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Re-evaluation Decision

RVD2025-04

Abamectin and Its Associated End-use Products

Final decision

(publié aussi en français)

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Re-evaluation decision for abamectin 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) to ensure that they meet current health and environmental standards and have value. The re-evaluation considers data and information from pesticide manufacturers, published scientific reports and other regulatory agencies, as well as comments received during public consultations. Health Canada applies internationally accepted risk assessment methods as well as current risk management approaches and policies. More details, on the legislative framework, risk assessment and risk management approach, are provided under the section of Evaluation approach of this document.

Abamectin is an acaricide/insecticide registered for use on a wide-range of outdoor field-grown fruit and vegetable crops, outdoor ornamentals, greenhouse vegetables and greenhouse ornamentals for the control or suppression of a variety of agricultural pests such as mites, sawflies, moths, thrips, leafminers, psyllids, aphids and certain beetles. It is also registered for commercial and domestic indoor and/or outdoor structural use to control cockroaches and ants.

Currently registered products containing abamectin can be found in the Pesticide Product Information Database and in Appendix I. The Proposed Re-evaluation Decision PRVD2023-01, *Abamectin and Its Associated End-use Products*¹ containing the evaluation of abamectin and proposed decision, underwent a 90 day consultation period ending on 29 May 2023. PRVD2023-01 proposed continued registration of abamectin and all associated end-use products provided new risk mitigation measures are put in place. The proposed human health mitigation measures included cancellation of greenhouse ornamentals grown for cut flower production, additional personal protective equipment for agricultural workers, a limit to the amount of abamectin handled per day and restricted-entry intervals for several crops/uses. The proposed environmental mitigation measures included additional precautionary label statements, spray buffer zones, measures to reduce exposures to bees, the use of vegetative filter strips and restriction of the maximum application rate for outdoor uses.

Health Canada received comments (and information) relating to the health, environmental and value assessments. 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 dietary, occupational and environmental risk assessments and an updated value review (see Science evaluation update), and resulted in changes to the proposed re-evaluation decision as described in PRVD2023-01, such as retaining the use on greenhouse ornamentals grown for cut flowers.

¹ "Consultation statement" as required by subsection 28(2) of the *Pest Control Products Act*.

A reference list of information used as the basis for the proposed re-evaluation decision is included in PRVD2023-01, and further information used in the re-evaluation decision (RVD2025-04) is listed in Appendix XI 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 PRVD2023-01 and the information set out in Appendix XI herein.

This document presents the final re-evaluation decision² for the re-evaluation of abamectin, 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 abamectin that are registered in Canada are subject to this re-evaluation decision.

Re-evaluation decision for abamectin

Health Canada has completed the re-evaluation of abamectin. Under the authority of the *Pest Control Products Act*, Health Canada has completed all required evaluations and consultations and has determined that the registration of products containing abamectin is required to be amended, in accordance with paragraph 21(2)(a) of the *Pest Control Products Act*. An evaluation of available scientific information respecting the health and environmental risks and value of abamectin found that all uses of abamectin products meet current standards for protection of human health and the environment and have acceptable value when used according to the amended conditions of registration which includes new mitigation measures. Label amendments, as summarized below and listed in Appendix X, 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 any revised/updated label statements and/or mitigation measures, as a result of the re-evaluation of abamectin, are summarized below. Refer to Appendix X for details.

Human health

The following risk-reduction measures are required for continued registration of abamectin in Canada:

To protect workers entering treated areas from occupational exposure, the following risk-reduction measures are required:

- Restricted-entry intervals were updated for some activities.

The following label improvements are required to meet current standards:

- Updated personal protective equipment label statements as per current labelling standards.

² “Decision statement” as required by subsection 28(5) of the *Pest Control Products Act*.

- Updated precautionary statements to minimize exposure at residential sites.

The following label restrictions was added in response to comment from the registrant:

- Prohibit the application of abamectin via handheld airblast/mistblower.

Environment

To protect the environment, the following risk-reduction measures are required for continued registration of abamectin in Canada:

- Label statements to inform users of potential risks to bees, beneficial arthropods, birds, small wild mammals, and aquatic organisms.
- Spray buffer zones to reduce the risk to aquatic habitats from spray drift.
- Label restrictions to reduce the exposure to bees.
- Construction and maintenance of a 10 m wide vegetative filter strip to reduce the risk to aquatic organisms from runoff.
- Reduction of the maximum cumulative application rate to 38.2 g a.i./ha/per year for outdoor uses.

Implementation of the re-evaluation decision

Regulatory Directive DIR2018-01, *Policy on Cancellations and Amendments Following Re-evaluation and Special Review* provides information and general timelines regarding the implementation of post-market decisions, (for example, up to 24-month timeline for label amendments and up to 36-month phase-out timeline for cancelled registrations), and *Information Note: update on implementation of post-market decisions* provides additional information on phase-out measures for post-market decisions that include cancellations. The post-market decision considers potential health and environmental risks regarding the use of the pest control product, and its value, when establishing the implementation timelines.

