposed cancellation of domestic-class indoor aerosol space sprays applied using pressurized products (including total release foggers) as well as the mitigation required for commercial-class indoor space sprays. The following comments were made regarding inputs in the postapplication inhalation assessment:

- a) The highest theoretical surface residues of pyrethrins following surface directed products, results in dermal and oral (hand and object to mouth) risk estimates that are all acceptable.

- b) The highest 8-hour time-weighted average air concentration following space spray use or spraying animal quarters from an indoor air monitoring study for an aerosol product (Selim, 2002) could be used.
- c) The air exchange rate (ACH) could be increased to 10 per hour for animal barns.
- d) The re-entry intervals currently on domestic-class products in the exposure assessment (for example, 10–15 minutes for animal quarters) could be considered.

A list of studies conducted by the Non-Dietary Exposure Task Force (NDETF) that are relevant to the consumer and occupational exposure assessment of pyrethrins was also submitted.

Health Canada response:

As discussed in Appendix VI, the postapplication assessments for all indoor space sprays were updated to reflect the submitted use pattern information and available data. The suggested inputs above were considered by Health Canada for the updated assessments. This is discussed in greater detail below.

Health Canada agrees with the statement that the resulting surface residues of pyrethrins following the use of surface directed products results in no dermal or oral (hand or object to mouth) risks of concern, when the appropriate mitigation is implemented, as outlined in Appendix IV.

As noted in PRVD2020-08, Health Canada used the maximum measured air concentration and normalized it to registered application rates in order to estimate postapplication inhalation exposure. A time-weighted average (TWA) approach was not considered appropriate to assess postapplication inhalation exposure to aerosols, based on the current use pattern of pyrethrins and the study data. TWA values are typically used for longer-term exposure durations, and they are conducted in conjunction with a short-term assessment to ensure that the maximum air concentration is considered. The available studies (Selim, 2002; Acedo, 2016) monitored air concentrations over 2 hours, which is consistent with the expected duration that aerosols may be suspended in the air after an application and available for exposure. Using these data to calculate an average air concentration over 8 hours would include 6 hours of time when aerosols are not expected to be available for exposure. Averaging air concentrations over 8 hours would result in a lower air concentration to estimate postapplication exposure, and would not address the peak air concentration, which is relevant to the adverse toxicological effects (portal of entry) noted in the 13-week rat inhalation toxicity study that was used to derive the point of departure for the inhalation risk assessments.

In PRVD2020-08, Health Canada used standard air exchange rates from the USEPA Residential SOPs (2012). In order to use different values, as proposed by the commenter, science-based information or a rationale would be required (for example, nationally-representative data reflective of air changes in these buildings). The commenter did not provide such a rationale. For pyrethrins, the postapplication exposure assessments for indoor space sprays applied using pressurized products were conducted with data from the Acedo (2016) air concentration study, which was considered to be representative of application in residential areas and the air concentrations from this study could not be modified to reflect animal barns.

Re-entry intervals were considered for the postapplication assessment following commercial-class product application. For pressurized products (excluding total release foggers), a re-entry interval of 15 minutes is required for space spray applications. For domestic application of a space spray using a pressurized product, risks were not shown to be acceptable immediately following application. Health Canada does not establish risk-based re-entry intervals for domestic-class products. Therefore, this use is to be cancelled for domestic-class products. Refer to Appendix VI for more information.

Health Canada examined the list of the submitted NDETF studies. These studies are incorporated into the USEPA Residential SOPs (2012) which were used to assess residential exposure to pyrethrins.

1.4 Comments related to incident reports

1.4.1 Comment regarding few incident reports for individual products containing pyrethrins

One registrant commented on the low number of incidents reported for their product.

Health Canada response:

Health Canada evaluates all available information from various sources. A low number or lack of incidents cannot be used to imply an absence of risks of concern. Underreporting of incidents and barriers to reporting has been documented in many areas including pesticides.¹⁵ Health Canada therefore, considers all available data and scientific information to ensure that registered pesticides continue to meet current health and environmental safety standards and continue to have value. For PRVD2020-08, the incident report evaluation, leading to the proposed mitigations, was based on incidents submitted to three regulators (in other words, Health Canada, the California Department of Pesticide Regulation and the United States Environmental Protection Agency).

2.0 Comments related to the environmental risk assessment

2.1 Comment regarding applications during cranberry crop bloom

The Quebec Cranberry Growers Association raised concerns that application of products containing pyrethrins would not be allowed during cranberry crop bloom.

¹⁵ Prado J.B., Mulay P.R., Kasner E.J., Bojes H.K. and Calvert, G.M. (2017). Acute pesticide-related illness among farmworkers: Barriers to reporting to Public Health Authorities. *Journal of Agromedicine*, 22(4): 395-405., and: Bell, E.M., Sandler, D.P., and Alavanja, M.C. (2006). High Pesticide exposure events among farmers and spouses enrolled in the Agricultural Health Study. *Journal of Agricultural Safety and Health*, 12(2):101-116.

They commented that proposed pollinator mitigation measures would negatively affect the control of second-generation insect pests. They indicated that impact on insect pollinators would be limited as:

- Applications are timed during periods when there are no honeybees on farms.
- Applications are done when the flowering percentage in fields is low
- (< 20%), a period when pollinators rarely frequent flowers.
- Applications are done exclusively at night, when there are no pollinators in the fields.
- Pollinators exposure to pyrethrins when visiting flowers or through exposure to nectar is very unlikely

Health Canada response:

PRVD2020-08 proposed to “Prohibit and restrict application during crop blooming period”. This assessment was conducted based on application method. During the course of the re-evaluation, a minor use submission for use on cranberries was assessed and approved with labels requiring the following restrictions for pollinators: “*DO NOT apply this product to flowering crops if bees are visiting the treatment area. Minimize spray drift to reduce harmful effects on bees in habitats close to the application site.*”

This current re-evaluation decision requires the following label statement to appear on labels with application to cranberry. This statement will replace the statement that was required on labels at the time of the minor use registration: “**Avoid application during the crop blooming period. If applications must be made during the crop blooming period, restrict applications to evening when most bees are not foraging.**” Other pollinator mitigation statements are also required on product labels (see Appendix IV).

As a result, this use on cranberries during crop bloom has restrictions but is not prohibited. Please refer to the label statements Section.

Managed honeybees are not the only pollinators of concern. Health Canada also considers non-*Apis* pollinators (for example, *Apidae*, *Bombus*, *Megachile*), which may be foraging under different environmental conditions than *Apis* pollinators. Although pyrethrins are not systemic insecticides, following application they are expected to be present on cranberry plants (including flowers that are present during spray application). Pollen from flowers represents a source of exposure to pyrethrins via direct contact with the insect during foraging activity.

Please refer to the document “Health Canada’s Protecting Pollinators during Pesticide Spraying - Best Management Practices” for additional information on Health Canada’s approach to pollinator protection.

2.2 Comment regarding buffer zones for cranberries

The Quebec Cranberry Growers Association agreed that the ground boom application buffer zones proposed in PRVD2020-08 are required to protect non-target aquatic organisms and should be applicable to the (overhead) chemigation uses on cranberries.

Cranberries were added to the Pyganic EC1.4 II label as a result of a User Requested Minor Use Label Expansion (URMULE) with buffer zones less than those proposed in PRVD2020-08 for similar use scenarios (see Table 1 for comparison).

Health Canada response:

The URMULE was completed prior to the publication of PRVD2020-08 and relied on an older data set. The environmental risk assessment was updated in PRVD2020-08, but due to the timing of the URMULE, the cranberry uses registered through the URMULE were not included in the assessment presented in PRVD2020-08.

As a result, the cranberry buffer zones were re-calculated using results of the updated environmental risk assessment. Results of the buffer zone calculations for the URMULE, PRVD2020-08 and the updated buffer zones for cranberry required as a result of the final re-evaluation decision are presented in Table 3.

Health Canada assumes chemigation overhead spray and ground boom applications to be equivalent for the purposes of buffer zone calculations. Buffer zones are not required for drip-irrigation application in cranberry fields. Buffer zones proposed in PRVD2020-08 are larger than those currently on product labels. Updated ecotoxicity endpoints used in PRVD2020-08 for marine organisms were more sensitive than those used for the URMULE assessment, resulting in larger buffer zones for these habitats. Although the cranberry use has two additional applications and shorter application intervals, the buffer zones are smaller than those calculated for other crops. This is a result of the cranberry buffer zones being calculated using medium spray droplet quality (as opposed to fine spray droplet quality for other crops) and application timing (early and late season for some other crops).

Table 3 Comparison of relevant buffer zones PRVD2020-08 and subsequent URMULE for cranberries

	Crop (maximum application rate in g a.i./ha × number of applications per season × application interval in days)	Buffer zones (meters) required for the protection of:			
		Freshwater habitat of depths:		Estuarine/Marine habitats of depths:	
		Less than 1 m	Greater than 1 m	Less than 1 m	Greater than 1 m
URMULE	Cranberries (60 g a.i./ha × 10 applications × 3 days; ASAE S572.1 medium spray droplet)	10	1	2	1
PRVD2020-08	Various crops – application with groundboom sprayer to Blueberry, grape, raspberry, Herbs and Spices (Crop Group 19), Pinto bean, snap bean, wax bean, and tomato (60 g a.i./ha × 8 applications × 7 days; assumed ASAE S572.1 fine spray droplet)	25	4	45	25

	Crop (maximum application rate in g a.i./ha × number of applications per season × application interval in days)	Buffer zones (meters) required for the protection of:			
		Freshwater habitat of depths:		Estuarine/Marine habitats of depths:	
		Less than 1 m	Greater than 1 m	Less than 1 m	Greater than 1 m
Updated Cranberry Buffer Zones	Cranberries (60 g a.i./ha × 10 applications × 3 days; assumed ASAE S572.1 medium spray droplet)	40	5	15	5

3.0 Comments related to the value assessment

3.1 Comments regarding the importance of pyrethrins in agriculture and public health

Several stakeholders commented on the vital role professional pest control plays in protecting our food supply and public health. Professional pest control officers, require pyrethrins and piperonyl butoxide products, to target flies, cockroaches and stored product pests that spread food borne pathogens, impact public health and adulterate the food supply. Due to a lack of available alternatives, Health Canada's proposed cancellation of the application of pyrethrins via mechanically pressurized handheld ultra-low volume (ULV) foggers in food factories and warehouses will result in the use of fumigation, which is considered a more drastic approach to fogging. Pyrethrins products are applied using handheld ULV foggers which allow applicators to target applications to where pests hide, so to have a flushing effect, therefore helping to pinpoint pest infestations. As a result, handheld ULV foggers are an effective application tool in integrated pest management, resulting in more targeted applications, and a reduction in the use of additional general surface and broadcast applications. In addition, pyrethrins are one of the few pest control products that are approved for use in organic facilities.

Health Canada response:

Health Canada acknowledges the role professional pest control plays in protecting our food supply and public health. Note that all commercial-class pyrethrins products are co-formulated with conventional active ingredients. Health Canada recognizes the need for effective pest control products, and the importance of equipment such as ULV foggers, which allows for targeted applications, resulting in a flushing effect to help pinpoint pests. To clarify, the proposed re-evaluation decisions for pyrethrins and piperonyl butoxide (PRVD2020-08 and PRVD2020-09, respectively), indicated that the use mechanically pressurized handheld sprayers for mists, aerosols, and fogs were proposed for cancellation for domestic products. In the case of commercial products, this type of equipment was not proposed for cancellation. Rather, the addition of a two-hour re-entry interval, new requirements for personal protective equipment and engineering controls and limits on the amount of pyrethrins and piperonyl butoxide handled per day (0.05 kg of active ingredient per person/day and 0.27 kg of active ingredient per person/day, respectively) were proposed. The comments received during consultation did not change the outcome of the proposed decision (in other words, continued registration of commercial products using mechanically pressurized handheld ULV foggers for indoor space sprays with the above risk mitigation measures; cancellation of domestic products using mechanically pressurized handheld sprayers for mists, aerosols, and fogs).

3.2 Comment regarding the importance of pyrethrins for stored grains

A stakeholder commented on the importance of pyrethrins and piperonyl butoxide as a direct application to stored grains, and for use in grain facilities or empty storage areas. The importance of these products lies in the rapid breakdown of pyrethrins, which makes it a major tool for pest management in food and feed facilities.

Health Canada response:

Health Canada acknowledges the value of pyrethrins and piperonyl butoxide as important pest management tools for use in food and feed handling facilities and users will continue to have access to products containing these active ingredients for structural applications in these locations of use. However, risks of concern remain for direct application to stored grains therefore this specific use of pyrethrins and piperonyl butoxide is cancelled. Alternatives such as malathion and silicon dioxide are registered for direct application to stored grains.

3.3 Comments regarding crops not specifically listed on product labels

Comments related to the specific crops included in the dietary assessment for pyrethrins, and its consequences for several Quebec and Canadian organic producers were received. The commercial pyrethrins product Trounce, registration number 24363, is registered with broad categories of crops including field and greenhouse vegetables and fruits and has a general statement concerning “other listed insects”. Trounce has been widely adopted and used by growers of various crops including organic field and greenhouse grown cucurbits and fruiting vegetables, and organic field grown *Brassica* vegetables therefore it was requested that these crops be included in the dietary assessment. The comments indicated that it was unclear if the registration of commercial product Pyganic, registration number 30164, was maintained for crop subgroup 13-07 because it was not included in the list of food uses assessed in the dietary assessment.

Health Canada response:

The crop subgroup 13-07G was added to the Pyganic label as of June 2021. Therefore, this use is currently registered and retained. Use of pyrethrins on crops not included in the risk assessment are cancelled. While there are some conventional alternatives available, there are few products registered for use on organic crops. Health Canada acknowledges that the loss of pyrethrins will leave gaps in pest control programs for some growers. Health Canada encourages grower groups to contact the registrants of potential alternative products, Agriculture and Agri-Food Canada (AAFC), and their provincial minor use coordinator to discuss the possibility of pursuing new registrations to address their crop-specific needs.

3.4 Comments regarding the importance of pyrethrins for domestic use

Several stakeholders commented on the importance of domestic products for use by the public to target household pests when applied indoors as dusts and space sprays. Space sprays are important for use in unoccupied garages and sheds which are open to the outside therefore subject to house fly and mosquito incursions. Stakeholders also commented on the importance of domestic pyrethrins and piperonyl butoxide products for use in and around homes to kill household pests that can transmit disease including ticks and mosquitoes. Comments indicated

that the cancellation of uses could result in fewer products being available for Canadians who require these products to control pests such as cockroaches and bed bugs, in homes and apartments, as there are limited alternative active ingredients registered. Alternative products that contain other registered active ingredients include baits, attractants, pheromones, insecticide powders and dusts, however, these are not suitable alternatives to products containing pyrethrins and piperonyl butoxide. The reduction in available products, may also encourage Canadians to do more cross-border shopping and/or mix homemade pesticides, both of which pose their own risk. Further, e-commerce companies have allowed shipping of United States products into Canada “for personal use;” therefore, it is likely that there will be an increase in this activity by consumers if they are unable to find products in Canada to meet their pest control needs.

Health Canada response:

Health Canada acknowledges the importance of domestic products to control household and disease vector pests. Health Canada agrees there is value to the use of pyrethrins and piperonyl butoxide products for personal use in and around homes when applied as dusts and space sprays. Based on the additional information received during consultation, Health Canada updated the risk assessment, and indoor use of dust products, and all domestic outdoor space spray applications are retained. Indoor space sprays using aerosol cans are retained with mitigation (rate reduction). However, risk concerns remain for space spray applications using products formulated as liquids and total release foggers and these uses are cancelled. Additionally, the metered-release device uses are cancelled because the rate on registered products exceeds the maximum application rate of 0.0358 mg of pyrethrins released every minute.

Following the re-evaluation of pyrethrins and piperonyl butoxide consumers will continue to have pyrethrins and piperonyl butoxide products to meet their pest control needs. If consumers do purchase products online, they need to ensure that they are purchasing a product that is registered in Canada. Further information can be found on the [Buying pest control products](#) page on Canada.ca. A list of the registered products containing pyrethrins in Canada can be accessed through the PMRA’s Pesticide Product Information Database (PPID).

3.5 Comments regarding the importance of pyrethrins in organic agriculture

Stakeholders commented that the removal of pyrethrins and piperonyl butoxide domestic products for use on food crops will leave consumers with fewer products for organic food production during a period when there is an increased interest in organic grown garden food crops. Pyrethrins are known to be highly effective in controlling pests as well as being safe and having rapid breakdown. There are few products, containing pyrethrins only, that are registered for use on food crops and none of the alternatives are as effective or considered a suitable alternative. The lack of effective alternatives for use on organic crop production could result in an increase of homemade pesticides instead of registered pesticides.

Health Canada response:

Health Canada recognises that there are limited domestic products available for organic grown garden food crops. Health Canada advises consumers to be aware that preparing, storing, and using homemade pesticides may pose health and environmental safety risks. Homemade pesticides do not undergo any scientific evaluation and do not have label directions that the user can follow to ensure safe use or effectiveness. Health Canada encourages stakeholders to engage registrants to discuss the possibility of pursuing new registrations to address crop specific needs.

4.0 Comments related to other considerations**4.1 Comment on proposed cancellation of domestic-class uses in PRVD2020-08**

The registrant commented that dust and indoor space spray applications are proposed for cancellation for domestic-class products but not for commercial-class products. Should the proposal be maintained at final decision the registrant would like to convert the domestic-class products to commercial-class products.

Health Canada response:

As outlined in this re-evaluation decision, domestic-class dust products and domestic-class aerosol space spray products are acceptable for continued registration provided that the required risk mitigation measures presented in this re-evaluation decision are implemented (Appendix IV).

4.2 Comments on the timeline to implement required label amendments

Registrants and stakeholders commented for the PMRA to be clear to whom the 24-month label amendment timeline applies to (registrants, retailers, distributors and/or users). In addition, registrants requested more than 24 months to implement required label amendments.

Health Canada response:

Regulatory Directive DIR2018-01, *Policy on Cancellations and Amendments Following Re-evaluation and Special Review* provides the general framework for amendments to pesticide product uses following a re-evaluation or special review decision. The policy outlines the process and how the associated timelines for amendment of pesticide products are established.

The main consideration for the implementation timeline for label amendments is based on the risks of concern to human health or the environment. Following a re-evaluation, regulatory changes are to be implemented as soon as possible to manage identified risks. The timelines provided by the policy are intended to facilitate the timely and orderly implementation of the decision where there is acceptable risk.

This pyrethrins re-evaluation decision requires different implementation timelines to manage risks to human health for domestic-class products with indoor uses. The implementation timelines outlined in section “Next steps” are applicable to registrants, retailers/distributors, and users.

Appendix IV Label amendments for products containing pyrethrins

The label amendments presented below do not include all label requirements for individual end-use products, such as first aid statements, disposal statements, precautionary statements and supplementary protective equipment. Additional information on labels of currently registered products should not be removed unless it contradicts the label statements given below.

Pyrethrins is co-formulated with other active ingredients. When updating the label statements, follow the more stringent label directions of all the actives with which a given product is co-formulated.

For acceptable uses, differentiate on labels between residential and non-residential sites and include the definitions as noted below.

In addition, label statements are required to be updated as per the 2020 PMRA Guidance Document, *Structural Pest Control Products: Label Updates* and as per DIR2002-01 Regulatory Directive: *Canadian Label Improvement Program for Pesticides Used on Companion Animals*.

Label amendments relating to the health risk assessments

1.0 Label amendments for commercial-class end-use products containing pyrethrins

1.1 Commercial-class Agricultural Products

The following changes are required on all commercial-class agricultural product labels:

- Any references to “trees” should be changed to “Ornamental Trees”
- Any references to “shrubs” should be changed to “Ornamental Shrubs”
- Any references to “greenhouse and interior plantings” should be removed
- Any references to vague crops (for example, “fruits”, “vegetables”, “fruit trees”) should be removed

Add to **DIRECTIONS FOR USE:**

- Create a new sub-header: CROP ROTATION

Add to **CROP ROTATION:**

“Where applicable, a rotational plant-back interval of 30 days must be observed for crops not listed on the label.”

Precautions

Personal Protective Equipment:

For application of liquid commercial-class products using a handheld airblast/mistblower, the following label statement is required:

“For application using handheld airblast/mistblower equipment, wear chemical-resistant coveralls with a chemical-resistant hood over long-sleeved shirt, long pants, chemical-resistant gloves, socks, chemical-resistant footwear and a respirator with a NIOSH-approved organic-vapour-removing cartridge with a prefilter approved for pesticides OR a NIOSH-approved canister approved for pesticides.”