The health and environmental considerations for the implementation timeline for this final decision are outlined below.

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.

Potential and relative health risks are considered acceptable during the general 2-year implementation period unless there is evidence from incident reports or other sources of real-world post-market surveillance data suggesting that there are adverse health effects occurring as a result of the use of the product(s) according to the currently approved label/use conditions. Taking into consideration these factors, the general 2-year implementation timeline for label amendments for abamectin is considered appropriate from a human health perspective. Therefore, the required label updates will be implemented within 24 months following the publication of the re-evaluation decision document.

Environmental considerations

Registered labels for products containing abamectin currently include all the precautionary statements that were determined to be required by the environmental assessment for the re-evaluation. Buffer zones were recalculated based on the reduction of the maximum cumulative application rate to 38.2 g a.i./ha and registrant's proposed change of the spray quality size from American Society of Agricultural and Biological Engineers (ASABE) Fine to ASABE Medium spray quality. The revised spray buffer zones are smaller or within the same range as buffer zones currently on product labels. Therefore, the required environmental precautionary statements and mitigative measures on product labels will be protective during the general 2-year implementation timeline for label amendments for pest control products containing abamectin, and environmental risks are considered to be acceptable.

Taking into consideration these factors, the general 2-year implementation timeline for label amendments for pest control products containing abamectin is considered appropriate from a human health and environmental perspective.

Amendment timeframe

Based on the above considerations, the required amendments (mitigation measures and label updates) for pest control products containing abamectin must be implemented within 24-months from the date of this decision document.

Refer to Appendix I for details on specific products impacted by this decision.

Next steps

To comply with this decision, the required amendments (mitigation measures and label updates) must be implemented on all product labels 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.

Refer to Appendix I for details on specific products impacted by this decision.

Other information

Any person may file a notice of objection³ regarding this decision on abamectin 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 and Pest Management Section of the Canada.ca website (Public Engagement Portal - Public Engagement Forms - Notice of Objection) or contact the PMRA's Pest Management Information Service.

The relevant confidential test data on which the decision is based (as referenced in PRVD2023-01 and in Appendix XI of this document) are available for public inspection, upon application, in the PMRA's Reading Room. For more information, please contact the PMRA's Pest Management Information Service.

³ 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* (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 the human health and 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 preamble 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*.⁴ 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.⁵

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 SPN2008-01.⁶

Assessments estimate potential health risks to defined populations⁷ 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. 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.

⁴ PMRA Guidance Document, *A Framework for Risk Assessment and Risk Management of Pest Control Products*

⁵ *Health Canada Decision-Making Framework for Identifying, Assessing, and Managing Health Risks* - August 1, 2000

⁶ Science Policy Note: *The Application of Uncertainty Factors and the Pest Control Products Act Factor in the Human Health Risk Assessment of Pesticides*

⁷ *Consideration of Sex and Gender in Pesticide Risk Assessment*

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.

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*.⁸

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.

⁸ PMRA Regulatory Directive DIR2018-01 *Policy on Cancellations and Amendments Following Re-evaluation and Special Review*

Science evaluation update

1.0 Introduction

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

2.0 Revised health risk assessment

2.1 Toxicology summary

No comments were received on the toxicological assessment during the consultation period. Therefore, there are no changes from the PRVD2023-01.

2.2 Dietary exposure and risk assessment

No comments relating to the dietary risk assessment were received during the public consultation period for PRVD2023-01. The dietary assessment was updated for the re-evaluation decision because there were significant changes required to the abamectin use pattern based on the environmental risk assessment, resulting in revised modelled estimated environmental concentrations (EECs) for drinking water. Newly available food monitoring data were also reviewed and incorporated. The dietary risks from exposure to abamectin through food and drinking water were shown to be acceptable for all subpopulations (Appendix IV). Therefore, this decision is consistent with the proposed re-evaluation decision stated in PRVD2023-01.

2.3 Occupational and non-occupational exposure and risk assessment

In PRVD2023-01, risks were shown to be acceptable with proposed mitigation measures, such as increased personal protective equipment, increased restricted-entry intervals, cancellation of greenhouse ornamentals grown for cut flower production, and limiting the amount handled per day for certain application equipment. As a result of the information and comments received during the consultation period for PRVD2023-01, many of the outcomes of the occupational exposure and risk assessment have changed.

During the consultation period for the proposed re-evaluation decision, information was submitted to Health Canada indicating that abamectin is not applied using handheld airblast/mistblower equipment. Due to this, the occupational mixer, loader, applicator assessment for handheld airblast/mistblowers was removed from the occupational assessment and a label statement prohibiting use of handheld airblast/mistblower equipment will be added to the abamectin labels.

The occupational postapplication assessment for the outdoor uses of abamectin was updated to reflect the environmental risk mitigation measure to limit the maximum cumulative application rate to 38.2 g a.i./ha/year. As a result, some proposed restricted-entry intervals were updated.