For mixing, loading, and application of liquid products to agricultural crops using a mechanically-pressurized handgun, the following label statement is required:

“Wear a long-sleeved shirt, long pants, chemical-resistant gloves, socks and shoes, and a respirator with a NIOSH-approved organic-vapour removing cartridge with a prefilter approved for pesticides, or a NIOSH-approved canister approved for pesticides during mixing, loading, application, clean-up and repair.”

For mixing, loading, and application using all other application equipment (including mechanically-pressurized handgun application to livestock), the following label statement is required on all commercial-class product labels, unless more protective statements are already present:

“Wear a long-sleeved shirt, long pants, chemical-resistant gloves, socks and shoes during mixing, loading, application, clean-up and repair.”

The following label statement is required for all labels with stationary fogger and handheld airblast/mistblower applications:

“If entering treated indoor areas prior to venting, wear chemical-resistant coveralls over long-sleeved shirt, long pants, chemical-resistant hood, chemical-resistant footwear, socks, chemical-resistant gloves, and a respirator with a NIOSH-approved organic-vapour-removing cartridge with a prefilter approved for pesticides OR a NIOSH-approved canister approved for pesticides.”

Restricted-entry intervals:

The following table is required on all commercial-class agricultural product labels and product labels with uses on pastures and feedlots, sod farms, and outdoor ornamentals grown for production, except when more restrictive statements are already in place:

“**DO NOT** enter or allow worker entry into treated areas during the intervals specified in the following table:”

Restricted-entry intervals (REI)/Preharvest intervals (PHI)

Crop	REI and/or PHI
Herbs and spices	1 day
Greenhouse pepper, pear orchard, raspberry, bearberry, billberry, blueberry, cloudberry, loganberry, muntries, partridgeberry, strawberry, cultivars (varieties and/or hybrids), cranberry, grape, herbs and spices, field tomato, pinto/snap/wax beans, roses (outdoor)	12 hours
Outdoor ornamentals and outdoor ornamental trees/shrubs grown for production	
Sod farms	

Drift statement:

In order to promote best practices, and to minimize human exposure from spray drift or from spray residues resulting from drift due to the agricultural use of pyrethrins, the following label statement is required for all liquid products, including soluble granules applied as a liquid drench:

“Apply only to agricultural crops when the potential for drift to areas of human habitation and human activity such as houses, cottages, schools and recreational areas is minimal. Take into consideration wind speed, wind direction, temperature inversions, application equipment, and sprayer settings.”

Indoor crop statement:

The following statement is required on all commercial-class agricultural product labels:

“**DO NOT** apply in greenhouses, except on greenhouse peppers.”

Other restrictions:

When applying using a handheld airblast/mistblower, the following statement is required:

“**DO NOT** handle more than [*0.05 kg a.i. to be reported in product equivalent value*] per person, per day when using a handheld airblast/mistblower (droplet sizes 0.1–100 µm). These restrictions are in place to minimize exposure to individual applicators. Application may need to be performed over multiple days or using multiple applicators.”

Directions for use:

The following use is to be cancelled and must be removed from product labels:

“Direct application to bulk or bagged stored grain.”

For all commercial-class products with crop uses, remove all references to crop uses other than the crops listed below if found on the label:

“Greenhouse peppers, highbush blueberry, grape, raspberry, low bush berries (bearberry, bilberry, low growing blueberry, cloudberry, cranberry, lingonberry, muntries, partridgeberry, strawberry, cultivars, varieties and/or hybrids), herbs and spices (Crop Group 19), pear orchards, pinto, snap and wax beans, and field tomato.”

1.2 Commercial-class structural/Non-agricultural products

Commercial-class structural/non-agricultural products include products used on agricultural premises and equipment (indoors and outdoors), animal housing, indoor sites (except for greenhouse peppers), outdoor sites and outdoor ornamentals (including golf courses and sod farms), mosquito abatement, residential dwellings/indoor sites, residential outdoor sites, and pet premises.

Pressurized Products with indoor metered release space spray applications (excluding barns):

Limit the maximum application rate of pyrethrins to 0.537 mg of pyrethrins released every 15 minutes. The active ingredient amount (in other words 0.0358 mg a.i./minute) is to be converted into the corresponding amount of product by the registrant for each applicable product.

Precautions

Use directions:

For liquid commercial-class products applied as an indoor surface spray, the following statement is required:

“**DO NOT** exceed an application rate of [*0.2760 g a.i./m² to be reported in product equivalent value*] when applying as an indoor surface spray.”

For liquid commercial-class products applied for mosquito abatement, the following statement is required:

“**DO NOT** exceed an application rate of [*3.02 g a.i./ha to be reported in product equivalent value*] when applying as a fogging spray for mosquito abatement.”

Personal protective equipment:

For application of liquid commercial-class products using a mechanically-pressurized handheld sprayers for mists, aerosols, and fogs, the following statement is required:

“For application using mechanically-pressurized handheld sprayer for mists, aerosols, and fogs (droplet sizes 0.1–100 µm), wear chemical-resistant coveralls with a chemical-resistant hood over long-sleeved shirt, long pants, chemical-resistant gloves, socks, chemical-resistant footwear and a respirator with a NIOSH-approved organic-vapour-removing cartridge with a prefilter approved for pesticides OR a NIOSH-approved canister approved for pesticides.”

For mixing, loading, and application of liquid commercial-class products using a mechanically-pressurized handgun, the following label statement is required:

“Wear a long-sleeved shirt, long pants, chemical-resistant gloves, socks and shoes, and a respirator with a NIOSH-approved organic-vapour removing cartridge with a prefilter approved for pesticides, or a NIOSH-approved canister approved for pesticides during mixing, loading, application, clean-up and repair.”

For mixing, loading, and application of dust commercial-class products, the following label statement is required:

“Wear a long-sleeved shirt, long pants, chemical-resistant gloves, socks and shoes, and a NIOSH approved N95 (minimum) filtering facepiece respirator (dust mask) that is properly fit tested during mixing, loading, application, clean-up and repair.”

For mixing, loading, and application using all other application equipment, the following statement is required for all commercial-class product labels, unless more protective statements are already present:

“Wear a long-sleeved shirt, long pants, chemical-resistant gloves, socks and shoes during mixing, loading, application, clean-up and repair.”

The following label statement is required on all labels with indoor stationary fogger applications, handheld airblast/mistblower, and mechanically-pressurized handheld equipment for mists, aerosols, and fogs, and total release foggers:

“If entering treated areas prior to venting or before the 2-hour re-entry interval, wear chemical-resistant coveralls with a chemical-resistant hood over long-sleeved shirt, long pants, chemical-resistant gloves, socks, chemical-resistant footwear and a respirator with a NIOSH-approved organic-vapour-removing cartridge with a prefilter approved for pesticides OR a NIOSH-approved canister approved for pesticides.”

Re-entry intervals:

The following statement is required on all liquid and pressurized product labels:

“**DO NOT** enter or allow entry into treated areas until sprays have dried.”

The following statement is required on all dust commercial-class product labels:

“**DO NOT** enter or allow entry into treated areas until dusts have settled.”

The following statement is required on all commercial-class labels with uses on livestock:

“Avoid contact with treated animals until dried.”

The following statement is required on all commercial-class pressurized product labels that are applied as an indoor space spray (excluding pressurized products applied as total release foggers):

“**DO NOT** enter or allow entry into treated areas for 15 minutes following application.”

The following statement is required on all commercial-class pressurized product labels that are applied as total release foggers:

“When space spray is applied as a total release fogger, **DO NOT** enter or allow entry into treated areas for 2 hours following application.”

The following statement is required on all commercial-class liquid product labels that are applied as an indoor fogging (space) spray:

“**DO NOT** enter or allow entry into treated areas for 2 hours following application.”

The following statement is required on all commercial-class labels that require 15-minute to 2-hour re-entry statements:

“The commercial applicator is responsible for notifying workers, the homeowner, and others of the re-entry period requirement.”

Drift statement:

The following statement is required on all outdoor commercial-class product labels:

“Apply only when the potential for drift beyond the area to be treated is minimal. Take into consideration wind speed, wind direction, temperature inversions, application equipment and sprayer settings.”

For pressurized products only:

“Apply only when the potential for drift beyond the area to be treated is minimal. Take into consideration wind speed, wind direction and temperature inversions.”

Indoor crop statements:

The following statement is required on all commercial-class labels that mention applications in greenhouses or ornamentals.

“**DO NOT** apply in greenhouses.”

If the product is registered for use on greenhouse peppers:

“**DO NOT** apply in greenhouses, except on greenhouse peppers.”

Other restrictions:

The following statement is required on all commercial-class labels with application using a mechanically-pressurized handheld sprayer for mists, aerosols, and fogs:

“**DO NOT** handle more than [*0.05 kg a.i. to be reported in product equivalent value*] per person per day when using mechanically-pressurized handheld sprayer for mists, aerosols, and fogs (droplet size 0.1–100 µm). These restrictions are in place to minimize exposure to individual applicators. Application may need to be performed over multiple days or using multiple applicators.”

1.3 Standard label statements for structural pest control products

The following statements are required on all commercial-class product labels with indoor and outdoor surface applications where necessary, based on the use pattern. Replace similar wording on the label with these statements. If more stringent mitigation is currently specified on the label, integrate it in the statements below, as applicable.

“Ventilate treated indoor areas after application either by opening windows and doors or using fans, where required, to aid in the circulation of air. Air exchange/ventilation systems confirmed to be operational may also be used.”

“**DO NOT** apply when people or pets [or livestock] are present, unless otherwise specified.”

For broadcast, perimeter, and spot spray (liquid formulation) applications, add:

“Use a coarse droplet size and low pressure spray not exceeding 345 kPa (50 psi) to avoid splashing onto non-target surfaces.”

For all commercial-class products registered for use in food and feed processing facilities, add:

“**DO NOT** apply when a food/feed processing facility is in operation.”

If also registered for milking parlours, milk houses or milk rooms, add:

“**DO NOT** apply when a food/feed processing facility, milking parlour [*if applicable to label*, milk room] or milk house is in operation.”

For commercial-class liquids and pressurized products applied indoors, add:

“**DO NOT** allow spray to drip or allow drift onto non-target surfaces.”

For commercial-class dust products applied indoors, add:

“**DO NOT** allow dust to deposit onto non-target surfaces.”

For all commercial-class products **not** registered for use on stored food/feed, add:

“**DO NOT** apply to surfaces that may come into contact with food/feed.”

For all commercial-class products **not** registered for use on stored food/feed, add:

“Cover or remove all food/feed. Cover all food/feed processing surfaces, equipment, and utensils or thoroughly wash following treatment.”

If not registered for use on stored food/feed but registered for use in milking parlours, milk houses or milk rooms, add:

“**DO NOT** apply to surfaces that may come into contact with food/feed. Cover or remove all food/feed (including bulk tanks that contain milk). Any milk accidentally contaminated with spray solution must be discarded. [*For products that can be applied in milking parlours, add the following statement: Cover or remove all milking equipment and thoroughly wash before use.*.]”

If only surface application types are supported on the liquid and pressurized product labels, add:

“**DO NOT** apply as a space spray treatment.”

For commercial-class product labels with indoor and outdoor surface applications (excluding soluble granule formulations):

“**DO NOT** apply to overhead areas or in confined spaces without appropriate respiratory and eye protection.”

The following statements are required on all commercial-class products approved for use on mattresses and furniture:

“**DO NOT** use on items which can be laundered (e.g., pillows, bedding, toys, etc.), unless otherwise specified.”

“Remove bedding before treating mattresses. Treated mattress must be dry before replacing laundered bedding.”

“Remove all objects before treatment of furniture, luggage, closets or other areas where clothing, toys, towels, and other items are stored. Treated furniture must be dry before replacing stored items.”

For products **not** registered for use on mattresses, clothing, or furniture, the following statement is required to be added:

“**DO NOT** apply to [furniture, mattresses], linens, pet bedding, toys or clothing.”

For all commercial-class labels with void application, add:

“Care should be taken to avoid the pesticide exiting the void. Any residue deposits on non-target surfaces must be removed by the applicator.”

For commercial-class labels registered for use on clothing, add:

“Only apply to clothing which can be laundered. Treated clothing must be laundered prior to wearing.”

The following statements are required on all commercial-class product labels with space spray applications. Replace similar wording on the label with these statements. If more stringent mitigation is currently specified on the label, integrate it in the statements below, as applicable.

“When applying to overhead areas or in confined spaces, wear appropriate respiratory and eye protection.”

“Ventilate treated indoor areas after application either by opening windows and doors or using fans, where required, to aid in the circulation of air. Air exchange/ventilation systems confirmed to be operational may also be used.”

“**DO NOT** apply when people or pets [or livestock] are present [unless otherwise specified].”

“**DO NOT** remain in treated area after application.”

For all commercial-class products registered for use in food and feed processing facilities, add:

“**DO NOT** apply when a food/feed processing facility is in operation.”

If also registered for milking parlours, milk houses or milk rooms, add:

“**DO NOT** apply when a food/feed processing facility, milking parlour [*if applicable to label*: milk room] or milk house is in operation.”

For all commercial-class products **not** registered for use on stored food/feed, add:

“Cover or remove all food/feed. Cover all food/feed processing surfaces, equipment and utensils or thoroughly wash following treatment.”

If also registered for milking parlours, milk houses or milk rooms, add:

“**DO NOT** apply to surfaces that may come into contact with food/feed. Cover or remove all food/feed (including bulk tanks that contain milk). Any milk accidentally contaminated with spray solution must be discarded. [*For products that can be applied in milking parlours, add the following statement: Cover or remove all milking equipment and thoroughly wash before use.*”

The following statement is required on commercial-class product labels with indoor fogging applications:

“Ventilate treated indoor areas after application either by opening windows and doors or using fans, where required, to aid in the circulation of air. Air exchange/ventilation systems confirmed to be operational may also be used.”

The following statement is required on all commercial-class product labels with outdoor structural/non-agricultural uses:

“Apply only when the potential for drift beyond the area to be treated is minimal. Take into consideration wind speed, wind direction, temperature inversions, application equipment, and sprayer settings.”

The following statements are required on all commercial-class product labels with structural uses (except Ready To Use (RTU) products):

“Space application is a suspension of fine droplets (0.1 to 100 µm) in the air within an indoor space.”

The following statements are required on commercial-class product labels with structural uses where the type of application is mentioned on the label:

“Outdoor broadcast application is to large outdoor structural surfaces (i.e., roofs, walls, doors, windows, porches, patios and foundations) and turf.”

“Indoor broadcast application is to broad expanses of indoor structural surfaces such as walls, floors, ceilings and indoor foundation walls/crawlspaces. Indoor perimeter application is less than 0.1 m wide along the edges of a room to baseboards, wall-floor and ceiling-wall joints, and around doorways or windows. Spot application is localized to a surface area not more than 0.2 m². Spots are not to be adjoining. The combined area of spots is not to exceed 10% of the total surface area of a room. Crack and crevice is an application directly into narrow openings on the surface of the structure. It does not include the treatment of exposed surfaces. Narrow openings typically occur at expansion joints, utility entry points, and along baseboards and mouldings. Void application applies to inaccessible, enclosed empty spaces of a structure. For example, hollow walls and suspended ceilings.”

For all commercial-class product labels with furniture treatment, including but not limited to hard surface furniture, mattresses, box springs, pet bedding, bed frames, the following definitions must be added, where applicable:

“**Broadcast** – Broadcast application covers large areas or the entire surface of listed items. **Spot** – Spot application is up to 10% of the surface of the treated item. **Crack and crevice** – Crack and crevice treatments are applications to junction points on items. **Tufts and/or seams (mattresses and upholstered furniture only)** – Tufts and/or seam treatment is to the junction of two or more pieces of fabric and any decorative trim (e.g., buttons). **Void** – Void treatment targets inaccessible empty spaces of items. For example, inside the dust cover on the underside of furniture or hollow table legs.”

The following statement is required on all commercial-class product labels where residential areas are mentioned on the label:

“Residential areas are defined as any use site where the general public, including children, could be exposed during or after application. For structural uses, in residential sites, this includes homes, schools, restaurants, public buildings or any other areas where the general public including children may potentially be exposed. Non-residential areas include, but are not limited to: industrial/commercial indoor sites (for example, laboratories, warehouses, food granaries); modes of transport in areas where passengers are not present (for example, buses, railcars, trailers); and animal housing (for example, livestock and poultry housing, and pet kennels).”

1.4 Domestic-class end-use products

It is the responsibility of the registrant to ensure that application rate restrictions can be met based on how the product is packaged and sold.

The following domestic-class labels are to be cancelled:

- Pressurized products used as total release foggers (including lock-valve mechanisms)
- Domestic-class metered-release devices

Pressurized Products with Indoor Space Spray Applications (not metered release):

Limit the maximum application rate of pyrethrins to 0.004 g a.i./m³. The active ingredient amount (in other words, 0.004 g a.i.) is to be converted into the corresponding amount of applied product by the registrant for each applicable product.

Precautions:

The following statements are required on all liquid domestic-class product labels:

“**DO NOT** apply using stationary or handheld fogging or misting equipment.”

“**DO NOT** apply as a space spray.”

Any instructions to apply as a space spray must be removed from the liquid domestic-class product labels.

The following statements are required for all domestic-class pressurized product labels with space spray applications:

“Ventilate treated indoor areas after application by opening windows and doors or using fans, where required, to aid in the circulation of air.”

“**DO NOT** apply when people or pets [or livestock] are present.”

“**DO NOT** remain in treated areas after application.”

“**DO NOT** allow people or pets [or livestock] to enter treated areas until sprays have settled.”

“Cover or remove all food/feed. Cover all food/feed processing surfaces, equipment and utensils or thoroughly wash following treatment.”

The following statements are required for all domestic-class labels with indoor and outdoor surface applications:

“**DO NOT** apply to overhead areas or in confined spaces (e.g., attics, crawlspaces, small storage rooms, closets).”

“Ventilate treated indoor areas after application by opening windows and doors or using fans, where required, to aid in the circulation of air.”

“**DO NOT** apply when people or pets [or livestock] are present.”

“**DO NOT** apply to surfaces that may come into contact with food/feed.”

“Cover or remove all food/feed. Cover all food/feed processing surfaces, equipment and utensils or thoroughly wash them following treatment.”

For liquid and pressurized products, add:

“**DO NOT** allow people or pets [or livestock] to enter treated areas until sprays have dried.”

For liquid and pressurized products applied indoors, add:

“**DO NOT** allow spray to drip or allow drift onto non-target surfaces.”

For dust products, add:

“**DO NOT** allow people or pets [or livestock] to enter treated areas until dusts have settled.”

For dust products applied indoors, add:

“DO NOT allow dust to deposit onto non-target surfaces.”

The following statements are required for domestic-class product labels approved for use on mattresses and furniture:

“DO NOT use on items which can be laundered (e.g., pillows, bedding, toys, clothing) unless otherwise specified.”

“Remove bedding before treating mattresses. Treated mattress must be dry before replacing laundered bedding.”

“Remove all objects before treatment of furniture, luggage, closets or other areas where clothing, toys, towels, and other items are stored. Treated furniture and treated surfaces must be dry before replacing stored items.”

When approved for tuft and/or seam application only, add:

“DO NOT apply to the entire mattress or piece of furniture. Apply to tufts [and/or] seams only.”

The following statement is required for labels of domestic-class products which are approved to control a pest (in other words, bed bugs, fleas) that can be found on mattresses and furniture but mattresses and furniture are not specifically stated on the label. Adjust statement as necessary (in other words, if furniture is stated on the label but not mattresses, remove furniture from this statement and vice versa).

“DO NOT apply to [furniture], [mattresses], linens, pet bedding, toys or clothing.”

The following statement is required for domestic-class product labels with void applications:

“Care should be taken to avoid the pesticide exiting the void. Any residue deposits on non-target surfaces must be removed by the applicator.”

The following statement is required for domestic-class product labels approved for use for treating clothing:

“Only apply to clothing which can be laundered. Treated clothing must be laundered prior to wearing.”

The following statement is required for all domestic-class coil product labels:

“DO NOT use indoors or in enclosed spaces.”

The following statement is required for labels of all domestic-class products for use in domestic greenhouses:

“DO NOT apply in commercial greenhouses.”

The following statements are required on all domestic-class product labels with structural uses (except Ready To Use (RTU) products):

“Space application is a suspension of fine droplets (0.1 to 100 µm) in the air within an indoor space.”

The following statements are required on labels of all domestic-class products, where the type of application is mentioned on the label:

“Outdoor broadcast application is to large outdoor structural surfaces (i.e., roofs, walls, doors, windows, porches, patios and foundations) and turf.

“Indoor broadcast application is to broad expanses of indoor structural surfaces such as walls, floors, ceilings and indoor foundation walls/crawlspaces. Indoor perimeter application is less than 0.1 m wide along the edges of a room to baseboards, wall-floor and ceiling-wall joints, and around doorways or windows. Spot application is localized to a surface area not more than 0.2 m². Spots are not to be adjoining. The combined area of spots is not to exceed 10% of the total surface area of a room. Crack and crevice is an application directly into narrow openings on the surface of the structure. It does not include the treatment of exposed surfaces. Narrow openings typically occur at expansion joints, utility entry points, and along baseboards and mouldings. Void application applies to inaccessible, enclosed empty spaces of a structure. For example, hollow walls and suspended ceilings.”

For all domestic-class product labels with furniture treatment, including but not limited to hard surface furniture, mattresses, box springs, pet bedding, bed frames, the following definitions must be added, where applicable:

“Broadcast – Broadcast application covers large areas or the entire surface of listed items. Spot – Spot application is up to 10% of the surface of the treated item. Crack and crevice – Crack and crevice treatments are applications to junction points on items. Tufts and/or seams (mattresses and upholstered furniture only) – Tufts and/or seam treatment is to the junction of two or more pieces of fabric and any decorative trim (e.g., buttons). Void – Void treatment targets inaccessible empty spaces of items. For example, inside the dust cover on the underside of furniture or hollow table legs.”

Toxicological information:

For domestic-class pyrethrins products used at residential sites in enclosed areas (for example, indoor space spray or indoor surface spray), including applications to furniture, the following label statements are required (in the Toxicological Information Section of the Label) to inform the consumer of the potential effects that can be expected following the use of pyrethrins products co-formulated with piperonyl butoxide or other active ingredients:

“Skin exposure may cause transient sensations (tingling, burning, itching, numbness).”

“Other symptoms of exposure could include respiratory effects (such as cough, respiratory irritation, or shortness of breath), nausea, headache or dizziness.”

Directions for use:

For all domestic-class products with crop uses, remove all references to crop uses other than the crops listed below if found on the label:

Greenhouse peppers, blueberry, grape, raspberry, low bush berries (bearberry, bilberry, lowbush blueberry, cloudberry, cranberry, lingonberry, muntries, partridgeberry, strawberry, cultivars, varieties and/or hybrids), herbs and spices (Crop Group 19), pear orchards, pinto, snap and wax beans, and field tomato.

All companion animal spray and shampoo products containing pyrethrins must reflect the statements outlined in DIR2002-01, *Canadian Label Improvements for Pesticides used on Companion Animals*. The statements required for specific products are outlined in the additional guidance for registrants.

In addition, the following label statements must be included for companion animal products, in other words, pyrethrins sprays or shampoos:

Add label statements to inform the consumer as to the possible side effects that may be expected in their pets following use of pyrethrins sprays and shampoos.¹⁶ For shampoo or spray products registered for use on both cats and dogs, the labels must contain statements, as listed below, for both animal types.

For products used on dogs:

“Monitor your dog after application. Side effects may include: skin irritation such as redness or scratching; changes in behaviour such as agitation or lethargy; or gastrointestinal effects such as vomiting or loss of appetite. If these or other side effects occur consult your veterinarian or [Registrant at 1-800-number].”

For products used on cats:

“Monitor your cat after application. Side effects may include: skin irritation such as scratching or hair loss at the application site, or changes in behaviour such as agitation or lethargy. Gastrointestinal effects such as drooling, vomiting, or loss of appetite may also occur. If these or other side effects occur consult your veterinarian or [Registrant at 1-800-number].”

¹⁶ The recommendations are similar to those outlined in the PMRA Guidance Document: Label Improvements for Spot-on Pesticides Used on Companion animals, 6 December 2019 (see Section 4.0)

Add label language to restrict the use of other companion animal products with the same active ingredient(s) as that in the spray/shampoo product¹⁷ (for example, “This product contains [name of active ingredient(s)]. Do not apply another pest control product such as a shampoo, spot-on, spray, collar, or powder that contains [name of active ingredient(s)] to the treated animal after applying [name of spray/shampoo product]”).

Label language that allows re-application of the product before the end of the effective control period¹⁷ must be removed.

Additionally, the general term “pet” or “animal”, as currently noted in the use directions, must be replaced by the type of companion animal, in other words, “cat”, “dog” or “cats and dogs”, on which the specific product is registered for use.

2.0 Label amendments relating to the environmental risk assessment

2.1 Label amendments for technical grade active ingredient and manufacturing concentrate products

Under the heading Environmental Precautions for all registered pyrethrins technical grade active ingredients:

“TOXIC to aquatic organisms.”

“DO NOT discharge effluent containing this product into sewer systems, lakes, streams, ponds, estuaries, oceans or other waters.”

2.2 Label amendments for commercial class products

Under **ENVIRONMENTAL PRECAUTIONS**, remove:

“Toxic to wildlife.”

For products containing petroleum distillates, Under **ENVIRONMENTAL PRECAUTIONS**, add:

“This product contains active ingredients and aromatic petroleum distillates which are toxic to aquatic organisms. “

2.2.1 Outdoor mosquito abatement

Under **DIRECTIONS FOR USE**, for liquid commercial-class products applied for mosquito abatement, add:

“**DO NOT** exceed an application rate of [3.02 g a.i./ha to be reported in product equivalent value] when applying as a fogging spray for mosquito abatement.”

¹⁷ These recommendations are similar to those outlined in Regulatory Proposal PRO2018-01 for spot-on products used on companion animals.

2.2.2 Non-structural uses – crops and ornamentals

Under **ENVIRONMENTAL PRECAUTIONS**, add:

“This product contains active ingredients and aromatic petroleum distillates which are toxic to aquatic organisms. Observe buffer zones specified under **DIRECTIONS FOR USE**.”

“To reduce runoff from treated areas into aquatic habitats avoid application to areas with a moderate to steep slope, compacted soil, or clay.”

“Avoid application of this product when heavy rain is forecast.”

“Contamination of aquatic areas as a result of runoff may be reduced by including a vegetative filter strip between the treated area and the edge of the water body.”

“**TOXIC to bees.** Bees may be exposed through direct spray, spray drift, and residues on leaves, pollen and nectar in flowering crops and weeds. Minimize spray drift to reduce harmful effects on bees in habitats close to the application site. Avoid applications when bees are foraging in the treatment area in ground cover containing blooming weeds. To further minimize exposure to pollinators, refer to the complete guidance “Protecting Pollinators during Pesticide Spraying – Best Management Practices” on the Health Canada website (www.healthcanada.gc.ca/pollinators). Follow crop specific directions for application timing.”

“To reduce runoff from treated areas into aquatic habitats avoid application to areas with a moderate to steep slope, compacted soil, or clay.”

“Avoid application when heavy rain is forecast.”

“Contamination of aquatic areas as a result of runoff may be reduced by including a vegetative strip between the treated area and the edge of the water body.”

For crops that are highly attractive to pollinators (tomatoes, roses, beans, blueberry, grape, raspberry, pears) or when using managed bees for pollination services, add the following statement in addition to the above statements for Environmental Precautions:

“Do not apply during the crop blooming period.”

For all other crops add the following statement in addition to the above statements for Environmental Precautions:

“Avoid application during the crop blooming period. If applications must be made during the crop blooming period, restrict applications to evening when most bees are not foraging.”

“Toxic to certain beneficial insects. Minimize spray drift to reduce harmful effects on beneficial insects in habitats next to the application site such as hedgerows and woodland. Pyrethrins may impact predatory and parasitic arthropod species used in IPM programs within the treatment area. Unsprayed refugia for beneficial species of at least 1 metre from treatment area will help maintain beneficial arthropod populations.”

Under **DIRECTIONS FOR USE**, add:

“Do not wet plants to the point of runoff or drip.”

“As this product is not registered for the control of pests in aquatic systems, **DO NOT** use to control aquatic pests.”

“**DO NOT** contaminate irrigation or drinking water supplies or aquatic habitats by cleaning of equipment or disposal of wastes.”

For all products applied using groundboom or airblast equipment:

Field sprayer application: **DO NOT** apply during periods of dead calm. Avoid application of this product when winds are gusty. **DO NOT** apply with spray droplets smaller than the American Society of Agricultural Engineers (ASAE S572.1) fine classification. Boom height must be 60 cm or less above the crop or ground.

DO NOT apply by air.

Buffer zones:

Spot treatments using hand-held equipment **DO NOT** require a buffer zone.

The buffer zones specified in the table below are required between the point of direct application and the closest downwind edge of sensitive freshwater habitats (such as lakes, rivers, sloughs, ponds, prairie potholes, creeks, marshes, streams, reservoirs and wetlands) and estuarine/marine habitats.

Method of application	Crop	Buffer zones (metres) required for the protection of:			
		Freshwater habitat of depths:		Estuarine/Marine habitats of depths:	
		Less than 1 m	Greater than 1 m	Less than 1 m	Greater than 1 m
Chemigation	Cranberry	15	2	4	2

Method of application	Crop	Buffer zones (metres) required for the protection of:				
		Freshwater habitat of depths:		Estuarine/Marine habitats of depths:		
		Less than 1 m	Greater than 1 m	Less than 1 m	Greater than 1 m	
Groundboom sprayer	Low Growing Berry Group (bearberry, bilberry, lowbush blueberry, cloudberry, cranberry, lingonberry, Muntries, partridgeberry, strawberry)	40	5	15	5	
	Pinto bean, snap bean, wax bean, tomato, rose, Herbs and Spices (Crop Group 19)	25	4	15	5	
Airblast sprayer	Pear, highbush blueberry, grape, raspberry	Early airblast	45	15	35	25
		Late airblast	35	10	25	15

For tank mixes, consult the labels of the tank-mix partners and observe the largest (most restrictive) buffer zone of the products involved in the tank mixture and apply using the coarsest spray (ASAE) category indicated on the labels for those tank mix partners.

The buffer zones for this product can be modified based on weather conditions and spray equipment configuration by accessing the Buffer Zone Calculator on the Health Canada web site.

Label amendments for all greenhouse uses:

Add the following statement for all greenhouse uses:

“Greenhouse use: Toxic to bees and other beneficial insects. May harm bees and other beneficial insects, including those used in greenhouse production. Do not apply when bees or other beneficial insects are foraging in the treatment area.”

“Do not wet plants to the point of runoff or drip.”

2.2.3 Products formulated as Soluble Granules

Under **ENVIRONMENTAL PRECAUTIONS**, add:

“Toxic to aquatic organisms”

“To reduce runoff from treated areas into aquatic habitats avoid application to areas with a moderate to steep slope, compacted soil, or clay.”

“Avoid application when heavy rain is forecast.”

“Contamination of aquatic areas as a result of runoff may be reduced by including a vegetative filter strip between the treated area and the edge of the water body.”

Under **DIRECTIONS FOR USE**, add:

“As this product is not registered for the control of pests in aquatic systems, DO NOT use to control aquatic pests.”

“DO NOT contaminate irrigation or drinking water supplies or aquatic habitats by cleaning of equipment or disposal of wastes.”

2.2.4 Products formulated as emulsifiable concentrates

Under **DIRECTIONS FOR USE**, remove:

“This concentrate is relatively non-toxic to honey bees. To avoid possible harm to honey bees, it is advisable to apply in the early morning or late evening hours”

Under **ENVIRONMENTAL PRECAUTIONS**, add,

“Toxic to aquatic organisms.”

For products used on yellow jackets, hornets and wasps:

“Toxic to bees. This product is intended for use on yellow jackets, hornets and wasps only.”

“**Toxic to bees.** Avoid application around blooming plants. If applications must be made during the blooming period, restrict applications to evening when most bees are not foraging.”

“Toxic to beneficial arthropods (which may include predatory and parasitic insects, spiders, and mites). Minimize exposure to non-target areas.”

Under **DIRECTIONS FOR USE**, add:

“As this product is not registered for the control of pests in aquatic systems, DO NOT use to control aquatic pests.”

“DO NOT contaminate irrigation or drinking water supplies or aquatic habitats by cleaning of equipment or disposal of wastes.”

2.3 Label amendments for domestic class products

Under **ENVIRONMENTAL PRECAUTIONS**, add:

“Toxic to aquatic organisms”

“Toxic to bees. Avoid application around blooming plants. If applications must be made during the blooming period, restrict applications to evening when most bees are not foraging”

“Toxic to beneficial arthropods (which may include predatory and parasitic insects, spiders, and mites). Minimize exposure to non-target areas.”

Under **DIRECTIONS FOR USE**, add:

“DO NOT apply to any body of water.”

“DO NOT contaminate irrigation or drinking water supplies or aquatic habitats by cleaning of equipment or disposal of wastes.”

“Avoid application of this product when winds are gusty.”

“Do not wet plants to the point of runoff or drip.”

3.0 Label amendments relating to the value assessment

Any reference to the use to control lice on mattresses, bedding, furniture, and garments are to be removed from domestic-class product labels.

Appendix V Revised dietary exposure and risk assessment estimates for pyrethrins

Table 1 Results of acute and chronic dietary risk analysis for pyrethrins without canadian grain uses

Population subgroup	Acute dietary ¹ (Food and drinking water) 95 th percentile of exposure		Chronic dietary ² (Food and drinking water)	
	Dietary exposure (mg/kg bw)	%ARfD	Dietary exposure (mg/kg bw/day)	%ADI
General Population (total)	0.010626	15	0.002647	26
All Infants (< 1 year old)	0.023537	34	0.006579	66
Children 1–2 years old	0.023111	33	0.007072	70
Children 3–5 years old	0.017536	25	0.005811	58
Children 6–12 years old	0.012252	18	0.003801	38
Youth 13–19 years old	0.008596	12	0.002488	25
Adults 20–49 years old	0.007155	10	0.002317	23
Adults 50+ years old	0.005239	7	0.001778	18
Female 13–49 years old	0.006690	10	0.002077	21

¹Acute Reference Dose (ARfD) of 0.07 mg/kg bw for all population subgroups

²Acceptable Daily Intake (ADI) of 0.01 mg/kg bw/day for all population subgroups

Appendix VI Revised occupational and non-occupational exposure and risk assessments for pyrethrins

Details for the revised risk assessment are included in this appendix. Please refer to PRVD2020-08 for additional information.

Use pattern

As outlined in PRVD2020-08, additional data were required under Section 19 of the *Pest Control Products Act* to confirm that application rates and use directions on product labels are consistent with the rates used in the health risk assessments. As a result of the information received from registrants in response to this data call-in, the occupational and non-occupational risk assessment of pyrethrins was revised to reflect the clarifications to the currently registered use pattern, such as application rates, application equipment, crops, formulations, container sizes, concentration of pyrethrins, and application intervals. The revised use pattern formed the basis of the revised occupational and residential risk assessment for pyrethrins and reflects the information available.

Dislodgeable foliar residue (DFR)

In PRVD2020-08, a standard peak value of 25% of the application rate with a daily dissipation rate of 0% was used for greenhouse pepper crops. The occupational postapplication risk assessment for greenhouse pepper crops was updated with a daily dissipation rate of 2%.

Outdoor air concentrations

The postapplication inhalation risk assessment for outdoor space spray applications in residential areas using pressurized products was refined using air concentration data from a study submitted through a clarification with the registrant (Boatwright, 2009). The product used in this study did not contain pyrethrins, but was considered to be representative of registered pyrethrins pressurized products based on the fact that the resulting air concentrations were primarily due to behaviour of the aerosols following application of a pressurized product in an outdoor environment, rather than to chemical-specific properties. To estimate pyrethrins air concentrations, study air concentrations were normalized by the concentration of active ingredient in the study product and extrapolated to pyrethrins concentrations in registered products. This approach is conservative (that is, an upper bound estimate of exposure) as it assumed the largest registered pyrethrins aerosol product was applied to the treated area.

Indoor air concentrations

The indoor air concentration studies considered for the postapplication inhalation risk assessment for pressurized space spray products were revisited based on comments received during the PRVD consultation period. For the assessment summarized in PRVD2020-08, both the Selim (2002) and Acedo (2016) studies were considered in the assessment. For the updated assessment, the Selim (2002) study was not used as the ventilation system was turned off in the study for the duration of the sampling, which is not typical practice in commercial and residential buildings. The Acedo (2016) study was considered to be more representative, as the ventilation system was turned off for 15 minutes after application and then re-started. These conditions are

representative of typical uses in commercial sites and are conservative for residential sites, where ventilation is unlikely to be turned off. Air concentrations in the study were normalized by the study application rate and extrapolated to the registered Canadian application rates. The data from these studies were not considered appropriate to characterize air concentrations for liquid formulations or total release fogger pressurized products, as the application rates and droplet sizes are different.

Occupational exposure and risk assessment

The occupational mixer, loader, applicator, and postapplication assessments were revised to incorporate the use pattern information submitted to Health Canada. Results are summarized in Tables 2–6.

In the updated assessment, risks were determined to be acceptable for all of the occupational scenarios except for:

- Liquid application using a handheld airblast/mistblower (HH AB/MB) / mechanically pressurized handheld sprayer for mists, aerosols, and fogs (MPHS) (agricultural crops, livestock, indoor sites, and mosquito abatement)
- Mixing, loading and application liquid formulation using a mechanically pressurized handgun (MPHG) (agricultural crops, outdoor sites)
- Mixing, loading, and application liquid formulations using a truck mounted sprayer (mosquito abatement)
- Mixing, loading, and application liquid formulations using PCO MPHW (indoor sites)
- Mixing, loading, and application dust formulations using all dust application equipment (indoor and outdoor sites).

A restricted-entry interval (REI) of 12 hours for all agricultural crops, including sod farms and ornamentals (including ornamental shrubs and trees) grown for production, is maintained in the revised assessment. Re-entry to golf courses, treated areas following mosquito abatement, and following application to livestock is required to be delayed “until sprays have dried”. Re-entry following dust application to indoor and outdoor areas is required to be delayed “until dusts have settled”. Consistent with PRVD2020-08, the revised occupational non-agricultural/structural postapplication exposure assessment is addressed by the non-occupational postapplication exposure and risk assessment. For example, risk to postapplication workers in these scenarios would be similar to or less than residential postapplication risks, since time spent in residential areas is assumed to be longer than time spent working.

See Table 1 for a summary of mitigation required as a result of the revised occupational risk assessment. The mitigation required for mixers, loaders, and applicators and postapplication workers is comparable to that proposed in PRVD2020-08, except for the application rate limit for indoor broadcast surface sprays and outdoor space sprays (mosquito abatement) using liquid commercial-class products. Application rates were limited for these uses as handler and residential postapplication risks were not shown to be acceptable using these rates. Therefore, products for which only one rate was available, and which is the highest rate for each use, will be cancelled.

Non-occupational handler exposure and risk assessment

The non-occupational mixer/loader/applicator assessments were revised to incorporate the use pattern information submitted to Health Canada. Standard default assumptions from the USEPA Residential SOPs (2012) were used to assess exposure. The results of the updated non-occupational handler assessment is summarized in Table 7. See Table 1 for a summary of mitigation required as a result of the updated risk assessment.

Risks were shown to be acceptable for all assessed application equipment. The clarified use information for pyrethrins indicated that liquid domestic-class products could be applied as an indoor space spray. Trigger-spray bottles were included in the indoor environments assessment with an area treated per day value of 369 m³ based on the average volume of a residential home (USEPA, Exposure Factors Handbook, 2011). No data were available to assess residential handler risks for using handheld or stationary fogging (space spray) equipment. As postapplication risks for liquid product space sprays were not shown to be acceptable, as discussed below, all space spray uses of liquid domestic-class products will be cancelled. A label statement will also be added to domestic-class liquid products to prohibit the use of fogging and misting application equipment.

Non-occupational postapplication exposure and risk assessment

The non-occupational postapplication assessments were updated to reflect the clarified use pattern and to incorporate the air concentration data for indoor and outdoor space sprays using pressurized products. Standard default assumptions from the USEPA Residential SOPs (2012) were used to assess exposure, unless otherwise indicated. The results of the updated residential postapplication assessments are summarised in Tables 8–18.

For all products, further label revisions as per the PMRA Guidance Document, *Structural Pest Control Products: Label Updates* are required. These include ventilation and other best practice statements aimed at reducing postapplication exposure.