The occupational postapplication assessment for the greenhouse uses of abamectin was also updated to include a greenhouse dislodgeable foliar residue study. When considering these new data, risks were shown to be acceptable for all greenhouse postapplication activities with a restricted-entry interval of 12 hours. Therefore, the use of abamectin on greenhouse ornamentals grown for cut flower production will not be cancelled.

There were no updates required to the residential risk assessment and risks continue to be acceptable as described in PRVD2023-01.

Therefore, the registered uses of abamectin are acceptable for continued registration provided the mitigation outlined in Appendix X are followed. Health Canada responses to specific comments are presented in Appendix III. Details of the final occupational and residential risk assessments are presented in Appendix V.

2.4 Aggregate exposure and risk assessment

Aggregate exposure is the total exposure to a single pesticide that may occur from dietary (food and drinking water), residential and other non-occupational sources, and from all known plausible exposure routes (oral, dermal, and inhalation). The aggregate exposure and risk assessment for abamectin was revised to include the updated dietary exposures (food and drinking water exposures) and the non-occupational (residential) postapplication dermal exposures from commercial application to apple and pear trees in residential areas. Aggregate risks were shown to be acceptable for abamectin. Details of the final aggregate assessment are presented in Appendix VI.

2.5 Cumulative assessment

Abamectin belongs to the avermectin class of insecticides and shares a similar toxicological profile with another member of this class, emamectin benzoate. The findings related to the cumulative assessment for abamectin were previously summarized in PRVD2023-01. No comments related to the cumulative risk assessment were received during the consultation period. However, a review of the newer food monitoring data was conducted to ensure that there are no changes to previous conclusions. Monitoring results from the Canadian Food Inspection Agency (CFIA) (2012–2021) and the United States Department of Agriculture (USDA) Pesticide Data Program (PDP) (2014–2023) data on abamectin and emamectin are consistent with the results in the proposed re-evaluation decision and show <1% positive detects (in other words, 0.06% detects in >175 000 samples). Therefore, cumulative risks from potential co-exposure to abamectin and emamectin are still acceptable and this decision is consistent with the proposed re-evaluation decision (PRVD2023-01).

2.6 Health incident reports

Since the publication of PRVD2023-01 (in other words, from 2 August 2022 to 19 November 2024), 4 human and 4 domestic animal incidents involving abamectin were submitted to the PMRA.

Overall, the patterns of exposure during product use (in other words, personal protective equipment not worn) and the mainly minor adverse effects (in other words, minor skin, respiratory and general effects) following exposure to abamectin, as noted in these incidents, were similar to the previous review of human incidents conducted for PRVD2023-01. Domestic animals were exposed by accidental ingestion of abamectin in ant and/or cockroach baits similar to what was noted in PRVD2023-01.

The adverse effect and exposure trends noted in the current review of abamectin incidents received following the PRVD publication is similar to that outlined in PRVD2023-01. No additional health concerns were identified following this incident report review. Labels of abamectin products should be updated with the appropriate general label improvement and precautionary statements to minimize exposure following the use of the products. Although the statement “Keep out of reach of children and domestic animals” was proposed, Health Canada accepts S.C. Johnson’s recommendation to change the statement to “Keep out of reach of children and pets”.

3.0 Revised environmental risk assessment

The environmental risk assessment for abamectin was updated to:

- incorporate the risk mitigation measure proposed in PRVD2023-01 (reduction of the maximum cumulative application rate from 136.8 g a.i./ha to 38.2 g a.i./ha),
- consider new information on birds and freshwater invertebrates provided by the registrant during the consultation period, and;
- change spray droplet size for field sprayer applications to Medium rather than Fine, as requested by the registrant.

The updated risk assessment indicates potential risks to non-target terrestrial organisms (bees, beneficial arthropods, birds and mammals) and all aquatic organisms (except algae).

New information on chronic exposure of freshwater *Daphnia magna* to abamectin provided a more sensitive endpoint that shows higher risks to *Daphnia* at the reduced maximum cumulative rate comparable to risks at the registered rate. The new information on birds did not result in a change to the risk profile.

Risks to aquatic organisms at the reduced maximum application rate can be mitigated by the use of spray buffer zones at the time of application to protect nearby aquatic habitats from spray drift and by the construction and maintenance of a mandatory 10 m vegetative filter strip to protect aquatic organisms from runoff. Risks to terrestrial organisms are acceptable with label statements required to indicate hazards to bees, beneficial arthropods, birds and small wild mammals and label restrictions to protect bees from exposure to abamectin.

3.1 Exposure from drinking water

3.1.1 Concentrations in drinking water

Previous modelling performed using the registered rates and use patterns indicated risks to the environment were not acceptable. Therefore, a reduction in the application rate along with other risk mitigation measures were required to make the risks acceptable. Current modelling is based on the reduced maximum annual cumulative application rate of 38.2 g a.i./ha for outdoor uses proposed in PRVD2023-01.

Estimated Environmental Concentrations (EECs) for a combined residue of abamectin and six of its transformation products – NOA 448111, NOA 448112, NOA 426289, NOA 445495, NOA 457464 and NOA 457465 – in potential sources of drinking water were calculated using the Pesticide in Water Calculator (PWC) model, version 1.52 for both groundwater and surface water.