All non-occupational postapplication dermal and inhalation risks were found to be acceptable except for the following:

- Commercial mosquito abatement (outdoor fogging) application in non-occupational areas
- Commercial indoor liquid surface spray application in non-occupational areas
- Commercial indoor space spray application using a pressurized product in non-occupational areas
- Domestic indoor space spray application using a pressurized product
- Commercial indoor liquid space spray (fogging) and total release fogger application in non-occupational areas
- Domestic indoor liquid space spray application
- Domestic total release fogger application
- Automatic metered release device use

The postapplication inhalation assessment for outdoor space spray using pressurized products was refined using data from Boatwright (2009).

For mosquito abatement uses, risks were shown to be acceptable provided that the rate for commercial-class liquid products is limited. For nest applications, postapplication risks was assessed qualitatively and considered to be addressed by the other outdoor uses.

For surface sprays in indoor environments, risks were shown to be acceptable for non-occupational areas, provided that the rate for commercial-class liquid products is limited.

For clothing application, postapplication risks were assessed qualitatively and considered to be addressed by surface spray applications, as registered rates are lower than the assessed surface spray application rates and treated clothing is laundered prior to wearing. Label statements are required for treated clothing, such as laundering prior to wearing.

For space sprays in indoor environments (except metered-release), inhalation risks were not shown to be acceptable for pressurized products following application of products at the maximum registered rates. The postapplication inhalation assessments for commercial and domestic indoor space spray using pressurized products were refined using chemical-specific data from Acedo (2016). Using data from this study, postapplication risks following commercial indoor space spray application using pressurized products were found to be acceptable with a 15 minute re-entry interval for all indoor areas (occupational and non-occupational). Health Canada does not establish risk-based re-entry intervals for domestic-class products; therefore, postapplication risks following domestic indoor space spray using pressurized product applications were mitigated by limiting application rate.

Postapplication inhalation risks were identified following a liquid commercial indoor fogging application and commercial-class total release fogger application. To mitigate risk, a 2-hour re-entry interval will be required on all commercial-class product labels with fogging uses. Health Canada does not establish risk-based re-entry interval for domestic-class products, and as risks of concern were identified following liquid domestic-class products applied as a space spray as well as total release fogger application, these uses will be prohibited.

Postapplication inhalation risks were identified when metered release devices were used in indoor areas (excluding barns). The risk assessment was refined using chemical-specific data from Selim (2008). Using data from this study, inhalation risks were found to be acceptable. As the peak concentration from the study was determined from average values measured over many applications and days, it could not be extrapolated to the rates of registered metered release products (both commercial and domestic-class). Therefore, the application rate for all metered release sprays in indoor areas (excluding barns) will be limited to the application rate from the study (maximum of 0.0358 mg a.i./minute).

All incidental oral risks (hand-to-mouth, object-to-mouth, soil ingestion, granule ingestion) were found to be acceptable with the required mitigation measures.

See Table 1 for a summary of mitigation required as a result of the revised risk assessments.

Table 1 Summary of mitigation requirements based on the revised risk assessment

Scenario	Required mitigation
Commercial liquid M/L/A using MPHG (agricultural crops, outdoor sites)	Respirator
Commercial dust M/L/A using all dust application equipment (indoor and outdoor sites)	Filtering facepiece respirator (dust mask)
Commercial liquid application using a HH AB/MB / MPHS (agricultural crops, livestock, indoor sites, mosquito abatement)	CR coveralls over long pants and long-sleeved shirt, CR gloves, socks, CR footwear and a respirator. Restrict the amount handled per day to 0.05 kg a.i. per day.
Commercial liquid M/L/A surface spray using PCO MPHW (indoor sites)	Do not exceed an application rate of 0.276 g a.i./m ² when applying as an indoor surface spray.
Commercial liquid application using truck mounted sprayer (mosquito abatement)	Do not exceed an application rate of 3.02 g a.i./ha when applying using a truck mounted fogger for mosquito abatement.
Occupational postapplication	REI of 12 hours for all agricultural crops, outdoor ornamentals (including ornamental shrubs and trees) grown for production, and sod farms. “Until sprays have dried” for golf courses, scouting outdoor areas following mosquito abatement application, and application to livestock. “Until dusts have settled” for indoor and outdoor areas.
Workers entering treated indoor areas prior to venting (or 2 hour re-entry interval) following application of a fogger (including total release foggers)	CR coveralls over long pants and long-sleeved shirt, CR gloves, socks, CR footwear and a respirator.
Mosquito abatement application	Do not exceed an application rate of 3.02 g a.i./ha in residential areas.
Residential handler application using handheld fogger and stationary fogger	Use prohibited
Commercial indoor space spray using pressurized product	Re-entry interval of 15 minutes
Domestic indoor space spray using pressurized product	Do not exceed an application rate of 0.004 g a.i./m ³ .
Commercial indoor liquid fogging spray, commercial total release fogger application	Re-entry interval of 2 hours
Domestic indoor liquid space spray	Use prohibited
Domestic-class total release fogger	Products that are only used as a total release fogger are to be cancelled. For products where there are uses other than total release fogger, the total release fogger (lock valve mechanism) use is prohibited.
Commercial-class metered release device use in indoor areas (excluding barns)	Do not exceed an application rate of 0.0358 mg a.i./minute.

M/L/A = mixer/loader/applicator; CR = chemical-resistant; HH AB/MB = handheld airblast/mistblower; MPHS = mechanically pressurized handheld sprayer for mists, aerosols, and fogs; REI = restricted entry interval

Table 2 Short- to long-term exposure and risk estimates for occupational handlers for agricultural uses

Crop	Application equipment	Formulation	Maximum application rate	ATPD/AHPD	Dermal exposure ^a (µg/kg bw/day)	Inhalation exposure ^a (µg/kg bw/day)	Dermal MOE ^b	Inhalation MOE ^c
PPE (M/L/A): Single layer (long pants, long-sleeved shirt, CR gloves)								
GH Peppers	Automated Boom Sprayer ^d	Liquid	59.5 g a.i./ha	3.6 ha/day	0.157	0.002	6 300 000	1 500 000
Low-Bush Berry Crops (not including cranberries), Herbs and Spices, Field Tomato, Beans (Pinto, Snap, Wax), Roses, Ornamental Shrubs/Landscape Trees, Outdoor Ornamentals	Groundboom (custom) ^e	Liquid	73.2 g a.i./ha	360 ha/day	27.637	0.761	36 000	3400
High Bush Berry Crops, Grapes, Pear Orchard, Ornamental Shrubs/Landscape Trees, Roses, Outdoor Ornamentals	Airblast	Liquid	73.2 g a.i./ha	20 ha/day	70.049	0.178	14 000	15 000
Pastures and Feedlots (Mosquito Abatement) ^f	Truck Mounted Sprayer (fogger) ^g	Liquid	3.02 g a.i./ha ^h	1200 ha/day	173.399	0.440	5800	5900
Berry Crops (not including cranberries), Grapes, GH Peppers, Herbs and Spices, Field Tomato, Bean (Pinto, Snap, Wax), Roses, Ornamental Shrubs/Landscape Trees, Outdoor Ornamentals	Backpack	Liquid	0.6 g a.i./L ⁱ	150 L/day	6.127	0.070	160 000	37 000
	MPHW				1.061	0.051	940 000	51 000
	MPHG				159.186	4.304	6300	600
Cranberries	Chemigation	Liquid	60 g a.i./ha	140 ha/day	6.143	0.066	160 000	39 000
Livestock ^j	Backpack	Liquid	0.0472 g a.i./animal	6440 animals/day	20.692	0.236	48 000	11 000
	MPHW				3.584	0.172	280 000	15 000
	MPHG				21.223	0.574	47 000	4500
	Backpack + Brush ^k			120 animals/day	4.096	0.057	240 000	46 000
	MPHW + Brush ^k			3.777	0.056	260 000	47 000	

Crop	Application equipment	Formulation	Maximum application rate	ATPD/AHPD	Dermal exposure ^a (µg/kg bw/day)	Inhalation exposure ^a (µg/kg bw/day)	Dermal MOE ^b	Inhalation MOE ^c
	MPHG + Brush ^k				4.106	0.063	240 000	41 000
Livestock ^l	Aerosol Can	Pressurized Product	0.22 g a.i./animal	120 animals/day	48.374	0.543	21 000	4800
	Aerosol Can + Cloth ^m				65.668	0.788	15 000	3300
Poultry	Aerosol Can	Pressurized Product	0.015 g a.i./m ³ _n	2540 m ³ /day	69.813	0.784	14 000	3300
PPE: (M/L) Single layer (long pants, long-sleeved shirt, CR gloves)								
(A) CR coveralls with a CR hood over long-sleeved shirt, long pants, CR gloves, socks, CR footwear and a respirator^o								
Pastures and Feedlots	HH AB/MB ^p	Liquid	0.0302 g a.i./L ^{h, q}	150 L/day	1.847	0.223	540 000	12 000
Berry Crops, Grape, GH Peppers, Pear Orchard, Roses, Ornamental Shrubs/Landscape Trees, Outdoor Ornamentals			0.6 g a.i./L ⁱ		36.697	4.433	27 000	590
Livestock ^j			HH AB/MB ^p + Brush ^{k, r}	0.0472 g a.i./animal	6440 animals/day	123.941	14.973	8100
		120 animals/day		6.020	0.332	170 000	7800	

M/L/A = mixer/loader/applicator; MOE = margin of exposure; MPHWH = manually pressurized handwand; MPHG = mechanically pressurized handgun; CR = chemical resistant; HH AB/MB = handheld airblast/mistblower; ATPD = area treated per day; AHPD = amount handled per day; PPE = personal protective equipment; SG = soluble granule; GH = greenhouse; a.i. = active ingredient; NOAEL = No Observed Adverse Effect Level; LOAEL = Lowest Observed Adverse Effect Level

Bolded cells indicate that the target MOE was not met and further mitigation is required (see Table 3).

^a Where dermal/inhalation exposure (µg/kg bw/day) = (unit exposure × ATPD/AHPD × application rate)/80 kg. A dermal absorption value was not required in the equation for dermal exposure as the NOAEL is based on a dermal study.

^b MOE = NOAEL/Exposure. Dermal MOEs for short- to long-term exposure durations were based on a NOAEL of 1000 mg/kg bw/day from a 21-day rabbit dermal toxicity study and a target MOE of 300.

^c MOE = LOAEL/Exposure. Inhalation MOEs for intermediate- to long-term exposure durations were based on a LOAEL of 2.6 mg/kg bw/day from a 13-week rat inhalation toxicity study and a target MOE of 1000. Since the same point of departure and a lower target MOE (300) were established for short-term inhalation scenarios, the longer-term inhalation assessments address the short-term inhalation exposure scenarios.

^d Assessed using open M/L scenario.

^e Custom groundboom assessed even though not all crops would have custom application.

^f Pastures and feedlots were assessed separately because there were risk concerns for mosquito abatement at the higher application rate for Outdoor Areas (see Table 4). This application rate also includes overgrown wasteland areas, recreational areas, residential areas, roadsides, shrubbery and vegetation around stagnant pools, marshy areas, ponds and shorelines.

^g Airblast application equipment exposure was used as surrogate for truck-mounted sprayer (fogger).

^h Maximum registered application rate for pastures and feedlots.

ⁱ Calculated using maximum application rate of 60 g a.i./ha with a spray volume of 100 L/ha.

^j Includes beef/dairy cattle, horses, mules, hogs/swine.

^k Assessed using unit exposures for handheld equipment + paintbrush.

^l Includes beef/dairy cattle, horses, hogs/swine, sheep, goats.

^m Assessed using unit exposures for aerosol + paintbrush.

ⁿ Rate is expressed in m³ and not per animal since the product is applied as mist over the birds.

^o NIOSH-approved organic-vapour-removing cartridge with a prefilter approved for pesticides OR a NIOSH-approved canister approved for pesticides.

^p Unit exposures based on Thouvenin (2015) and Testman (2015).

^q Calculated using a maximum application rate of 3.02 g a.i./ha with a spray volume of 100 L/ha.

^r PPE was baseline + CR gloves for the brushing portion of application.

Table 3 Short- to long-term exposure and risk estimates for occupational handlers for agricultural uses with required mitigation

Crop	Application equipment	Formulation	Maximum application rate (Amount handled per day)	Dermal exposure ^a (µg/kg bw/day)	Inhalation exposure ^a (µg/kg bw/day)	Dermal MOE ^b	Inhalation MOE ^c
PPE (M/L/A): Single layer (long pants, long-sleeved shirt, CR gloves) + Respirator^d							
Berry Crops (not including cranberries), Grapes, GH Peppers, Herbs and Spices, Field Tomato, Bean (Pinto, Snap, Wax), Roses, Ornamental Shrubs/Landscape Trees, Outdoor Ornamentals	MPHG	Liquid	0.6 g a.i./L ^e	159.186	0.430	6300	6000
PPE: (M/L) Baseline – long pants, long-sleeved shirt, CR gloves (A) CR coveralls with a CR hood over long-sleeved shirt, long pants, CR gloves, socks, CR footwear and a respirator^d							
Berry Crops, Grape, GH Peppers, Pear Orchard, Roses, Ornamental Shrubs/Landscape Trees, Outdoor Ornamentals, Livestock ^f	HH AB/MB ^g	Liquid	(0.05 kg a.i./day) ^h	0.0215	0.0026	46000	1000

MLA = mixer, loader, applicator; MOE = margin of exposure; MPHG = mechanically pressurized handgun; CR = chemical resistant; HH AB/MB = handheld airblast/mistblower; ATPD = area treated per day; PPE = personal protective equipment; GH = greenhouse; a.i. = active ingredient; NOAEL = No Observed Adverse Effect Level; LOAEL = Lowest Observed Adverse Effect Level

^a Where dermal/inhalation exposure (µg/kg bw/day) = (unit exposure × ATPD × application rate)/80 kg. A dermal absorption value was not required in the equation for dermal exposure as the NOAEL is based on a dermal study.

^b MOE = NOAEL/Exposure. Dermal MOEs for short- to long-term exposure durations are based on a NOAEL of 1000 mg/kg bw/day from a 21-day rabbit dermal toxicity study and a target MOE of 300.

^c MOE = LOAEL/Exposure. Inhalation MOEs for intermediate- to long-term exposure durations are based on a LOAEL of 2.6 mg/kg bw/day from a 13-week rat inhalation toxicity study and a target MOE of 1000. Since the same point of departure and a lower target MOE (300) were established for short-term inhalation scenarios, the longer-term inhalation assessments address the short-term inhalation exposure scenarios.

^d NIOSH-approved organic-vapour-removing cartridge with a prefilter approved for pesticides OR a NIOSH-approved canister approved for pesticides.

^e Calculated using maximum application rate of 60 g a.i./ha with a spray volume of 100 L/ha.

^f Includes beef/dairy cattle, horses, mules, hogs/swine.

^g Unit exposures based on Thouvenin (2015) and Testman (2015).

^h Limit amount handled per day to 0.05 kg a.i./day as mitigation.

Table 4 Short- to long-term exposure and risk estimates for commercial application to non-agricultural/Structural areas (Commercial and residential sites)

Formulation	Site(s)	Application method	Application equipment	Max application rate	ATPD/AHPD	Dermal exposure (mg/kg bw/day) ^a	Inhalation exposure (mg/kg bw/day) ^a	Dermal MOE ^b	Inhalation MOE ^c
PPE (M/L/A): Single Layer (long pants, long-sleeved shirt) + CR gloves									
PP	Agricultural Premises and Equipment (Indoor), Animal Housing, General Indoor/Outdoor Sites, Outdoor Ornamentals, Dwellings/Indoor Sites, Residential Outdoor Sites/Ornamentals, Pet Premises	Space and Void Spray; Broadcast, Spot, CC, Perimeter, Clothing Spray; Total Release Fogger	Aerosol (RTU)	0.006 kg a.i./can ^d	14 cans/day	0.1539	0.0017	6500	1500
	Agricultural Premises (Indoor), General Indoor Sites, Pet Premises	Metered Release (Indoor) ^e	Automatic Dispenser	-	-	-	-	-	-
SN, EC	Agricultural Premises and Equipment (Indoor); Animal Housing; General Indoor Sites; Dwellings/Indoor	Space Spray (Fogger)	Stationary Fogger	0.0000387 kg a.i./m ³	28 317 m ³	0.0008	8.63E-06	1200 000	300 000

Formulation	Site(s)	Application method	Application equipment	Max application rate	ATPD/AHPD	Dermal exposure (mg/kg bw/day) ^a	Inhalation exposure (mg/kg bw/day) ^a	Dermal MOE ^b	Inhalation MOE ^c
	Sites								
	Agricultural Premises and Equipment (Indoor); General Indoor Sites; Dwellings/Indoor Sites; Pet Premises	Broadcast, Perimeter, CC, Spot, Nest Spray	PCO MPH ^{wf}	0.00402 kg a.i./m ²	1040 m ²	4.4862	0.0172	220	150
			Trigger-Spray Bottle ^g	0.000276 kg a.i./m ²		0.3781	0.0003	2600	9200
	Agricultural Premises and Equipment (Outdoor); General Outdoor Sites; Outdoor Ornamentals; Residential Outdoor Sites	Broadcast, Perimeter, CC, Spot, Nest Spray	MPHW	0.0000457 kg a.i./m ²	8100 m ²	0.0044	0.0002	230 000	12 000
			Backpack			0.0252	0.0003	40 000	9000
			MPHG		40500 m ²	0.1292	0.0035	7700	744
			Hose-end Sprayer		20000 m ²	0.3657	5.87E-5	2700	44 000
	Mosquito Abatement	Fogger	Truck mounted Sprayer	0.176 kg a.i./ha	1200 ha	10.1054	0.0256	100	100
DU	General Indoor/Outdoor Sites; Dwellings/Indoor Sites; Residential Outdoor Sites	Broadcast, Perimeter, CC, Spot, Void, Furniture, Nest Application	Bulbous/Plunger Duster ^g	0.00006 kg a.i./m ²	111 m ²	0.0130	0.0002	77 000	12 000
			Shaker Can, Hand-Crank Duster, Electric/Power Duster			0.0202	0.0032	50 000	810
SG	General Outdoor Sites; Outdoor Ornamentals; Residential Outdoor Sites (Incl. Ornamentals, Lawns, Groundcovers, Sod Farm, Golf Course)	Broadcast, Perimeter, Nest Application	Push Rotary Spreader	0.263 kg a.i./ha	2 ha	0.0031	0.0001	320 000	24 000
			Solid Broadcast Spreader		30 ha	0.0029	0.0004	350 000	6900
			Belly Grinder		0.4 ha	0.0335	0.0002	30 000	16 000
			Liquid Drench ^h	150 L	0.0000875 kg a.i./L	0.0009	1.38E-05	1 100 000	190 000
PPE (M/L): Single Layer (long pants, long-sleeved shirt) + CR gloves; (A): CR coveralls, CR hood, CR gloves, CR footwear, socks + Respiratorⁱ									
SN, EC	Agricultural Premises and Equipment (Indoor); Animal	Space Spray (Fogger)	MPHS ^j	0.0000387 kg a.i./m ³	2540 m ³	0.0401	0.0048	25 000	540

Formulation	Site(s)	Application method	Application equipment	Max application rate	ATPD/AHPD	Dermal exposure (mg/kg bw/day) ^a	Inhalation exposure (mg/kg bw/day) ^a	Dermal MOE ^b	Inhalation MOE ^c
	Housing; General Indoor Sites; Dwellings/Indoor Sites								
	Agricultural Premises and Equipment (Indoor)	Broadcast Spray		0.00402 kg a.i./m ²		1.7047	0.2059	590	10
	General Indoor Sites; Dwellings/Indoor Sites; Pet Premises	Broadcast, CC, Perimeter, Spot, Nest Spray (Surface Spray) (Fogger/ULV/Mister)		0.0001336 kg a.i./m ²	1040 m ²	0.0567	0.0068	18 000	380
	Mosquito Abatement	Handheld Fogger		0.176 kg a.i./ha	0.81 ha	0.0581	0.0070	17 000	370

PPE = personal protective equipment; MOE = margin of exposure; RTU = ready-to-use; PP = pressurized product; CC = crack and crevice; CR = chemical resistant; PCO = pest control operator; MPHWP = manually pressurized handwand; MPHGP = mechanically pressurized handgun; MPHSP = mechanically pressurized handheld sprayer for mists, aerosols, and fogs; Max = maximum; SN = solution; EC = emulsifiable concentrate; DU = dust; SG = soluble granule; AHPD = amount handled per day; ATPD = area treated per day; ULV = ultra low volume; a.i. = active ingredient; M/L/A = mixer/loader/applicator; NOAEL = No Observed Adverse Effect Level; LOAEL = Lowest Observed Adverse Effect Level

Respirator = NIOSH-approved organic-vapour-removing cartridge with a prefilter approved for pesticides OR a NIOSH-approved canister approved for pesticides.

Bolded cells indicate that target MOE was not met and mitigation measures are required (see Table 5).

^a Where dermal/inhalation exposure (mg/kg bw/day) = (unit exposure × area treated per day × application rate)/80 kg. A dermal absorption value was not required in the equation for dermal exposure as the NOAEL is based on a dermal study.

^b MOE = NOAEL/Exposure. Dermal MOEs for short- to long-term exposure durations are based on a NOAEL of 1000 mg/kg bw/day from a 21-day rabbit dermal toxicity study and a target MOE of 300.

^c MOE = LOAEL/Exposure. Inhalation MOEs for intermediate- to long-term exposure durations are based on a LOAEL of 2.6 mg/kg bw/day from a 13-week rat inhalation toxicity study and a target MOE of 1000. Since the same point of departure and a lower target MOE (300) were established for short-term inhalation scenarios, the longer-term inhalation assessments address the short-term inhalation exposure scenarios.

^d Based on maximum can size of 600 g and maximum pyrethrins guarantee of 1%.

^e Minimal applicator exposure expected.

^f Unit exposures based on Krotski (2014).

^g PPE for trigger-spray bottle and bulbous/plunger duster do not include CR gloves.

^h End use product is a SG but it is added to water, mixed, and applied as a liquid. Exposure assessed using backpack application equipment.

ⁱ NIOSH-approved organic-vapour-removing cartridge with a prefilter approved for pesticides OR a NIOSH-approved canister approved for pesticides.

^j Unit exposures based on Thouvenin (2015) and Testman (2015).

Table 5 Short- to long-term exposure and risk estimates for commercial application to non-agricultural/Structural areas (Commercial and residential sites) uses with required mitigation

Formulation	Site(s)	Application method	Application equipment	Application rate (Amount handled per day)	Dermal exposure (mg/kg bw/day) ^a	Inhalation exposure (mg/kg bw/day) ^a	Dermal MOE ^b	Inhalation MOE ^c
PPE (M/L/A): Single layer (long pants, long-sleeved shirt) + CR gloves								
SN, EC	Agricultural Premises and Equipment (Indoor); General Indoor Sites; Dwellings/Indoor Sites; Pet Premises	Broadcast, Perimeter, CC, Spot, Nest Spray	PCO MPHWD ^d	0.000276 kg a.i./m ^{2e}	0.3080	0.0012	3200	2200
SN, EC	Mosquito Abatement	Fogger	Truck-mounted Sprayer	0.00302 kg a.i./ha ^e	0.1734	0.0004	5800	5900
PPE (M/L/A): Single Layer (long pants, long-sleeved shirt) + CR gloves + Respirator^h								
SN, EC	Agricultural Premises and Equipment (Outdoor); General Outdoor Sites; Outdoor Ornamentals; Domestic Outdoor Sites	Broadcast, Perimeter, CC, Spot	MPHG	0.0000457 kg a.i./m ²	0.1292	0.0003	7700	7400
PPE (A): CR coveralls, CR hood, CR gloves, CR footwear, socks + Respirator + Restriction on Amount Handled per Day								
SN, EC	Agricultural Premises and Equipment (Indoor); Animal Housing; General Indoor Sites; Dwellings/Indoor Sites; Pet Premises; Mosquito Abatement	Space Spray, Broadcast, CC, Perimeter, Spot, Nest Spray (Surface Spray)	MPHS ⁱ	(0.05 kg a.i./day) ^j	0.0215	0.0026	46000	1000
PPE (M/L/A): Single Layer (long pants, long-sleeved shirt) + CR gloves^k + Filtering Facepiece Respirator (Dust Mask)^l								
DU	General Indoor/Outdoor Sites; Dwellings/Indoor Sites; Residential Outdoor Sites	Broadcast, Perimeter, CC, Spot, Void, Furniture, Nest Application	Shaker Can, Hand-Crank Duster, Electric/Power Duster	0.00006 kg a.i./m ²	0.0202	0.0006	50000	4000

PPE = personal protective equipment; MOE = margin of exposure; CR = chemical-resistant; MPHG = mechanically pressurized handgun; SN = solution; EC = emulsifiable concentrate; DU = dust; CC = crack and crevice; MPHS = mechanically pressurized handheld sprayer for mists, aerosols, and fogs; MLA = mixer, loader, applicator; PCO = pest control operator; MPHWD = manually pressurized handwand; a.i. = active ingredient; NOAEL = No Observed Adverse Effect Level; LOAEL = Lowest Observed Adverse Effect Level

Respirator = NIOSH-approved organic-vapour-removing cartridge with a prefilter approved for pesticides OR a NIOSH-approved canister approved for pesticides.

^a Where dermal/inhalation exposure (mg/kg bw/day) = (unit exposure × area treated per day × application rate)/80 kg. A dermal absorption value was not required in the equation for dermal exposure as the NOAEL is based on a dermal study.

^b MOE = NOAEL/Exposure. Dermal MOEs for short- to long-term exposure durations are based on a NOAEL of 1000 mg/kg bw/day from a 21-day rabbit dermal toxicity study and a target MOE of 300.

^c MOE = LOAEL/Exposure. Inhalation MOEs for intermediate- to long-term exposure durations are based on a LOAEL of 2.6 mg/kg bw/day from a 13-week rat inhalation toxicity study and a target MOE of 1000. Since the same point of departure and a lower target MOE (300) were established for short-term inhalation scenarios, the longer-term inhalation assessments address the short-term inhalation exposure scenarios.

^d Unit exposures based on Krolski (2014).

^e Maximum application rate was lowered based on unacceptable postapplication risks. This mitigation also mitigates commercial applicator risks.

^h Required mitigation is the addition of a NIOSH-approved organic-vapour-removing cartridge with a prefilter approved for pesticides OR a NIOSH-approved canister approved for pesticides.

ⁱ Unit exposures based on Thouvenin (2015) and Testman (2015).

^j Limit amount handled per day to 0.05 kg a.i./day as mitigation.

^k PPE for trigger-spray bottle and bulbous/plunger duster does not include CR gloves.

^l Required mitigation is the addition of a filtering facepiece respirator (dust mask).

Table 6 Postapplication exposure and risk assessment for agricultural crops

Crop	Activity	TC (cm ² /hr)	Rate (kg a.i./ha)	Maximum number of applications per year	Minimum interval between applications (days)	MOE (Day 0) ^a	REI ^b	
Greenhouse Peppers	All	1400	0.059	10	7	8400	12 hours	
Berry Crops ^c	All	1750	0.06	10	3	11 000		
Grapes	All	19 300	0.06	8	7	1800		
Cranberry	All	1100	0.06	10	3	17 000		
Herbs and Spices, Field Tomato, Bean (Pinto, Snap, Wax)	All	1750	0.06	8	7	20 000		
Pear Orchards	All	3000	0.0595	10	7	12 000		
Roses (Outdoor), Outdoor Ornamental Shrubs/Landscape Trees, ^d Outdoor Ornamentals ^d	All	4000	0.875 ^e	30	7	600		
Sod Farm (Liquid Drench) ^f	All	6700	0.875	24	7	8900		
Golf Course (Liquid Drench) ^f	All	3500	0.875	24	7	17 000		“Until sprays have dried”
Workers scouting treated areas following mosquito abatement application ^g	Scouting	1100	0.176	30	7	11 000		“Until sprays have dried”

MOE = margin of exposure; REI = restricted entry interval; TC = transfer coefficient; DFR = dislodgeable foliar residue; TTR = turf transferable residue; BW =

body weight; a.i. = active ingredient; NOAEL = No Observed Adverse Effect Level

As no chemical-specific DFR/TTR studies were submitted, a peak standard DFR value of 25% was used for all crops and a peak TTR value of 1% was used for turf. A 10% dissipation rate per day was used for outdoor crops and turf, and a 2% dissipation rate per day was used for greenhouse pepper crops.

^a MOE = NOAEL/Exposure. Dermal MOEs for short- to long-term exposure durations are based on a NOAEL of 1000 mg/kg bw/day from a 21-day rabbit dermal toxicity study and a target MOE of 300.

Dermal Exposure ($\mu\text{g}/\text{kg}$ bw/day) = DFR/TTR \times TC \times Duration (8 hours)/BW (80 kg)

^b If the target MOE is met on day 0, the REI is set at 12 hours.

^c Berry Subgroup (CG 13-07G) Bearberry; Bilberry; Blueberry, low/highbush; Cloudberry; Lingonberry; Muntries; Partridgeberry; Strawberry; Cultivars, varieties and/or hybrids), Raspberry.

^d Ornamentals (including ornamental shrubs and trees) grown for production.

^e Maximum rate from soluble granule (liquid drench) application, which is used for outdoor ornamentals.

^f Sod and golf course application - the formulation for this scenario is a soluble granule, applied as a liquid drench. A postapplication assessment was not conducted for the soluble granule application to these areas as minimal residues are expected to be on the foliage from the application of a granule.

^g Assessed using TCs for scouting in forage crops. Addresses postapplication exposure to workers scouting in wasteland areas, recreational areas, residential areas, roadsides, shrubbery and vegetation around stagnant pools, marshy areas, ponds and shorelines following mosquito abatement application.

Table 7 Short-term residential applicator exposure and risk assessment

Scenario	Formulation	Application equipment	Application type	Application rate ^a	ATPD ^b	Dermal exposure (mg/kg bw/day) ^c	Inhalation exposure (mg/kg bw/day) ^c	Dermal MOE ^d	Inhalation MOE ^e
Lawns and Turf	Liquid	Hose-end Sprayer	Broadcast Spray	0.000014 kg a.i./m ²	2000 m ²	0.0103	1.7×10^{-5}	97 000	150 000
		MPHW		0.002 kg a.i./L	18.927 L	0.0657	1.89×10^{-5}	15 000	140 000
		Sprinkler Can		0.000014 kg a.i./m ²	93 m ²	0.0005	7.98×10^{-7}	2 100 000	3 300 000
		Backpack		0.002 kg a.i./L	18.927 L	0.1356	1.47×10^{-4}	7400	18 000
	RTU	Aerosol Can	Broadcast Spray	0.0012 kg a.i./can	1 can	0.0122	9.92×10^{-5}	82 000	26 000
		Trigger-Spray Bottle	Broadcast Spray	0.002 kg a.i./bottle	1 bottle	0.0047	3.25×10^{-6}	210 000	800 000
		Hose-end Sprayer		0.000014 kg a.i./m ²	2000 m ²	0.0048	2.63×10^{-5}	210 000	99 000
	Granules	Push-type Rotary Spreader	Broadcast, Nest Application	0.0000263 kg a.i./m ²	2000 m ²	0.0012	3.75×10^{-6}	850 000	690 000
		Belly Grinder			93 m ²	0.0243	2.63×10^{-6}	41 000	990 000
		Spoon			9.3 m ²	4.18×10^{-5}	5.81×10^{-7}	24 000 000	4 500 000

Scenario	Formulation	Application equipment	Application type	Application rate ^a	ATPD ^b	Dermal exposure (mg/kg bw/day) ^c	Inhalation exposure (mg/kg bw/day) ^c	Dermal MOE ^d	Inhalation MOE ^e	
		Cup, Shaker Can				7.34×10^{-7}	8.87×10^{-8}	1 400 000 000	29 000 000	
		Hand Dispersal				0.0011	2.57×10^{-6}	930 000	1 000 000	
	WDG ^f	Backpack ^g	Spot and Nest Spray (Liquid Drench)	0.0000875 kg a.i./L	18.927 L	0.0031	5.03×10^{-5}	320 000	52 000	
Gardens and Trees	Liquid	MPHW	Broadcast, Perimeter, CC, Spot, Nest Spray	0.00008 kg a.i./m ²	111.48 m ²	0.015	4.46×10^{-6}	65 000	580 000	
		Hose-end Sprayer, Sprinkler Can				0.014	3.46×10^{-7}	70 000	7 500 000	
		Backpack				0.032	3.46×10^{-5}	31000	75 000	
			Backpack – Exterior Surface of Structures	Broadcast, Perimeter, CC, Spot Spray	0.005 kg a.i./L	18.927 L	0.3390	3.67×10^{-4}	2900	7100
	RTU	Aerosol Can, Total Release Fogger	Broadcast, Perimeter, CC, Spot, Nest Spray	0.00325 kg a.i./can	2 cans	0.0663	5.37×10^{-4}	15 000	4800	
		Trigger-Spray Bottle	Broadcast, Perimeter, CC, Spot, Nest Spray	0.005 kg a.i./bottle	2 bottles	0.0235	1.63×10^{-5}	43 000	160 000	
		Hose-end Sprayer	Broadcast, Perimeter, CC, Spot, Nest Spray	0.00008 kg a.i./m ²	111.48 m ²	0.002	8.36×10^{-6}	650 000	310 000	
	Dust	Bulb Duster, Plunger Duster	Broadcast, Perimeter, CC, Spot Application	0.00008 kg a.i./m ²	111.48 m ²	0.0614	4.18×10^{-4}	16 000	6200	
		Electric Power Duster, Hand Crank Duster, Shaker Can				1.0568	4.42×10^{-3}	950	590	
	Granules	Push-type Rotary Spreader	Broadcast, Perimeter, Nest Application	0.0000263 kg a.i./m ²	111.48 m ²	0.0001	2.09×10^{-7}	15 000 000	12 000 000	
		Belly Grinder				0.0291	3.15×10^{-6}	34 000	820 000	
		Spoon				0.0005	6.96×10^{-6}	2 000 000	370 000	
		Cup				8.80×10^{-6}	1.06×10^{-6}	110 000 000	2 400 000	
Shaker Can,		0.0129				3.08×10^{-5}	77 000	84 000		

Scenario	Formulation	Application equipment	Application type	Application rate ^a	ATPD ^b	Dermal exposure (mg/kg bw/day) ^c	Inhalation exposure (mg/kg bw/day) ^c	Dermal MOE ^d	Inhalation MOE ^e
		Hand Dispersal							
	WDG ^f	Backpack ^g	Spot and Nest Spray (Liquid Drench)	0.0000875 kg a.i./L	18.927 L	0.0031	5.03×10^{-5}	320 000	52 000
Outdoor Fogging/Misting System	RTU	OASS	Space Spray	0.00325 kg a.i./day ^h	1 can	0.0331	2.69×10^{-4}	30 000	9700
	Solid	CCTM (coil)	Minimal Handler Exposure						
Indoor Environments	Liquid	MPHW	Broadcast, CC, Spot, Nest Furniture, Clothing Spray	0.0096 kg a.i./L	1.89 L/day	0.0345	0.0006	29 000	4700
		Backpack ⁱ			1.89 L/day	0.0650	7.03×10^{-5}	15 000	37 000
	RTU	Aerosol Can, ^j Total Release Fogger	Space, Broadcast, Perimeter, CC, Spot, Furniture, Clothing Spray	0.00325 kg a.i./can	1 can	0.0331	0.0003	30 000	9700
		Trigger Spray Bottle ^k	Space Spray	0.000003 kg a.i./m ³	369 m ³ /day	0.0026	1.80×10^{-6}	390 000	1 400 000
			Broadcast, Perimeter, CC, Spot, Nest Furniture, Clothing Spray	0.0096 kg a.i./bottle	1 bottle	0.0225	1.56×10^{-5}	44 000	170 000
		Dust	Plunger Duster	Broadcast, Perimeter, Spot, CC, Furniture Application	0.004 kg a.i./kg dust	0.227 kg dust	0.0063	4.26×10^{-5}	160 000
	Bulb Duster		0.113 kg dust			0.0031	2.12×10^{-5}	320 000	120 000
	Electric Power Duster, Hand		0.227 kg ai/kg dust			0.1076	0.0005	9300	5800

Scenario	Formulation	Application equipment	Application type	Application rate ^a	ATPD ^b	Dermal exposure (mg/kg bw/day) ^c	Inhalation exposure (mg/kg bw/day) ^c	Dermal MOE ^d	Inhalation MOE ^e
		Crank Duster							
		Shaker Can		0.01 kg a.i./container	1 can	1.1850	0.0050	840	520
Treated Pets	RTU	Trigger Spray Bottle	Direct Application to Pets (Dogs, Cats, Birds, Rabbits)	0.000075 kg a.i./animal	2 animals	0.0034	1.37×10^{-5}	300 000	190 000
		Shampoo ^l		0.0002064 kg a.i./animal		0.0228	3.30×10^{-6}	44 000	790 000
		Aerosol Can		0.0000269 kg a.i./animal		0.0012	4.90×10^{-6}	820 000	530 000
	RTU	Trigger Spray Bottle	Direct Application to Livestock	0.0002064 kg a.i./animal	24 animals ^p	0.1119	4.51×10^{-4}	8900	5800
		Shampoo ^m		0.2730		3.96×10^{-5}	3700	66 000	
		Aerosol Can		0.0477		1.92×10^{-4}	21 000	14 000	
		Aerosol Can + Wipe ⁿ		0.1408		2.04×10^{-4}	7100	13 000	
	Liquid	Sponge ^o	0.0002064 kg a.i./animal	0.2184	2.85×10^{-5}	4600	91 000		
		MPHW	0.0001705 kg a.i./animal	0.0071	2.05×10^{-6}	140 000	1 300 000		

ATPD = area treated per day; MOE = margin of exposure; RTU = ready to use; SG = soluble granule; WDG = water dispersible granule; MPHWP = manually pressurized handwand; CC = crack and crevice; CCTM = candles, coils, torches, mats; OASS = outdoor aerosol space spray; a.i. = active ingredient; NOAEL = No Observed Adverse Effect Level; LOAEL = Lowest Observed Adverse Effect Level

^a Trigger sprayer bottle, aerosol can, and space spray application rates are based on net contents, maximum guarantee, and density, for some scenarios.

^b Based on standard values from the USEPA Residential SOP (USEPA, 2012) unless otherwise specified.

^c Where dermal/inhalation exposure (mg/kg bw/day) = (unit exposure × area treated per day × application rate)/80 kg. Dermal absorption is not required for the dermal exposure calculation as the dermal NOAEL is based on a dermal toxicity study.

^d MOE = NOAEL/Exposure. Based on a NOAEL of 1000 mg/kg bw/day from a 21-day rabbit dermal toxicity study and a target MOE of 300. Residential handler scenarios are considered to be short-term in duration.

^e MOE = LOAEL/Exposure. Based on a LOAEL of 2.6 mg/kg bw/day from a 13-week rat inhalation toxicity study and a target MOE of 300. Residential handler scenarios are considered to be short-term in duration.

^f Standards for WDG were used to assess soluble granule (liquid drench).

^g Exposure from the backpack application of soluble granules as a liquid drench. Addresses exposure to application using a MPHWP or sprinkler can (where

applicable).

^h Maximum “g PYR/day” based on a 650g can with a 0.5% pyrethrins guarantee.

ⁱ Backpack application equipment is not normally assessed for indoor environments however, it was added as potential application equipment due to label language and registrant information in the updated use pattern.

^j Addresses exposure from loading aerosol cans into metered release devices.

^k The updated use information indicates that liquid pyrethrins products may be applied by space spray application. As data are not available to assess exposure using handheld fogger/misters, this was assessed using a trigger spray bottle.

^l Exposure from shampoo application to pets will address exposure from ear drops, roller container, bottles with snap open lid, droppers.

^m Exposure from shampoo application to livestock will address exposure from roller ball container, bottles with sponge tip, and paste formulations.

ⁿ Used sponge scenario as a surrogate for wipe and added those unit exposures to aerosol unit exposure to address exposure from the aerosol + cloth/wipe-on scenario.

^o Addresses exposure for cloth, sponge, mitt wipe-on.

^p 95th percentile of horses and ponies from Statistics Canada (2016).