For surface water, PWC calculates the amount of pesticide entering the water body by runoff and drift, and the subsequent degradation of the pesticide in the water system. EECs are calculated by modelling a total land area of 173 ha draining into a 5.3 ha reservoir with a depth of 2.7 m. Groundwater EECs are calculated by simulating leaching through a layered soil profile and reporting the average concentration in the 1 m below a water table.

Drinking water modelling follows a tiered approach consisting of progressive levels of refinement. Level 1 EECs are conservative values intended to screen out pesticides that are not expected to pose any concern related to drinking water. These are calculated using conservative inputs with respect to application rate, application timing, and geographic scenario. Level 2 EECs are based on a narrower range of application timing, methods, and geographic scenarios, and are not considered conservative values that cover all regions of Canada.

Modelling was performed at Level 1. EECs were calculated for several scenarios representing different regions of Canada; only the highest EECs from across these scenarios are reported.

All groundwater scenarios were run using 100 years of simulation in an attempt to achieve breakthrough of the combined residue into the 1 m below the water table, but breakthrough did not occur in any scenario using these reduced rates. As a result, groundwater EECs are not reported, as without breakthrough, the EECs are unreliable. It is of note that the surface water EECs were much larger than the groundwater EECs in the most recent previous drinking water modelling, so the human health assessment for drinking water was driven by the surface water EECs regardless.

Level 1 EECs for drinking water, expressed as parent equivalent, are reported in Appendix VII, Table 4.

3.2 Fate and behaviour in the environment

The fate and behaviour of abamectin, as described in PRVD2023-01 remains unchanged.

3.3 Environmental risk characterization

The environmental risk assessment for abamectin presented in PRVD2023-01 was conducted with the registered use pattern. The risk assessment identified unacceptable risks to non-target terrestrial organisms (such as bees, beneficial arthropods, birds and mammals) and aquatic organisms (freshwater and marine invertebrates, freshwater fish and amphibians). As such, label statements to communicate hazard to terrestrial and aquatic organisms, as well as use instructions to protect bees were required. To mitigate risks, the maximum cumulative application rate in a season was proposed to be reduced to 38.2 g a.i./ha along with the requirement for a 10 m wide vegetative filter strip.

Following the consultation on PRVD2023-01, updates to the environmental risk assessment include the incorporation of:

- A maximum cumulative application rate of 38.2 g a.i./ha for outdoor uses.
- New bird and aquatic invertebrate ecotoxicity information submitted by the registrant.
- Updated surface water modelling and EEC values.
- The Medium American Society of Agricultural and Biological Engineers (ASABE) spray quality for field sprayer applications, as requested by the registrant.
- New water monitoring data. This includes data from Health Canada's Canadian Water Monitoring Program for Pesticides (CWMPP).

The updated environmental risk assessment was conducted as described in the PMRA guidance document, Health Canada's Approach to Environmental Risk Assessment for Pest Control Products, to estimate the potential for adverse effects on non-target species. Environmental exposure and ecotoxicology information were integrated by comparing estimated environmental concentrations (EECs) to effects-based values used to assess risk (effects metrics). EECs were estimated using standard models that consider application rate(s) and chemical and environmental fate properties, including pesticide dissipation between applications, Appendix VII, Tables 1–6. The EECs used in this risk assessment are presented in Appendix VII, Tables 2–6. Acute and chronic ecotoxicological data for non-target terrestrial, freshwater and marine organisms are summarized in Appendix VII, Table 7. In the risk assessment, toxicity endpoints were adjusted via an uncertainty factor (UF) to calculate the effects metrics. The effects metrics account for potential differences in species sensitivity as well as varying protection goals (in other words, protection at the community, population, or individual level). The effects metrics and UFs used in the risk assessment are presented in Appendix VII, Table 8.

Initially, a screening-level risk assessment was performed to identify specific uses that do not pose a risk to non-target organisms. The screening-level risk assessment used simple methods, conservative exposure scenarios and sensitive effects metrics. A risk quotient (RQ) was calculated by dividing the EEC by the effects metric and was then compared to the level of concern (LOC). When the screening-level RQ was below the LOC, the risk was considered to be acceptable, and no further risk characterization was necessary. When the screening-level RQ was equal to or greater than the LOC, a refined risk assessment was performed to further characterize the risk. The screening-level risk assessments are presented in Appendix VII, Tables 9–11.

The refined risk assessment evaluated additional and more realistic exposure scenarios, including consideration of spray drift and runoff, as well as effects metrics that were more reflective of potential exposure in the environment. Refinements to the risk assessment continued until the risk was adequately characterized or the available data did not permit further refinements. The refined risk assessments are presented in Appendix VII, Tables 12–15.

3.3.1 Risks to terrestrial organisms

Soil-dwelling invertebrates

The risk assessment was revised to take into account the reduced maximum cumulative application rate of 38.2 g a.i./ha. At the screening level, risks were acceptable for earthworms and soil dwelling arthropods (Appendix VII, Table 9).