Table 8 Short- to intermediate-term residential postapplication dermal exposure and risk assessment

Exposure scenario		Lifestage	TR ^a (µg/cm ²)	TC ^b (cm ² /hr)	ET ^c (hr/day)	Dermal dose ^d (mg/kg bw/day)	MOE ^e	
Lawns & Turf	Liquid ^f	Adult	0.13	180 000	1.5	0.4366	2300	
		Children (1 to <2 years old)		49 000		0.8643	1200	
	Granules ^g	Adult	0.01	200 000	1.5	0.0292	34 000	
		Children (1 to <2 years old)		54 000		0.0573	17 000	
	Liquids ^f and Granules ^g	Mowing Turf	Adult	0.13	5500	1	0.0089	110 000
			Youth (11 to <16 years old)		4500		0.0102	98 000
		Golfing	Adult	0.13	5300	4	0.0343	29 000
			Youth (11 to <16 years old)		4400		0.0399	25 000
			Children (6 to <11 years old)		2900		0.0469	21 000
Gardens & Trees		Liquid ^f	Adult	3.73	8400	2.2	0.8626	1200
	Children (6 to <11 years old)		4600		1.1	0.5905	1700	
	Adult		1700		1	0.0794	13 000	
	Children (6 to		930		0.5	0.0543	18 000	

Exposure scenario		Lifestage	TR ^a (µg/cm ²)	TC ^b (cm ² /hr)	ET ^c (hr/day)	Dermal dose ^d (mg/kg bw/day)	MOE ^e	
	Indoor Plants ^h	<11 years old)	2.19	220	1	0.0060	170 000	
		Adult						
	Solid ⁱ	Gardens	Children (6 to <11 years old)	3.41	8400	2.2	0.7887	1300
			Adult					
		Trees	Children (6 to <11 years old)		1700	1	0.0726	14 000
			Adult					
Outdoor Fogging/Misting Systems ^j	Outdoor Aerosol Space Spray ^k	Adult	0.16	180 000	1.5	0.5450	1800	
		Children (1 to <2 years old)						
	Mosquito Abatement ^l	Adult	0.034	180 000	1.5	0.1139	8800	
		Children (1 to <2 years old)						
Indoor Environments	Broadcast	Soft Surface	24.12 ^m	6800	8	16.4016	60	
								Children (1 to <2 years old)
		Hard Surface	32.16 ^m	6800	2	5.4672	180	
								Children (1 to <2 years old)
		Soft Surface	1.656 ⁿ	6800	8	1.1261	890	
								Children (1 to <2 years old)
	Hard Surface	2.208 ⁿ	6800	2	0.3754	2700		
							Children (1 to <2 years old)	
	Perimeter/Spot/Bedbug (Coarse and Pin Stream) ^o	Soft Surface	Adults	0.828	6800	8	0.5630	1800
			Children (1 to <2 years					

Exposure scenario		Lifestage	TR ^a ($\mu\text{g}/\text{cm}^2$)	TC ^b (cm^2/hr)	ET ^c (hr/day)	Dermal dose ^d (mg/kg bw/day)	MOE ^e	
		Hard Surface	old)	1.104	6800	2	0.1877	5300
			Adults					
		Hard Surface	Children (1 to <2 years old)	0.1656	1800	2	0.3613	2800
			Adults					
	Crack and Crevice ⁿ	Soft Surface	Children (1 to <2 years old)	0.2208	6800	8	0.1126	8900
			Adults					
		Hard Surface	Children (1 to <2 years old)	0.2208	1800	2	0.0375	27 000
			Adults					
	Fogger ^o	Soft Surface	Children (1 to <2 years old)	0.5662	6800	8	0.3850	2600
			Adults					
		Hard Surface	Children (1 to <2 years old)	0.7549	1800	2	0.1283	7800
			Adults					
	Space Spray ^p	Soft Surface	Children (1 to <2 years old)	1.2968	6800	8	0.8818	1100
			Adults					
		Hard Surface	Children (1 to <2 years old)	1.7290	1800	2	0.2939	3400
			Adults					
	Bed Bug Treatment ^q	Application to Mattresses	Children (1 to <2 years old)	24.0	SA:BW ratio (cm^2/kg) = 280		0.1008 ^r	9900
			Children (1 to <2 years old)		SA:BW ratio (cm^2/kg) = 640			
Children (1 to <2 years old)			1400		1	0.35	2900	

Exposure scenario			Lifestage	TR ^a (µg/cm ²)	TC ^b (cm ² /hr)	ET ^c (hr/day)	Dermal dose ^d (mg/kg bw/day)	MOE ^e
Treated Pets	Dogs and Cats ^s	All Sizes ^t	Adults	0.00334	5200	1	0.17	6000
			Children (1 to <2 years old)		1400	0.77	0.43	2400

TR = transferable residue; TC = transfer coefficient; ET = exposure time; MOE = margin of exposure; OASS = outdoor aerosol space sprays; DR = deposited residue; OASS = outdoor aerosol space spray; BW = body weight; a.i. = active ingredient; NOAEL = No Observed Adverse Effect Level
 Bolded cells indicate the MOE was not met.

^a Transferable residue calculated based on the application rate and the exposure scenario using fraction transferred values of 1% for lawns and turf, 25% for gardens and trees, 6% for soft surfaces, 8% for hard surfaces. For some scenarios (OASS and application to mattresses), this value is the deposited residue based on calculations using the application rate.

^b Transfer coefficient standard values from USEPA Residential SOPs (2012) were used.

^c Exposure time standard values from USEPA Residential SOPs (2012) were used.

^d Dermal dose (mg/kg bw/day) = TR × TC × ET/BW (kg). Body weights of 80, 57, 19, and 11 kg were used for adults, youth (11 to <16 years old), children (3 to <6 years old), and children (1 to <2 years old) respectively, as stated in the USEPA Residential SOPs (2012). Dermal absorption was not required as the dermal point of departure was based on a dermal toxicity study.

^e MOE = NOAEL/exposure. Based on a NOAEL of 1000 mg/kg bw/day from a 21-day rabbit dermal toxicity study and a target MOE of 300.

^f Based on commercial and domestic-class product application rate of 0.0875 g a.i./m² (2 applications per year (lawns and turf) and 3 applications per year (gardens and trees); 7 day interval). Addresses exposure to broadcast spray of aerosol formulations.

^g Based on commercial and domestic-class product application rate of 0.0263 g a.i./m² (2 applications per year; 7 day interval).

^h Based on only 1 application (as per USEPA Residential SOP) (USEPA, 2012) assuming that postapplication exposure at the day 0 residue level would occur the entire duration of exposure.

ⁱ Based on domestic- and commercial-class dust product application rate of 0.08 g a.i./m² (3 applications per year; 7 day interval). Addresses exposure to soluble granular formulations applied as a granule.

^j Exposure from animal barn misting systems was addressed through the indoor environments risk assessment as exposure in indoor environments is higher than in animal barns.

^k Based on a maximum commercial-class product can size of 700 g (0.5% pyrethrins guarantee) (3 applications per year; 7 day interval). Calculated application rate is 0.0946 g a.i./m² (using standard values from USEPA Residential SOPs (2012)).

^l Based on a maximum commercial-class product rate of 176 g a.i./ha (30 applications per year; 7 day interval).

^m Based on maximum commercial-class product rate of 4.02 g a.i./m².

ⁿ Refinement based on maximum domestic-class product rate of 0.276 g a.i./m² as target MOEs were not met using maximum rate of 4.02 g a.i./m² (broadcast application). Addresses long-term exposure due to bedbug surface applications since the application rate is higher (0.24 g a.i./m² for bedbug applications) and the toxicology points of departure are the same.

^o Based on a commercial-class rate of 0.0387 g a.i./m³. This rate is only registered for use in commercial areas but was used to assess exposure to postapplication workers in industrial areas as well as residents. Addresses exposure following commercial application of total release foggers.

^p Based on a maximum can size of 650 g and PYR concentration of 1.8%. Addresses exposure from metered release devices in residential areas and barns.

^q Based on the maximum domestic-class bedbug product mattress rate of 0.24 g a.i./m².

^r Dermal Dose (mg/kg bw/day) = DR (µg/cm²) × Surface Area/Body Weight Ratio (cm²/kg) × Fraction of body that contacts residue (0.5) × Fraction of a.i. available for transfer from treated mattress (6%) × protection factor (0.5)/BW (80 kg adult; 11 kg children (1 to <2 years old)).

^s Based on a maximum domestic product rate of 0.0162 g a.i./kg body weight.

^t Based on exposure to a large dog which addresses exposure to all other animals.

Table 9 Short- to intermediate-term residential postapplication inhalation exposure and risk assessment

Exposure Scenario ^a		Lifestage	C _o or Mass a.i. ^b	Exposure Time (hr/day) ^c	Inhalation Exposure (mg/kg bw/day) ^d	MOE ^e
Outdoor Fogging/Misting Systems	Outdoor Aerosol Space Spray ^f	Adult	3500 mg a.i./day	NA	0.0052	500
		Children (1 to <2 years old)			0.0194	130
	Coils ^g	Adult	75 mg a.i./coil	2.3	8.66×10^{-5}	30 000
		Children (1 to <2 years old)			0.0003	8000
	Mosquito Abatement ^h	Adult	35.2 mg a.i./m ³	1.5	0.0042	620
					Children (1 to <2 years old)	0.0158
Children (1 to <2 years old)		0.604 mg a.i./m ³	1.5	7.25×10^{-5}	36 000	
				2.72×10^{-4}	9600	
Indoor Environments	Space Spray – Aerosol (Commercial – max rate ⁱ)	Adult	11.70 mg a.i./m ³	2	0.1234	21
		Children (1 to <2 years old)			0.4629	6
	Space Spray- Aerosol (Commercial – max rate, ⁱ 2 hr re-entry interval)	Adult	0.94 mg a.i./m ³	2	0.0099	260
		Children (1 to <2 years old)			0.0372	70
	Space Spray- Aerosol (Domestic – max rate ^k)	Adult	16 mg a.i./m ³	2	0.1688	15
		Children (1 to <2 years old)			0.6330	4
	Space Spray – Liquid (Fogger) (Commercial – max rate in commercial areas ^l)	Adult	38.7 mg a.i./m ³	2	0.4083	6
		Children (1 to <2 years old)			1.5311	2
	Space Spray – Liquid (Fogger) (Commercial – max rate in commercial/residential areas ^m)	Adult	24.6 mg a.i./m ³	2	0.2595	10
		Children (1 to <2 years old)			0.9732	3
Space Spray – Liquid (Mist) (Domestic – max rate ⁿ)	Adult	3.0 mg a.i./m ³	2	0.0316	82	
	Children (1 to <2 years old)			0.1187	22	
	Adult	0.3 mg a.i./m ³	2	0.0032	820	

Exposure Scenario ^a		Lifestage	C _o or Mass a.i. ^b	Exposure Time (hr/day) ^c	Inhalation Exposure (mg/kg bw/day) ^d	MOE ^e
	Space Spray – Liquid (Mist) (Domestic – min rate ^o)	Children (1 to <2 years old)			0.0119	220

NA = not applicable; MOE = margin of exposure; hr = hours; C_o = initial concentration; max = maximum; min = minimum; IR = inhalation rate; AR = application rate; Q = airflow through treated area; BW = body weight; V_E = Vaporization Efficiency; ER = emission rate; UL = useful life of product; ET = exposure time; V = volume of treated space; AP = amount applied; F = fraction of chemical available in outdoor air; ACH = air exchanges per hour; LOAEL = Lowest Observed Adverse Effect Level **Bolded** cells indicate target MOE not met.

^a Short-term exposure scenarios unless otherwise indicated.

^b Outdoor Fogging/Misting Systems application rate determined from maximum container/product size and highest % guarantee. Mosquito abatement and indoor space spray based on the maximum application rates from the updated use pattern information.

^c Exposure time based on standard values from the USEPA Residential SOP (2012).

^d Inhalation exposure calculated using:

Outdoor Aerosol Space Spray: Inhalation Exposure (mg/kg bw/day) = IR (m³/hr; Adult = 0.64, Children (1 to <2 years old) = 0.33) × AR (mg a.i./day)/Q (5400 m³/hr) × BW (kg; Adult = 80 kg, Children (1 to <2 years old) = 11 kg)

Coils: Inhalation Exposure (mg/kg bw/day) = IR (m³/hr; Adult = 0.64, Children (1 to <2 years old) = 0.33) × V_E (100%) × ER (mg in coil × # coils used (n = 1)/ UL (4 hours))/Q (3960 m³/hr) × (ET (2.3 hrs/day) – V (51 m³)/Q (3960 m³/hr))/BW (kg; Adult = 80 kg, Children (1 to <2 years old) = 11 kg)

Mosquito Abatement: Inhalation Exposure (mg/kg bw/day) = AP (35.2 mg/m³) × F (1%) × IR (m³/hr; Adult = 0.64, Children (1 to <2 years old) = 0.33) × ET (1.5 hours)/BW (kg; Adult = 80 kg, Children (1 to <2 years old) = 11 kg)

Indoor Space Spray: Inhalation Exposure (mg/kg bw/day) = [C_o (mg/m³) × IR (m³/hr; Adult = 0.64, Children (1 to <2 years old) = 0.33)/ACH (0.45 hr⁻¹) × BW (kg; Adult = 80 kg, Children (1 to <2 years old) = 11 kg)] × (1 – e^(-ACH × ET))

^e MOE = LOAEL/exposure. Based on a LOAEL of 2.6 mg/kg bw/day from a 13-week rat inhalation toxicity study and a short-term target MOE of 300 and an intermediate-term target MOE of 1000.

^f Rate calculated using maximum commercial-class can size (700 g) with highest pyrethrins guarantee (0.5%).

^g Rate based on largest product size (12.5 g/coil) and highest pyrethrins guarantee (0.6%).

^h Rate based on maximum commercial-class mosquito abatement rate (176 g a.i./ha = 35.2 mg ai/m³). Risk mitigated with lower registered commercial-class mosquito abatement rate (3.02 g a.i./ha = 0.604 mg a.i./m³). Determined by calculating the amount applied to a 1 m × 1 m × 0.5 m area. Mosquito abatement is an intermediate-term exposure scenario due to the number of applications permitted per year.

ⁱ Rate based on maximum commercial-class aerosol product space spray rate of 0.0117 g a.i./m³.

^k Rate based on maximum domestic-class aerosol product space spray rate of 0.016 g a.i./m³.

^l Rate based on maximum commercial-class liquid product space spray rate of 0.0387 g a.i./m³. This rate is only registered for use in commercial areas but was used to assess exposure to postapplication workers in industrial areas as well as residents. After a 2 hour re-entry, exposure is expected to be minimal. Addresses commercial use of total release foggers.

^m Rate based on maximum commercial-class liquid product space spray rate of 0.0246 g a.i./m³. This rate is registered for use in both commercial and residential areas. After a 2 hour re-entry, exposure is expected to be minimal. Addresses commercial use of total release foggers.

ⁿ Rate based on maximum domestic-class liquid product space spray rate of 0.003 g a.i./m³.

^o Rate based on minimum domestic-class liquid product space spray rate of 0.0003 g a.i./m³.

Table 10 Refined Short-term Postapplication Inhalation Risk Assessment Following Outdoor Aerosol Space Sprays using Boatwright (2009)

Sampling interval (min)	Sampling duration (hours)	Cyfluthrin air concentration ($\mu\text{g}/\text{m}^3$) ^a	Estimated PYR air concentration ($\mu\text{g}/\text{m}^3$) ^b	Adult inhalation exposure (mg/kg bw/day) ^c	Children (1 to <2 years old) Inhalation exposure (mg/kg bw/day) ^c
0 to 5	0.0833	2.33	70	0.000046	0.000174
5 to 10	0.0833	1	30	0.000020	0.000075
10 to 20	0.167	0.5	15	0.000020	0.000075
20 to 40	0.333	0.25	7	0.000020	0.000075
40 to 80	0.667	0.125	4	0.000020	0.000075
80 to 120	0.667	0.125	4	0.000020	0.000075
Total exposure (mg/kg bw/day)^d				1.46E-04	5.48E-04
Inhalation MOE^e				18000	4700

MOE = margin of exposure; PYR = pyrethrins; BW = body weight; IR = inhalation rate; LOQ = limit of quantification
Bold indicate when residues were <LOQ and air concentration was calculated based on ½ LOQ.

^a Cyfluthrin air concentration based on application rate of 0.117 g cyfluthrin dispensed from entire can.

^b Maximum amount of pyrethrins per can of outdoor aerosol space spray = 3.5 g PYR/can. Fold difference between cyfluthrin g/can and pyrethrins g/can = 28. Estimated pyrethrins air concentration = g cyfluthrin \times 28.

^c Inhalation exposure (mg/kg bw/day) = PYR air concentration ($\mu\text{g}/\text{m}^3$) \times IR (0.33 m³/hr (children 1 to <2 years old); 0.64 m³/hr (adult) \times Sampling Duration (hrs)/BW (11 kg (children 1 to <2 years old); 80 kg (adult))

^d Total Exposure (mg/kg bw/day) = Sum of exposures over 2 hour sampling period.

^e MOE = LOAEL/Exposure. Based on a LOAEL of 2.6 mg/kg bw/day from a 13-week rat inhalation toxicity study and a target MOE of 300.

Table 11 Short-term postapplication exposure from aerosols following indoor space spray – Refined using air concentration estimates for pressurized product (Acedo, 2016)

Sampling interval (min)	Exposure time ^a (hrs)	Estimated PYR Air concentration (mg/m ³) ^b		Exposure (mg/kg bw/day) ^c	
		1 ft ^c	5 ft ^d	Children (1 to <2 years old) (1 ft) ^f	Adults (5 ft)
Maximum commercial-class product application rate 0.0117 g ai/m³ (no re-entry interval)					
0–15	0.25	2.202	0.441	0.0165	0.0009
15–30	0.25	0.420	0.398	0.0031	0.0008
30–60	0.5	0.222	0.192	0.0033	0.0008
60–120	1	0.096	0.061	0.0029	0.0005
Total exposure^g				0.0259	0.0029
Inhalation MOE^h				100	880
Maximum commercial-class product application rate 0.0117 g ai/m³ (15 minute re-entry interval)					
15–30	0.25	0.420	0.398	0.0031	0.0008
30–60	0.5	0.222	0.192	0.0033	0.0008
60–120	1	0.096	0.061	0.0029	0.0005
Total exposure^g				0.0094	0.0013
Inhalation MOE^h				280	2100
Maximum domestic-class product application rate 0.016 g ai/m³					
0–15	0.25	3.011	0.603	0.0226	0.0012
15–30	0.25	0.574	0.545	0.0043	0.0011
30–60	0.5	0.303	0.263	0.0046	0.0011

Sampling interval (min)	Exposure time ^a (hrs)	Estimated PYR Air concentration (mg/m ³) ^b		Exposure (mg/kg bw/day) ^c		
		1 ft ^c	5 ft ^d	Children (1 to <2 years old) (1 ft) ^f	Adults (5 ft)	
60–120	1	0.132	0.084	0.0039	0.0007	
				Total exposure^g	0.0354	0.0040
				Inhalation MOE^h	70	650
Lower registered domestic-class product application rate 0.0040 g ai/m³						
0–15	0.25	0.753	0.151	0.0056	0.0003	
15–30	0.25	0.143	0.136	0.0011	0.0003	
30–60	0.5	0.076	0.066	0.0011	0.0003	
60–120	1	0.033	0.021	0.0010	0.0002	
				Total exposure^g	0.0088	0.0010
				Inhalation MOE^h	290	2600

Min = minutes; PYR = pyrethrins; MOE = margin of exposure; LOAEL = Lowest Observed Adverse Effect Level
Bolded cells indicate target MOE not met.

^a Exposure time is the length of the duration of sampling.

^b Estimated using data from chemical-specific study (Acedo, 2016).

^c Represents breathing area of children (1 to <2 years old).

^d Represents breathing area of adult.

^e Exposure = air concentration (mg/m³) × inhalation rate (m³/hr) × exposure time (hr)/body weight. Inhalation rates are 0.64 and 0.33 m³/hr for adults and children (1 to <2 years old), respectively. Body weights are 80 and 11 kg for adults and children (1 to <2 years old), respectively.

^f Exposure for children (1 to <2 years old) addresses exposure to children (3 to <6 years old) in barns.

^g Total Exposure = Sum of exposures over 2 hour sampling period.

^h MOE = LOAEL/Exposure. Based on a LOAEL of 2.6 mg/kg bw/day from a 13-week rat inhalation toxicity study and a target of 300.

Table 12 Intermediate-term residential postapplication inhalation exposure and risk assessment (Metered release devices)

Exposure Scenario		Lifestage	Air Concentration (mg/m ³) ^a	Exposure Time (hr/day) ^b	Inhalation Exposure (mg/kg bw/day)	MOE ^c
Indoor Environments	Metered Release – Agricultural Premises (ABMS)	Adult	0.0191 ^d	4	1.22 × 10 ^{-3 e}	2100
		Children (3 to <6 years old)		2	1.69 × 10 ^{-3 e}	1500
	Metered Release – Indoor Environments	Adult	0.0191 ^d	16	0.0435 ^f	60
		Children (1 to <2 years old)		18	0.1834 ^f	14
		Adult		16	1.02 × 10 ^{-4 h}	25000
		Children (1 to <2 years old)		18	3.84 × 10 ^{-4 h}	6800

MOE = margin of exposure; ABMS = animal barn misting systems; AC = air concentration; IR = inhalation rate; ET = exposure time; PR = pulse rate; ACH = air exchanges per hour; BW = body weight; LOAEL = Lowest Observed Adverse Effect Level

Bolded cells indicate target MOE not met.

^a Average air concentration of pyrethrins based on product rate information (3.24 mg a.i./45 minute, treats 170 m³) and chemical-specific study data (Selim, 2008).

^b Exposure Time (hr/day) standard values obtained from the USEPA Residential SOPs (2012) for vapours for indoor

residential environments and barn misting systems for agricultural premises. The exposure time for vapours was used for indoor environments because metered release would be applied throughout the day and even though it is an aerosol space spray, the repetitive applications would have an exposure time more similar to vapours.

^c MOE = LOAEL/Exposure. Based on a LOAEL of 2.6 mg/kg bw/day from a 13-week rat inhalation toxicity study and a target MOE of 1000.

^d Based on a maximum domestic-class product rate of 3.24 mg a.i./170 m³ per spray event.

^e Inhalation exposure (mg/kg bw/day) = AC × IR (0.64 m³/hr (adults) and 0.42 m³/hr (children (3 to <6 years old))) × ET (hour) × PR (8 sprays/hour)/ACH (4 (1/hr)) × BW (80 kg for adults, 19 kg for children (3 to <6 years old)).

^f Inhalation dose (mg/kg bw/day) = AC × IR (0.64 m³/hr (adults) and 0.33 m³/hr (children (1 to <2 years old))) × ET (hour) × PR (8 sprays/hour)/ACH (0.45 (1/hr)) × BW (80 kg for adults, 11 kg for children (1 to <2 years old)).

^g Average air concentration of pyrethrins from chemical-specific study (peak to end of study) after metered release spray (Selim, 2008) at 1.8 m away from the device.

^h Inhalation Exposure (mg/kg bw/day) = [AC (mg/m³) × IR (0.64 m³/hr (adult), 0.33 mg/m³ (children (1 to <2 years old)))/ACH (0.45 hr⁻¹) × BW (80 kg for adults, 11 kg for children (1 to <2 years old))] × (1 - e^(-ACH × ET))

Table 13 Short- to intermediate-term residential postapplication hand-to-mouth exposure and risk assessment for children (1 to <2 years old)^a

Exposure scenario		Hand residue (mg/hour) ^b	ET (hr/day) ^c	Oral dose (mg/kg bw/day) ^d	MOE ^e	
Lawns and Turf	Liquid Residues Deposited on Lawns/Turf ^f	0.1902	1.5	0.0030	2100	
	Soluble Granules Deposited on Lawns/Turf ^g	0.0057		0.0001	71 000	
Outdoor Fogging/Misting Systems	OASS	Residue Deposited on Lawns/Turf ^h	0.2374	1.5	0.0038	1700
	Mosquito Abatement	Residues Deposited on Lawns/Turf ^f	0.0496	1.5	0.0008	8100
	Animal Barn Misting Systems (Children (3 to <6 years old))	Broadcast, Hard Surface ^j	0.1332	2	0.0016	3900
Indoor Environments	HtM Broadcast ^k	Soft Surface	0.2236	4	0.0102	630
		Hard Surface	0.2981	2	0.0068	940
	HtM Perimeter/Spot/Bedbug (Coarse and Pin Stream) ^k	Soft Surface	0.1118	4	0.0051	1300
		Hard Surface	0.1490	2	0.0034	1900
	HtM Crack and Crevice ^k	Soft Surface	0.0224	4	0.0010	6300
		Hard Surface	0.0298	2	0.0007	9400
	HtM Fogger ^l	Soft Surface	0.0764	4	0.0035	1800
		Hard Surface	0.1019	2	0.0023	2800
HtM Space Spray ^m	Soft Surface	0.1751	4	0.0080	800	
	Hard Surface	0.2334	2	0.0053	1200	
Treated Pets ⁿ	HtM Dog and Cat	All sizes ^o	0.0935	1	0.0011	6000

HtM = hand-to-mouth; OASS = outdoor aerosol space spray; MOE = margin of exposure; ET = exposure time; OFMS = outdoor fogging/misting systems; ABMS = animal barn misting systems; NOAEL = No Observed Adverse Effect Level

^a Risk assessment for children (1 to <2 years old) except for animal barn misting system scenario where the index lifespan for this scenario is children (3 to <6 years old).

^b Hand residue is based on the dermal postapplication exposure × fraction of a.i. on hands compared to body (0.06 and 0.027 for lawns/turf, 0.06 for OFMS, 0.15 for indoor sites and ABMS, 0.04 for treated pets).

^c Exposure time based on standard values from the USEPA Residential SOPs (2012).

^d Where Oral Dose (mg/kg bw/day) = [Hand Residue (mg/hour) × Fraction of hand mouthed/event (0.13) × Exposure Time (hr) × (1 - (1 - Saliva Extraction Factor (0.48))^{Number events per hour/Replenishment Intervals (4/hr)})] / Body Weight (kg).

Number of events per hour: Lawns and turf, OASS, mosquito abatement, ABMS (14 events/hr); Indoor environments, treated pets (20 events/hr).

^e Oral MOE = NOAEL/Oral exposure. Based on an offspring NOAEL 6.4 mg/kg bw/day from an oral 2-generation reproductive toxicity study in the rat and a target MOE of 300.

^f Based on maximum commercial- and domestic-class SG (liquid drench) product rate of 0.0875 g a.i./m² (2 applications per year; 7 day interval).

^g Based on maximum commercial- and domestic-class SG product rate of 0.0263 g a.i./m² (2 applications per year; 7 day interval).

^h Based on maximum commercial-class container size (700 g), max guarantee (0.5%) (3 applications per year; 7 day interval).

ⁱ Based on a commercial mosquito abatement rate of 176 g a.i./ha, 30 applications per year, 7 day interval.

^j Based on maximum guarantee (1.8%) from commercial- and domestic-class products.

^k Based on the mitigated commercial-class application rate of 0.276 g a.i./m² for surface sprays.

^l Based on the maximum commercial-class application rate of 0.0387 g a.i./m³ for fogging application.

^m Based on maximum container size of 650 g and guarantee of 1.8% for space sprays. Addresses exposure from metered release devices in residential settings.

ⁿ Based on maximum application rate (0.0162 g a.i./kg bw).

^o Based on a large dog which has the highest exposure and addresses exposure to all smaller animals.

Table 14 Short- to intermediate-term residential postapplication object-to-mouth exposure and risk assessment for children (1 to <2 years old)

Exposure scenario		Object residue (µg/cm ²) ^a	ET (hr/day) ^b	Oral dose (mg/kg bw/day) ^c	MOE ^d	
Lawns & Turf	Liquid ^e	0.1294	1.5	0.0005	12 000	
	Soluble Granule ^f	0.0078		3.27 × 10 ⁻⁵	200 000	
Outdoor Fogging/Misting Systems	OASS	Residue Deposited on Lawns/Turf ^g	0.1615	1.5	0.0007	9400
	Mosquito Abatement	Residues Deposited on Lawns/Turf ^h	0.0337	1.5	0.0001	45 000
	Animal Barn Misting Systems (Children (3<6 years))	Broadcast, Hard Surface ⁱ	0.658	4	0.0043	1500
Indoor Environments	OtM Broadcast ^j	Carpet	1.656	4	0.0216	300
		Hard Surface	2.208	2	0.0144	440
	OtM Perimeter/Spot/Bedbug (Coarse and Pin Stream) ^j	Carpet	0.828	4	0.0108	590
		Hard Surface	1.104	2	0.0072	890
	OtM Crack and Crevice ^j	Carpet	0.166	4	0.0022	3000
		Hard Surface	0.221	2	0.0014	4400
	OtM Fogger ^k	Carpet	0.566	4	0.0074	860
		Hard Surface	0.755	2	0.0049	1300
	OtM Space Spray ^l	Carpet	1.297	4	0.0169	380
		Hard Surface	1.729	2	0.0113	570

OtM = object-to-mouth; ET = exposure time; MOE = margin of exposure; OASS = outdoor aerosol space spray; ABMS = animal barn misting system; NOAEL = No Observed Adverse Effect Level

^a For lawns and turf scenario: Object residue = turf transferable residue ($\mu\text{g}/\text{cm}^2$), deposited residue based on overall maximum application rate (0.0875 g a.i./m² for liquids and 0.0263 g a.i./m² for granules; 2 applications, 7 days apart). For Indoor Environment scenario: Deposited Residue ($\mu\text{g}/\text{cm}^2$) \times Fraction of residue transferred (6% for soft surfaces and 8% for hard surfaces). Deposited residue based on mitigated application rate of 0.276 g a.i./m² for surface sprays, maximum application rate (0.0246 g a.i./m³) for foggers, and maximum container size (650 g) and pyrethrins guarantee (1.8%) for space sprays. For OASS scenario: Object residue = turf transferable residue ($\mu\text{g}/\text{cm}^2$), deposited residue based on maximum container size (700 g) and guarantee (0.5%) (3 applications, 7 days apart). For mosquito abatement: Object residue = turf transferable residue ($\mu\text{g}/\text{cm}^2$), deposited residue based on overall maximum application rate (176 g a.i./ha; 30 applications, 7 days apart). For ABMS scenario: Deposited residue based on maximum guarantee (1.8%).

^b Exposure time based on standard values from the USEPA Residential SOPs (2012).

^c Where Oral Dose (mg/kg bw/day) = [Object Residue ($\mu\text{g}/\text{cm}^2$) \times 0.001 $\text{mg}/\mu\text{g}$ \times Surface Area of object mouthed (10 cm^2/event) \times (Exposure Time (hr) \times Replenishment Intervals (4/hr)) \times (1 - (1 - Saliva Extraction Factor (0.48)) Number events per hour/Replenishment Intervals (4/hr))] / Body Weight (11 kg). Number of events per hour = 14 (indoors, ABMS) or 9 (lawns, OASS, mosquito abatement).

^d Oral MOE = NOAEL/Oral exposure. Based on an offspring NOAEL 6.4 mg/kg bw/day from an oral 2-generation reproductive toxicity study in the rat and a target MOE of 300.

^e Based on maximum commercial- and domestic-class SG (liquid drench) product rate of 0.0875 g a.i./m² (2 applications per year; 7 day interval).

^f Based on maximum commercial- and domestic-class SG product rate of 0.0263 g a.i./m² (2 applications per year; 7 day interval).

^g Based on maximum commercial-class container size (700 g), max guarantee (0.5%).

^h Based on a commercial mosquito abatement rate of 176 g a.i./ha, 30 applications per year, 7 day interval.

ⁱ Based on maximum guarantee (1.8%) from commercial- and domestic-class end-use products.

^j Based on the mitigated commercial-class application rate of 0.276 g a.i./m² for surface sprays.

^k Based on the maximum commercial-class application rate of 0.0387 g a.i./m³ for fogging application.

^l Based on maximum container size of 650 g and pyrethrins guarantee of 1.8% for space sprays. Address exposure for metered release devices in residential settings

Table 15 Short- to intermediate-term postapplication incidental soil ingestion exposure and risk assessment for children (1 to <2 years old)

Exposure scenario	Application rate ^a	SR _t ($\mu\text{g}/\text{g}$) ^b	Oral dose (mg/kg bw/day) ^c	MOE ^d
Lawns and Turf – Liquid	0.0875 g ai/m ²	5.863	2.66×10^{-5}	240000
Lawns and Turf – Soluble Granule	0.0263 g ai/m ²	1.762	8.01×10^{-6}	800000

MOE = margin of exposure; BW = body weight; SR_t = soil residue on day “t”; AR = application rate; FS = Fraction available in uppermost centimeter of soil; FD = fraction of residue that dissipates daily; t = postapplication day; SIgR = soil ingestion rate; NOAEL = No Observed Adverse Effect Level

^a Based on maximum commercial- and domestic-class SG (liquid drench) product rate of 0.0875 g ai/m² and soluble granule product rate of 0.0263 g ai/m² (2 applications per year; 7 day interval).

^b SR_t ($\mu\text{g}/\text{g}$) = AR (kg ai/m²) \times FS (1.0) \times (1-F_D(0.1))^{t(t=0)} \times 0.67 cm^3/g soil

^c Where Oral Dose (mg/kg bw/day) = SR_t \times SIgR (50 mg/day)/BW (11 kg)

^d Oral MOE = NOAEL/Oral exposure. Based on an offspring NOAEL of 6.4 mg/kg bw/day from an oral 2-generation reproductive toxicity study in the rat and a target MOE of 300.

Table 16 Acute postapplication incidental granule ingestion exposure and risk assessment for children (1 to <2 years old)

Exposure scenario	Fraction of a.i. in dry pesticide ^a	Oral dose (mg/kg bw) ^b	MOE ^c
Lawns and Turf	0.175%	0.0477	420

MOE = margin of exposure; GIgR = Ingestion rate of dry pesticide formulation; FD = Fraction of a.i. in dry formulation; BW = body weight; a.i. = active ingredient; NOAEL = No Observed Adverse Effect Level

^a Based on the maximum guarantee in granular products.

^b Where Oral Dose (mg/kg bw) = GIgR (0.3 g/day) × FD (0.175%)/BW (11 kg)

^c Oral MOE = NOAEL (mg/kg bw)/Oral exposure (mg/kg bw). Based on a NOAEL of 20 mg/kg bw from an acute oral neurotoxicity study in the rat and a target MOE of 300.

Table 17 Long-term residential postapplication hand-to-mouth exposure and risk assessment for children (1 to <2 years old)^a

Exposure Scenario		Hand Residue (mg/hr) ^b	ET (hr/day) ^c	Oral Dose (mg/kg bw/day) ^d	MOE ^e	
Indoor Environments	HtM Perimeter/Spot/Bedbug ^f (Coarse and Pin Stream)	Soft Surface	0.0234	4	0.0009	4800
		Hard Surface	0.0351	2	0.0007	6400
	HtM Crack and Crevice ^f	Soft Surface	0.0047	4	0.0002	24000
		Hard Surface	0.0070	2	0.0001	32000

HtM = hand-to-mouth; MOE = margin of exposure; ET = exposure time; a.i. = active ingredient; NOAEL = No Observed Adverse Effect Level

^a Dermal exposure based on refined long-term exposure values using 50th percentile values for fraction transferred and TCs.

^b Deposited residue based on the dermal postapplication long-term exposure from indoor applications (mg/day) / dermal exposure time (hour/day) × Fraction a.i. on hands (0.15).

^c Exposure time based on standard values from the USEPA Residential SOPs (2012).

^d Where Oral Dose (mg/kg bw/day) = [Hand Residue (mg/hr) × Fraction of hand mouthed/event (0.12) × ET (hr) × (1 - (1 - Saliva Extraction Factor (0.48))^{Number events per hour (14)/Replenishment Intervals (4/hr)})] / Body Weight (11 kg).

^e Oral MOE = NOAEL/Oral exposure. Based on a NOAEL of 4.4 mg/kg bw/day from an oral 2-year rat toxicity study and a target MOE of 300.

^f Based on the maximum domestic-class application rate for bedbug (0.24 g a.i./m²).

Table 18 Long-term residential postapplication object-to-mouth exposure and risk assessment for children (1 to <2 years old)

Exposure scenario		Object residue (µg/cm ²) ^a	ET (hr/day) ^b	Oral dose (mg/kg bw/day) ^c	MOE ^d	
Indoor Environments	OtM Perimeter/Spot/Bedbug ^e (Coarse and Pin Stream)	Soft Surface	0.480	4	0.0060	730
		Hard Surface	0.720	2	0.0045	980
	OtM Crack and Crevice ^e	Soft Surface	0.048	4	0.0006	7300
		Hard Surface	0.072	2	0.0005	9800

OtM = object-to-mouth; ET = exposure time; MOE = margin of exposure; NOAEL = No Observed Adverse Effect Level

^a Object Residue (µg/cm²) = Deposited residue (µg/cm²) × 50th percentile values for Fraction of residue transferred (2% for soft surfaces and 3% for hard surfaces).

^b Exposure time based on standard values from the USEPA Residential SOPs (2012).

^c Where Oral Dose (mg/kg bw/day) = [Object Residue (µg/cm²) × 0.001 mg/µg × Surface Area of object mouthed (10 cm²/event) × (Exposure Time (hr) × Replenishment Intervals (4/hr)) × (1 - (1 - Saliva Extraction Factor (0.48))^{50th percentile of Number events per hour (12)/Replenishment Intervals (4/hr)})] / Body Weight (11 kg).

^d Oral MOE = NOAEL/Oral exposure. Based on a NOAEL of 4.4 mg/kg bw/day from an oral 2-year rat toxicity study and a target MOE of 300.

^c Based on the maximum domestic-class application rate for bedbug (0.24 g a.i./m²).

Appendix VII Revised aggregate exposure and risk assessment for pyrethrins

Details for the revised aggregate risk assessment are included in this appendix. Please refer to PRVD2020-08 for additional information.

The aggregate assessments were updated, as the underlying residential exposure assessment and outcomes were revised from PRVD2020-08. Results are summarized in Tables 1–3. Risks were acceptable for all scenarios provided that the mitigation measures considered for route- and scenario-specific assessments are implemented as noted in Appendix IV.

Table 1 Summary of co-occurring exposures

Scenario	Lifestage	Co-occurring Exposures ^a
Lawns and Turf ^b	Adult	Applicator Inhalation Exposure (Liquid Backpack) Dietary Exposure
	Children (1 to <2 years old)	Hand-to-mouth Exposure Dietary Exposure
Gardens and Trees ^{b, c}	Adult	Applicator Inhalation Exposure (Dust Shaker Can) Dietary Exposure
Outdoor Fogging/Misting Systems	Adult	Applicator Inhalation Exposure (OASS) Postapplication Inhalation Exposure (ABMS, OASS, Coils, Mosquito Abatement) Dietary Exposure
	Children (3 to <6 years old)	Postapplication Inhalation Exposure (ABMS) Object-to-Mouth Exposure (ABMS) Dietary Exposure
	Children (1 to <2 years old)	Postapplication Inhalation Exposure (OASS, Coils, Mosquito Abatement) Hand-to-Mouth Exposure (OASS, Mosquito Abatement) Dietary Exposure
Indoor Environments (Short-, Intermediate-term)	Adult	Applicator Inhalation Exposure (Dust Shaker Can) Postapplication Inhalation Exposure (Commercial Space Sprays) Dietary Exposure
	Children (1 to <2 years old)	Postapplication Inhalation Exposure (Commercial Space Sprays) Object-to-Mouth Exposure Dietary Exposure
Indoor Environments (Long-term) ^d	Children (1 to <2 years old)	Object-to-Mouth Exposure Dietary Exposure
Treated Pets ^b	Adult	Applicator Inhalation Exposure (Livestock Shampoo) Dietary Exposure
	Children (1 to <2 years old)	Hand-to-Mouth Exposure Dietary Exposure

ABMS = animal barn misting system; OASS = outdoor aerosol space sprays

^a Only exposure that had toxicological significance to the aggregate assessment are listed. For short-, intermediate-term exposure, there is no dermal aggregate endpoint. All scenarios were considered to be short-, intermediate-term exposure except for indoor environments, which also considered long-term exposure for bedbug applications.

^b No postapplication inhalation exposure is expected.

^c Only children (6 to <11 years old) are expected to conduct activities in gardens and trees; therefore, no incidental oral exposure is expected.

^d No adult aggregate assessment required as applicator inhalation exposure is not expected to be long-term and postapplication inhalation exposure to aerosols is considered to be short-term and postapplication inhalation

exposure to vapours is not expected due to the vapour pressure of pyrethrins.

Table 2 Short- to intermediate-term aggregate exposure and risk assessment

Scenario	Lifestage ^a	Total Inhalation Exposure (mg/kg bw/day) ^b	Inhalation MOE ^c	Incidental Oral Exposure (mg/kg bw/day) ^d	Chronic Dietary Exposure (mg/kg bw/day) ^e	Total Oral Exposure (mg/kg bw/day) ^f	Oral MOE ^c	Aggregate MOE ^g
Lawns and Turf	Adult	1.47×10^{-4}	55 000	-	0.001672	0.001672	12 000	9800
	Children (1 to <2 years old)	-	-	0.0030	0.005231	0.0083	2400	2400 ^h
Gardens and Trees	Adult	4.42×10^{-3}	1800	-	0.001672	0.001672	12 000	1600
Outdoor Fogging/Misting Systems	Adult – OASS ⁱ	5.45×10^{-3}	1500	-	0.001672	0.001672	12 000	1300
	Children (3 to <6 years old) – ABMS	1.69×10^{-3}	4800	0.0043	0.004886	0.0092	2200	1500
	Children (1 to <2 years old) – OASS ⁱ	5.48×10^{-4}	15 000	0.0038	0.005231	0.0090	2200	1900
Indoor Environments	Adult	0.0063	1300	-	0.001672	0.001672	12 000	1200
	Children (1 to <2 years old)	0.0094	870	0.0216	0.005231	0.0269	740	400
Treated Pets	Adult	4.51×10^{-4}	18 000	-	0.001672	0.001672	12 000	7200
	Children (1 to <2 years old)	-	-	0.0011	0.005231	0.0063	3200	3200 ^h

OASS = outdoor aerosol space sprays; ABMS = animal barn misting systems; MOE = margin of exposure; NOAEL = No Observed Adverse Effect Level

^a Only the scenarios resulting in the highest exposure for adults and children are shown for each residential scenario.