Pollinators

Risks to pollinators at the maximum single application rate of 25.8 g a.i./ha remain unchanged. To mitigate risks to pollinators, application to bee attractive crops will be restricted during the bloom period and spray drift to habitats close to application sites will be minimized. With the proposed mitigation, risks to pollinators are considered acceptable.

Predatory and parasitic arthropods

The risk assessment was revised to consider the reduced cumulative application rate and ASABE Medium spray droplet size. The EECs were determined for both on-field and off-field exposure using the lowest single application rate on apples (14.3 g a.i./ha) and the maximum cumulative application rate of 38.2 g a.i./ha (19.1 g a.i./ha $\times$ 2 applications at a 7-day interval). The EECs for the maximum application rate were estimated by adjusting the sum of the applications for dissipation between applications using the default foliar half-life value for vegetation (10 days). The off-field EECs were determined based on the percentage drift that is expected from the method of application (in other words, spray drift deposition of field sprayer with an ASABE Medium spray quality, and early- and late-season airblast applications: 6, 74, and 59%, respectively) at 1 m downwind from the site of application. The risk quotients from the screening-level risk assessment exceeded the LOC of 1 (RQ = 169.6–215.8 on-field; 10.2–159.7 off-field; Appendix VII, Table 9).

To further characterize the risks, abamectin EEC values for beneficial predatory and parasitic arthropods were adjusted to consider foliar interception. The exposure estimates assume deposition to a 2-dimensional structure. Therefore, the values can be corrected to take into account the 3-dimensional structure where only a certain fraction of spray is intercepted by the crop (for on-field exposure) or the off-field vegetation (for off-field exposure). For the on-field EECs, crop-specific foliar interception factors are applied to the application rate (for example, 40% interception at leaf development phase for sunflower and apples; 50% interception at the development of stolon/shoots and young plant parts for strawberries and potatoes). For off-field EECs, a vegetation distribution factor (0.1) was applied to the application drift rate.

Field sprayer applications

At the maximum cumulative application rate, the risk quotients from a refined assessment on *Aphidius rhopalosiphi* (the most sensitive arthropod) using an ASABE Medium spray quality exceeded the LOC (RQ = 1.3). The LOC was not exceeded at the minimum single application rate (Appendix VII, Table 12).

Airblast applications

At the maximum cumulative as well as the minimum single application rate, the RQ from airblast applications exceeded the LOC after refinement (RQs of 5.9–7.4 at the single minimum and RQs of 12.7–16 at the maximum cumulative application rate; Appendix VII, Table 12).

This result is consistent with observations in laboratory and field studies where application rates as low as 0.895 g a.i./ha, and simulated spray drift off-field of 0.023 g a.i./ha, produced >50% adverse effects on survival and reproduction of beneficial insects exposed to fresh residues of abamectin both on-field and off-field.

Overall, there is a potential risk to beneficial arthropods. A label statement informing users of the potential toxicity of abamectin to beneficial arthropods is required on product labels.

Birds

The risk assessment was revised to consider the reduced maximum cumulative application rate, and updates to the acute avian effects metric based on data received during consultation (see Appendix III for detailed response to comments received). Notably, the acute oral endpoint used in PRVD2023-01 is no longer supported after further consideration of the study. As a result, available 5-day avian dietary LD₅₀ of 44.03 mg a.i./kg bw/d was used to update the acute effect metric used in the screening-level risk assessment for the re-evaluation decision (Appendix VII, Table 7). Screening-level RQs did not exceed the LOC for acute exposure and as such, the conclusion that abamectin poses acceptable acute risk to birds is maintained from the PRVD2023-1.

The screening level risk quotients exceeded the LOC for chronic risk for all sizes of birds (Appendix VII, Table 10). Chronic risk quotients ranged from 1.8–3.6 for small to large birds. The chronic risk to birds was further characterized by considering additional feeding guilds (frugivores and granivores in addition to insectivores), off-field spray deposition and mean abamectin residues on dietary items potentially consumed by birds (Appendix VII, Table 13). Refined risk quotients did not exceed the LOC for granivorous and frugivorous birds when exposed to abamectin dietary residues both on and off-field. Risk quotients for small and medium insectivorous birds slightly exceed the LOC both on- and off-field (maximum RQs of 2.48 and 1.93 on-field and 1.83 and 1.43 off-field).

Additional consideration was given to the relatively high percentage of diet (60% of total diet consisting of insects with mean abamectin residues) required to elicit effects, and the relatively conservative nature of the residues assumed in the risk assessment (direct spray residues for airblast application). In conclusion, it was determined that the potential chronic risks to birds is acceptable, however as per the PRVD2023-01, the recommendation to require label statements to indicate potential hazard of abamectin to birds is maintained.