^b Total Inhalation exposure (mg/kg bw/day) = Handler inhalation exposure (for adults) + Postapplication inhalation exposure. Highest inhalation exposure scenarios were used for the aggregate risk assessment.

^c MOE = NOAEL (mg/kg bw/day)/Exposure (mg/kg bw/day). Short- and intermediate-term aggregate endpoints for oral and inhalation exposure are 20 mg/kg bw/day and 8.1 mg/kg bw/day, respectively. Target MOE is 300.

^d Incidental oral exposure used for aggregate risk assessment is highest exposure of either hand-to-mouth or object-to mouth.

^e Chronic dietary exposure based on updated information.

^f Total Oral Exposure (mg/kg bw/day) = Incidental oral exposure (for children) + Chronic dietary exposure.

^g Aggregate MOE = $1/((1/\text{MOE}_{\text{inhalation}}) + (1/\text{MOE}_{\text{oral}}))$, unless otherwise indicated. Target MOE = 300.

^h Aggregate MOE = Aggregate oral NOAEL (20 mg/kg bw/day)/Total Oral Exposure (mg/kg bw/day).

ⁱ Scenario that addresses all other Outdoor Fogging/Misting Systems scenarios, for the indicated lifestage.

Table 3 Long-term aggregate exposure and risk assessment

Scenario	Lifestage	Incidental oral exposure (mg/kg bw/day) ^a	Chronic dietary exposure (mg/kg bw/day) ^b	Total oral exposure (mg/kg bw/day) ^c	Aggregate MOE ^d
Indoor Environments	Children (1 to <2 years old)	0.0060	0.005231	0.0112	390

MOE = margin of exposure; NOAEL = No Observed Adverse Effect Level

^a Incidental oral exposure used for aggregate risk assessment was object-to mouth since it was a higher value than hand-to-mouth.

^b Chronic dietary exposure based on updated information.

^c Total Oral Exposure (mg/kg bw/day) = Incidental Oral exposure + Chronic dietary exposure.

^d MOE = NOAEL (mg/kg bw/day)/Exposure (mg/kg bw/day). Long-term aggregate endpoint for incidental oral of 4.4 mg/kg bw/day was used. Target MOE = 300.

Appendix VIII Revised environmental risk assessment for pyrethrins

Details for the revised risk assessment are included in this appendix. Please refer to PRVD2020-08 for additional information.

The environmental risk assessment has been revised to take into account a higher application rate for mosquito control on outdoor vegetation. The maximum, cumulative application rate evaluated in PRVD2020-08 for mosquito control was 35 g a.i./ha, up to 26 applications per season with 7-day application intervals. A much higher rate (176 g a.i./ha, up to 24 applications per season with 7-day application intervals) was identified as a result of comments received during the consultation period for PRVD2020-08. The higher rate represents approximately a 5-fold increase compared to the rate assessed in PRVD2020-08. Using this new use information, environmental exposure for mosquito control uses was re-calculated for terrestrial (Table 1) and aquatic (Table 2) habitats.

Table 1 Terrestrial exposure for domestic outdoor areas resulting from application by thermal aerosol generator

Crop	Maximum single application rate (g a.i./ha)	Maximum no. of applications per season	Minimum Interval between applications (days)	Maximum Seasonal Application Rate (g a.i./ha)	Maximum cumulative Application rate accounting for 4.74 day DT ₅₀ in soil (mg a.i./kg soil)
For mosquito control around outdoor areas	176	24	7	4,224	2.93

Table 2 Screening Level pollinator and beneficial insect EECs for Reg. No. 23564 (for pollinators: using maximum single application rate = 176 g a.i./ha; for beneficial insects using a cumulative exposure of 458 g a.i./ha)

Application method/Use	Maximum single application (g a.i./ha)	Adult acute contact EEC (ug a.i./bee/day)	Adult acute oral EEC (ug a.i./bee/day)	Beneficial insects (g a.i./ha)
Domestic – thermal aerosol generator	176	0.42	5.0	458

For the bird and wild mammal risk assessment, it was assumed that 100% of the ULV spray from a thermal aerosol generator would be deposited directly onto vegetation and other food sources. A default 10-day foliar half-life was applied to the EEC for all food items, resulting in a cumulative application rate of 458 g a.i./ha. Results are presented in Tables 3 and 4.

Table 3 Screening Level Exposure Estimates for Birds for Reg. No. 23564 (assuming 100% deposition to vegetation and food sources from 24 applications of maximum single application rate of 176 g a.i./ha at 7-day intervals with a default 10-day foliar half-life for cumulative application rate of 458 g a.i./ha)

	Feeding guild (food item)	EDE (mg ai/kg bw)
Small bird (0.02 kg)		
Acute	Insectivore	37.27
Reproduction	Insectivore	37.27
Medium-sized bird (0.1 kg)		
Acute	Insectivore	29.08
Reproduction	Insectivore	29.08
Large-sized bird (1 kg)		
Acute	Herbivore (short grass)	18.79
Reproduction	Herbivore (short grass)	18.79

Table 4 Screening Level Exposure Estimates for Wild Mammals for Reg. No. 23564 (assuming 100% deposition to vegetation and food sources from 24 applications of maximum single application rate of 176 g a.i./ha at 7-day intervals with a default 10-day foliar half-life for cumulative application rate of 458 g a.i./ha)

	Feeding guild (food item)	EDE (mg ai/kg bw)
Small mammal (0.015 kg)		
Acute	Insectivore	21.44
Reproduction	Insectivore	21.44
Medium-sized mammal (0.035 kg)		
Acute	Insectivore	41.57
Reproduction	Insectivore	41.57
Large-sized mammal (1 kg)		
Acute	Herbivore (short grass)	22.21
Reproduction	Herbivore (short grass)	22.21

Table 5 Screening level exposure estimates for aquatic organisms for Reg. No. 23564 (7.84-day aquatic half-life assuming 100% deposition to water surfaces: freshwater - 24 applications of maximum single application rate of 176 g a.i./ha at 7-day intervals: marine 1 application of 176 g a.i./ha)

Use Site	Maximum single application rate (g a.i./ha)	Maximum no. of applications per season	Minimum Interval between applications (days)	Maximum cumulative Application rate accounting for 7.84 day DT ₅₀ in water (g a.i./ha)	Water depth (cm)	Freshwater EECs (mg a.i./L)	Marine EECs (mg a.i./L)
Outdoor Domestic Sites, Ornamentals, Lawns, Groundcovers from a thermal aerosol generator	176	24	7	9155	15	6.1	N/A
					80	1.14	0.022

Risk quotients were re-calculated using a screening level approach in which it was assumed the maximum application rate of 176 g a.i./ha would be applied 24 times per season using a thermal aerosol generator with the minimum interval of 7 days between applications, with the exception of risk to pollinators and marine organisms. For these exceptions, it was assumed that the maximum application of 176 g a.i./ha would be applied only once. Risk quotients and EECs are presented in Table 6. Risk was indicated for all non-target organisms with the exception of earthworms, small and medium-sized birds and all sizes of mammals on a reproductive basis, and marine diatoms. The highest risk quotients noted for terrestrial organisms were pollinators (33.3), aquatic organisms, amphibians (17 941) and lobsters at larval stage IV (2200).

Table 6 Revised screening level risk characterization for domestic mosquito control use – from thermal aerosol generator (Reg. No. 25364) 24 application, 7 day intervals at maximum application of 176 g a.i./ha for non-target organisms with the exception of pollinators and marine organisms in which EECs are calculated based on a single, maximum application rate of 176 g a.i./ha

PMRA#	Test substance	Species	Type of test	Toxicity endpoint	Uncertainty factor	Toxicity endpoint adjusted for uncertainty	EECs	Risk quotient
Terrestrial organisms								
EFSA	Technical grade active ingredient	<i>Eisenia foetida</i>	Acute 14-d	LC ₅₀ = 47.45 mg a.i./kg soil	2	24	0.12	0.005
EFSA	Technical grade active ingredient	<i>Eisenia foetida</i>	8 week chronic	NOEC = 0.5 mg a.i./kg soil	1	0.5	0.12	0.24
2134300	Technical grade active ingredient	Honey bee (<i>Apis mellifera</i>)	48 hr Acute contact	0.022 µg a.i./bee	1	0.022	0.42	19.09
2630000	Technical grade active ingredient	Honey bee (<i>Apis mellifera</i>)	48 hr acute oral	0.15 ug a.i./bee	1	0.15	5	33.33
2837888	CPY8EC414 (2% pyrethrins)	Aphid parasitoid (<i>Aphidius rhopalosiphi</i>)	Contact	LR ₅₀ = 35.6 g a.i./ha (35,600 mg a.i./ha)	1	35.6	457	12.87
2134301	Technical grade active ingredient	Bobwhite quail	Acute oral	LD ₅₀ = 250 mg a.i./kg bw/day	10	25	32.27	1.29
2958242	Technical grade active ingredient	Mallard duck	Reproductive	NOEC = 2000 ppm a.i. = 266 mg a.i./kg bw/day		266	37.27	0.14
2563931	Technical grade active ingredient	Rat	Acute oral	LD ₅₀ (females) = 700 mg a.i./kg bw; LD ₅₀ (males) = 2140 mg a.i./kg bw	10	70	41.57	0.59
2563931	Technical grade active ingredient	Rat	Reproductive	NOAEL = 6.4 mg a.i./kg bw/day; LOAEL = 65 mg a.i./kg bw/day	N/A	6.4	41.57	6.5

PMRA#	Test substance	Species	Type of test	Toxicity endpoint	Uncertainty factor	Toxicity endpoint adjusted for uncertainty	EECs	Risk quotient
Aquatic organisms - Freshwater								
2134308	Technical grade active ingredient	<i>Daphnia magna</i>	96-h Acute	EC ₅₀ = 0.0116 mg a.i./L	2	0.0058	0.05	8.6
2134309	test substance was Pyrenone Crop spray formulated with 6.02% total pyrethrins and 60.25% piperonyl butoxide	<i>Daphnia magna</i>	48-h acute toxicity	EC ₅₀ = 0.0067 mg a.i./L	2	0.0034	0.05	14.7
2134303	Technical grade active ingredient	<i>Daphnia magna</i>	Chronic (Life-cycle toxicity)	NOEC = 0.86 ug a.i./L based on cumulative no. of off-spring	N/A	0.00086	0.05	58.1
2837888	Technical grade active ingredient	Midge, (<i>Chironomus riparius</i>)	28-d static	NOEC = 0.0097 mg a.i./L	N/A	0.0097	0.05	5.2
2134306	Technical grade active ingredient	Rainbow trout (<i>Oncorhynchus mykiss</i>)	96-h Acute	96-h LC ₅₀ = 0.0051 mg a.i./L	10	0.00051	0.05	98.0
2134307	Technical grade active ingredient plus PBU	Rainbow trout (<i>Oncorhynchus mykiss</i>)	96-h Acute	96-h LC ₅₀ = 0.0034 mg a.i./L	10	0.00034	0.05	147.1
2134304	Technical grade active ingredient	Bluegill Sunfish (<i>Lepomis macrochirus</i>)	96-h Acute	96-h LC ₅₀ = 0.0106 mg a.i./L	10	0.00106	0.05	47.2
2134305	Technical grade active ingredient plus PBU	Bluegill Sunfish (<i>Lepomis macrochirus</i>)	96-h Acute	96-h LC ₅₀ = 0.0034 mg a.i./L	10	0.00034	0.05	147.1

PMRA#	Test substance	Species	Type of test	Toxicity endpoint	Uncertainty factor	Toxicity endpoint adjusted for uncertainty	EECs	Risk quotient
None	Used Rainbow trout acute endpoint	Amphibians	-	96-h LC ₅₀ = 0.0034 mg a.i./L	10	0.00034	0.25	735.3
2134302	Technical grade active ingredient	Fathead Minnow (<i>Pimphales promelas</i>)	Early life-stage	NOEC = 1.9 µg a.i./L based on hatchling success, growth and mean wet weight.	N/A	0.0019	0.05	26.3
2929913	(TEP; 5.9% PYR + 56.6% PBO)	Duckweed (<i>Lemna gibba</i>)	7-day	EC ₅₀ = 1.23 mg a.i./L	2	0.615	0.05	0.1
2929913	(TEP; 5.9% PYR + 56.6% PBO)	Freshwater Green algae, (<i>Pseudokirchneriella subcapitata</i>)	96-h	EC ₅₀ = 0.105 mg a.i./L	2	0.05	0.05	1
2929913	(TEP; 5.9% PYR + 56.6% PBO)	Freshwater Cyanobacteria (<i>Anabaena flos-aquae</i>)	96-h	EC ₅₀ > 0.460 mg a.i./L	2	0.023	0.05	0.22
2929913	(TEP; 5.9% Pyr + 56.6% PBO)	Freshwater Diatom (<i>Navicula pelliculosa</i>)		EC ₅₀ = 0.210 mg a.i./L	2	0.105	0.05	0.5
Aquatic organisms – Marine - Single application of 176 g a.i./ha								
2134310	Technical grade active ingredient	Sheepshead Minnow (<i>Cyprinodon variegatus</i>)	96-h Acute toxicity	LC ₅₀ = 0.016 mg a.i./L	10	0.0016	0.022	13.75
2134311	Pyrenone Crop Spray formulated with PYR + PBU	Sheepshead Minnow (<i>Cyprinodon variegatus</i>)	96-h Acute toxicity	LC ₅₀ = 0.0038 mg a.i./L	10	0.00038	0.022	57.89
2134312	Technical grade active ingredient	Eastern Oyster (<i>Crassostrea virginica</i>)	96-h – Shell deposition	96-hour LC ₅₀ = 0.086 mg ai./L	10	0.0086	0.022	2.56

PMRA#	Test substance	Species	Type of test	Toxicity endpoint	Uncertainty factor	Toxicity endpoint adjusted for uncertainty	EECs	Risk quotient
2134313	Pyrenone Crop Spray formulated with PYR + PBU	Eastern Oyster (<i>Crassostrea virginica</i>)	96 h – Shell deposition	96-hour LC ₅₀ = 0.026 mg ai./L	2	0.0013	0.022	1.7
2134314	Technical grade active ingredient	Mysid shrimp (<i>Mysidopsis bahia</i>)	96-h Acute toxicity	96-hour LC ₅₀ = 0.0014 mg ai./L	2	0.0007	0.022	31.4
2134315	Pyrenone Crop Spray formulated with PYR + PBU	Mysid shrimp (<i>Mysidopsis bahia</i>)	96-h Acute toxicity	96-hour LC ₅₀ = 0.00014 mg ai./L	2	0.00007	0.022	314.3
2929913	(TEP; 5.9% PYR + 56.6% PBO)	Saltwater Diatom (<i>Skeletonema costatum</i>)	96-h Acute toxicity	96-hour LC ₅₀ = 0.128 mg ai./L	2	0.064	0.022	0.34
2991298	Vet Kem Flea and Tick Pump Spray (0.06% pyrethrins + 0.6% piperonyl butoxide)	American lobster (<i>Homarus americanus</i>) Larval Stage I	48-h Acute toxicity	48-hour EC ₅₀ = 0.0044 mg a.i./L	2	0.00022	0.022	100
2991298	Vet Kem Flea and Tick Pump Spray (0.06% pyrethrins + 0.6% piperonyl butoxide)	American lobster (<i>Homarus americanus</i>) Larval Stage II	48-h Acute toxicity	48-hour EC ₅₀ = 0.00027 mg a.i./L	2	0.0000135	0.022	163

PMRA#	Test substance	Species	Type of test	Toxicity endpoint	Uncertainty factor	Toxicity endpoint adjusted for uncertainty	EECs	Risk quotient
2991298	Vet Kem Flea and Tick Pump Spray (0.06% pyrethrins + 0.6% piperonyl butoxide)	American lobster (<i>Homarus americanus</i>) Larval Stage III	48-h Acute toxicity	48-hour EC ₅₀ = 0.00014 mg a.i./L	2	0.00007	0.022	314.3
2991298	Vet Kem Flea and Tick Pump Spray (0.06% pyrethrins + 0.6% piperonyl butoxide)	American lobster (<i>Homarus americanus</i>) Larval Stage IV	48-h Acute toxicity	48-hour EC ₅₀ = 0.00010 mg a.i./L	2	0.00005	0.022	440

Bolded values indicate an exceedance of the level of concern.

PBO = Piperonyl Butoxide

Appendix IX Information considered in the updated human health assessment following the publication of PRVD2020-08

Note that the following includes only references that were not previously considered in PRVD2020-08.

Information considered in the updated toxicological assessment

Additional information considered

Published Information

PMRA document number	Reference
3279521	Kaufmann, W., Bader, R., Earnst, H., Harada, T., Hardisty, J. and Rosenbruch, M. 2009. 1st International ESTP Expert Workshop: Larynx squamous metaplasia, A re-consideration of morphology and diagnostic approaches in rodent studies and its relevance for human risk assessment. <i>Experimental and Toxicologic Pathology</i> , 61: 591-603.
3242164	WHO. 2017. World Health Organization Classification of Head and Neck Tumours. 4 th Edition, Volume 9. El-Naggar-A.K. et al. (ed). IARC Press, 2017.
3242165	Azab, M., Khabour, O., Alzoubi, K., Quttina, M. and Nassar, L. 2016. Assessment of genotoxicity of pyrethrin in cultured human lymphocytes. <i>Drug and Chemical Toxicology</i> . 40:251-255.
3242169	Harkema, J.R., Nikula, K.J. and Haschek, W.M. 2018. Chapter 14. Respiratory System. In: <i>Fundamentals of Toxicologic Pathology</i> . 3rd Edition. Wallig, M., et al., Ed. Academic Press.
3267103	US EPA. 2009. A Review of the Relationship Between Pyrethrins, Pyrethroid Exposure and Asthma and Allergies. Office of Pesticide Programs. Dated September 2009.
3267104	US EPA. 2017. Pyrethrins: Draft Human Health Risk Assessment for the Registration Review. Office of Chemical Safety and Pollution Prevention. Dated June 29, 2017.
3267105	US EPA. 2021a. Pyrethrins: Response to Comments on HED's Draft Health Risk Assessment in Support of Registration Review. Office of Chemical Safety and Pollution Prevention. Dated July 1, 2021.
3267106	US EPA. 2021b. Pyrethrins: Proposed Interim Registration Review Decision Case Number 2580. Pesticide Re-Evaluation Division. Dated June 30, 2021.
3272628	EFSA. 2017. Outcome of the Consultation with Member States, the Applicant and EFSA on the Pesticide Risk Assessment for Pyrethrins in Light of Confirmatory Data. European Food Safety Authority Technical Report Approved April 11, 2017.

Information considered in the updated dietary assessment
List of studies/Information submitted by registrant

PMRA Document Number	Reference
3206900	Pyrethrin I Confined Rotational Crop Study with One Radiolabel. David R. Dohn and Jack Chu. November 30, 2011. PTRL West Report No. 2047W-1. MRID 48677301.

Information considered in the updated occupational and non-occupational assessment**List of studies/Information submitted by registrant**

PMRA Document Number	Reference
3321433	Boatwright, T. 2009. A Study for Measurement of Air Concentration of Cyfluthrin and Prallethrin Following Application of KJM (Notebook No. 16543P163-2). Golden Pacific Laboratories, LLC (GPL). Study Number: 080290. Feb.20, 2009.

List of studies/Information submitted by task force

PMRA document number	Reference
2812971	Acedo, K.P. 2016. Determination of Concentration of Prallethrin, Piperonyl Butoxide, and MGK-264 in Air and on Surfaces Following the Use of Multicide® Flying Insect Killer 27471. Feb.3, 2016. Golden Pacific Laboratories. GLP Study No 130507. McLaughlin Gormley King Co. (MGK).