Mammals

The risk assessment was revised to consider the reduced maximum cumulative application rate as well as to correct a typographical error in the chronic LOAEL for mammals in the PRVD2023-01 (LOEL of 40 mg a.i./kg bw/d was changed to 0.2 mg a.i./kg bw/d) (Appendix VII, Table 7). Additional discussion surrounding the risk characterization for mammals is presented below compared to the PRVD2023-01. The screening level risk quotients exceeded the LOC for acute and chronic risks for all sizes of mammals. The RQs, which ranged from 1.7 to 23.4, exceeded the LOC (1) for all sizes of mammals from acute (RQ 3.2) and chronic (RQ 23.4) exposures (Appendix VII, Table 10).

The risks to mammals were further characterized by considering additional feeding guilds (frugivore and granivore in addition to insectivores), off-field spray deposition, mean abamectin residues on dietary items potentially consumed by mammals, as well as the effects noted in the lowest observed effects doses reported in chronic effects studies (Appendix VII, Table 13).

Overall, the available data suggests that a potential risk to mammals cannot be ruled out, and the recommendation from the PRVD2023-01 to require a label statement to inform users that the active ingredient can pose a hazard to mammals is maintained. The risk is considered acceptable given the further characterization of the potential risks identified in the assessment including:

- The maximum RQ across all feeding guilds and different sized mammals is 23.4 from maximum residues on the field, for medium sized mammals consuming contaminated grass in orchards.
- Considering mean residues, which estimate typical exposure levels on feed items immediately after application, the maximum RQs are 5.0 on the field and 3.7 off the field.
- Considering that the highest RQs are from consumption of short grass. Since airblast applications are directed towards the canopy, concentrations on feed items below the trees (such as broadleaf plants and grasses) would likely be less than what is estimated based on residue assumptions used in this risk assessment). As such, those RQs are likely overestimating risk for airblast uses.
- RQs exceeding the LOCs for reproductive effects to all sizes of mammals are also expected to be overestimated based on the interception anticipated from canopy applications to contaminated arthropods and other food sources in the understory, such as grasses.
- There is limited acute risk identified for small, and medium sized mammals on the field, with up to 87% of daily diet made of the contaminated food required to reach endpoints for small and medium sized mammals.

Terrestrial plants

The risk assessment was revised to consider the maximum cumulative application rate of 38.2 g a.i./ha. At this application rate, the risk quotients for vegetative vigour do not exceed the LOC at the screening-level ($RQ < 0.62$) (Appendix VII, Table 9).

3.3.2 Risks to aquatic organisms

The risk assessment was revised to consider the maximum cumulative application rate of 38.2 g a.i./ha. At the screening-level, risk quotients for acute and chronic exposure to all aquatic organisms (with the exception of freshwater and marine algae and acute exposures to the sheepshead minnow, *Cyprinodon variegatus*) exceeded the LOC (Appendix VII, Table 11).

The risk assessment was further characterized by considering spray drift at the time of application and runoff.

Assessment of potential risk from spray drift

Spray drift data were used to determine the maximum spray deposit into an aquatic habitat located 1 m downwind from the application site during spraying, using the maximum cumulative application rate of 38.2 g a.i./ha. The maximum percent drift deposition for field sprayer application was changed from the ASABE Fine droplet size used in PRVD2023-01 to ASABE Medium droplet size, as requested by the registrant. For field sprayer application, the ASABE Medium droplet size is used, which corresponds to a maximum drift of 6% of the application rate. For airblast application, a maximum 74% (early application) and 59% (late application) drift is used. In marine/estuarine habitats, cumulative deposit from multiple applications and chronic exposure resulting from spray drift is not expected given the high rates of water replacement due to tidal flushing. For this reason, risk from spray drift is determined based on the acute effects metric and the EECs for the maximum single application rate only on pears at 28.5 g a.i./ha.

With few exceptions, the refined risk quotients for freshwater and marine invertebrates, freshwater fish and amphibians indicate that the LOC from abamectin exposure due to spray drift at the minimum single application rate and maximum cumulative application rate is exceeded for all application methods (Appendix VII, Table 14). Spray buffer zones (up to 60 m) are required to mitigate risks to aquatic organisms from spray drift (Appendix X).

Refined risk assessment via runoff

Water modelling:

Estimated environmental concentrations in aquatic habitats from runoff were calculated using the Pesticide in Water Calculator (PWC) model (version 1.52). Model input parameters are presented in PRVD2023-01, Appendix IX, Table 1. PWC calculates the amount of pesticide entering the water body by runoff alone, and the subsequent transformation of the pesticide in the water system. EECs are calculated by modelling a total land area of 10 ha draining into a 1 ha pond of two different depths (15 and 80 cm). The model is run for 50 years. To assess acute risks based on modelling, the 90th percentile of 24- or 96-hour EECs were compared against the acute

effects metrics to generate acute RQ values. To assess chronic risks based on modelling, 21-day EECs were compared against the chronic effects metrics to generate chronic RQ values. The risk quotients from exposure to abamectin based on modelled runoff concentrations (RQ values up to 69 for freshwater organisms and up to 90.9 for marine organisms) are presented in Appendix VII, Table 15.

Water monitoring:

Canadian and US water monitoring databases were searched for abamectin between 2008 to 2024.

Prior to the publication of the abamectin proposed re-evaluation decision document (PRVD2023-01), no data for abamectin were found in Canadian and US water monitoring databases.

Since the publication of PRVD2023-01, data for abamectin in both surface water and groundwater are available in recent water monitoring programs in Canada including:

- Health Canada's Canadian Water Monitoring Program for Pesticides (CWMPP) from 2022-2023, and 2024 (PMRA# 3695796, 3695803); and,
- Ontario pesticide concentration in stream water from 2012–2022 (PMRA# 3695805).

The Canadian data were assessed to determine if they were reliable, relevant and robust for consideration in risk assessment. All the data sets were deemed to be reliable with sound data quality and sufficient information to interpret the data including limits of detection (LOD), sampling dates and locations where samples were collected. Some of the sites were not relevant for this assessment given that crops with registered uses of abamectin were not grown within the watershed where the samples were collected.

The CWMPP data were found to be sufficiently robust given that sampling frequency at most sites was twice a week at surface water locations for a period of two or more years. The Ontario dataset provides information on the potential for detection of abamectin. However, sampling was conducted at lower frequencies (monthly during summer months and, in one case, only once in a year) and therefore was not robust to consider quantitatively in a risk assessment.

In the US, data for abamectin in surface water and groundwater sources are available from:

- California Department of Pesticide Regulation (CADPR) ground and surface water monitoring database from 2009–2023 (PMRA# 3695804).

The data from the United States were not assessed against the reliable, relevancy and robustness criteria as the necessary data to determine the relevancy of the sites is not readily available.

Abamectin was not detected in surface water and groundwater samples in Canada and USA. However, the limit of detection of abamectin in the available water monitoring data in Canada is reported to be above the chronic effect metrics of aquatic invertebrates. This suggests that risks from chronic exposure of aquatic invertebrates to abamectin cannot be ruled out by the water monitoring data.

Runoff mitigation:

The PRVD2023-01 included an in-development (beta) pesticide in water calculator vegetative filter strip modeling system (PWC-VFSMOD) coupling (see PRVD2023-01). The soil inputs for VFSMOD were derived from the PWC scenario. Following the publication of PRVD2023-01, further modelling using the PWC-VFSMOD coupling for other pesticides and scenarios revealed that the method used to estimate the saturated hydraulic conductivity (KSAT), an important input to VFSMOD describing the permeability of the soil, was inappropriate. Furthermore, the estimated effectiveness of the VFS was highly sensitive to KSAT, which led to the results being far too dependent on this soil descriptor, and relatively insensitive to the descriptors for the pesticide itself by comparison. Due to the uncertainty in determining this value, VFSMOD was not considered when calculating EECs for the final re-evaluation decision (RVD) for abamectin.

In their “Ecological Mitigation Support Document to Support Endangered Species Strategies”, the USEPA reported a pesticide reduction of 65% for a 10 m wide VFS (PMRA# 3704432). The PMRA performed their own analysis of all relevant studies conducted with active ingredients with a K_{oc} (soil organic carbon-water partition coefficient) range that exceeded 1000 mg/L. For simplicity and to include sufficient data points, all VFS widths were considered together (0.5 to 63 m; median = 8 m). This analysis resulted in a similar findings to those of the USEPA: a reduction in pesticide concentration and mass of approximately 65 and 70%, respectively. The majority of studies reviewed as part of the analysis involved extreme (high intensity, short duration) rainfall events. When considering a 10 m VFS and rainfall that is more typical of the Canadian growing season, a reduction of pesticide carried with runoff would likely result in a higher removal rate.

Assuming a 10 m VFS would result in a reduction of 65% of the concentration of abamectin in runoff, the maximum freshwater RQ of 69 would be reduced to 24, and the maximum estuarine RQ of 90.9 would be reduced to 32.

In addition to standard runoff label statements, a mandatory 10 m vegetative filter strip is required between the edge of the application area and the adjacent, downhill aquatic habitat to protect aquatic organisms from the potential effects of runoff. With the implementation of these mitigation measures, the risks are considered acceptable.

3.3.3 Environmental incident reports

As of 19 November 2024, no environmental incident reports involving abamectin have been submitted to Health Canada. As USEPA Ecological Incident Information System (EIIS) is only updated to 2015, the incidents mentioned in the PRVD2023-01 remain the only incidents reported.

3.4 Pest control product policy considerations

3.4.1 Toxic substances management policy considerations

The Toxic Substances Management Policy considerations for abamectin were described previously in PRVD2023-01 and remain unchanged. Abamectin and its transformation products do not meet all TSMP track 1 criteria.

3.4.2 Formulants and contaminants of health or environmental concern

The review of formulants and contaminants of health or environmental concern for abamectin and its end-use products were described previously in PRVD2023-01 and remain unchanged. Abamectin and its end-use products do not contain any formulants or contaminants identified in the *List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern*.

4.0 Value assessment

Abamectin is an acaracide/insecticide registered for use on a wide-range of outdoor field-grown fruit and vegetable crops, outdoor ornamentals, greenhouse vegetables and greenhouse ornamentals for the control or suppression of a variety of agricultural pests such as mites, sawflies, moths, thrips, leafminers, psyllids, aphids and certain beetles. It is also registered for commercial and domestic indoor and/or outdoor structural use to control cockroaches and ants.

In response to the PRVD, a total of four comments were received which pertained to value. The Ontario Fruit and Vegetable Growers' Association confirmed that the proposed risk mitigation measures are feasible. Use information was received from Nova Scotia, New Brunswick and Prince Edward Island regarding the typical treatment period on raspberries and potatoes. This new information was taken into consideration in the revised water modelling used to determine estimated environmental concentrations. This change in the date range used for modelling, that was specific to potential field application timing, did not affect the risk assessment but provided the PMRA with valuable real world pesticide use information for abamectin.

Abamectin is valuable to both the agricultural crop production and structural sectors for resistance management because it is the only Insecticide Resistance Action Committee Group 6 mode of action active ingredient registered. Therefore, continued registration of abamectin has value. The reduction of the yearly total application rate for abamectin is expected to have minimum impact on agricultural users.

5.0 Conclusion of science evaluation

Health

It has been determined that the human health risks associated with the use of abamectin and its associated end-use products are shown to be acceptable with the implementation of additional mitigation measures. The human health risk assessment was updated to reflect changes to the abamectin use pattern from the conclusions of the environmental risk assessment. Comments and additional information received during consultation period for PRVD2023-01 were also considered and this resulted in changes to the occupational risk assessment. Risk mitigation measures include label statements prohibiting the use of handheld airblast/mistblower equipment, updates to the restricted-entry intervals proposed for occupational uses, and the retention of the use for greenhouse ornamentals grown for cut flower production.

Environment

It has been determined that environmental risks associated with the use of abamectin and its associated end-use products are shown to be acceptable with the implementation of additional mitigation measures. The environmental risk assessment was revised based on comments received during consultation period. Risk mitigation measures included reduction to the maximum cumulative application rate from 136.8 g a.i./ha to 38.2 g a.i./ha, incorporation of new information received for birds and freshwater invertebrates and the use of medium spray droplet size for field sprayer applications.

The revised risk assessment identified potential risks to non-target terrestrial organisms and aquatic organisms. Precautionary label statements are required to protect terrestrial organisms and label restrictions are required to protect bees. The use of spray buffer zones and 10-m wide vegetative filter strips are required to protect aquatic organisms.

Value

It has been determined that abamectin and its end-use products have acceptable value. Comments and additional information received during the consultation period for PRVD2023-01 were also considered in the revised risk assessment and this data did not change the conclusions of the value assessment. Abamectin is a valuable tool in resistance management since it is the only active ingredient registered that belongs to Insecticide Resistance Action Committee mode of action Group 6.

List of abbreviations

µg	micrograms
µL	microlitre
a.i.	active ingredient
ADI	acceptable daily intake
ARfD	acute reference dose
ASABE	American Society of Agricultural and Biological Engineers
ATPD	area treated per day
bw	body weight
CWMPP	Canadian Water Monitoring of Pesticide Program
cm ²	centimeters squared
CR	chemical-resistant
d	day
DAT	days after treatment
DA	dermal absorption
DT ₅₀	dissipation time 50% (the time required to observe a 50% decline in concentration)
DFR	dislodgeable foliar residue
dw	dry weight
EC ₅₀	effective concentration causing 50% effect on the population
ER ₅₀	effective rate causing 50% effect on the population
EDE	estimated daily exposure
EEC	estimated environmental concentration
EER	estimated environmental rate
EC	European Commission
EFSA	European Food Safety Authority
ET	exposure time
F ₀	parental generation
F ₁	offspring of the parent
FIR	food ingestion rate
Fw	fresh weight
g	gram(s)
ha	hectare(s)
HC ₅	hazardous concentration for 5% of species
HH AB/MB	handheld airblast/mistblower
h or hr	hour(s)
kg	kilogram(s)
K _{oc}	soil organic carbon-water partition coefficient
L	litre(s)
LC ₅₀	lethal concentration 50%
LD ₅₀	lethal dose 50%
LOAEL	lowest observed adverse effect level
LOC	level of concern
LOEC	lowest observed effect concentration
LOEL	lowest observed effect level
LR ₅₀	lethal rate 50%

m	meter
m ³	cubic meter
mg	milligram(s)
mL	millilitre
M/L/A	mixer/loader/applicator
MOE	margin of exposure
MPHG	mechanically pressurized handgun
MPHW	manually pressurized handwand
N/A	not applicable
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
NOED	no observed effect dose
NOEL	no observed effect level
OCSPP	office of chemical safety and pollution prevention
OECD	organisation for economic co-operation and development
PA	postapplication
PMRA	Pest Management Regulatory Agency
PPE	personal protective equipment
PRVD	Proposed Re-evaluation Decision
PWC	pesticide in water calculator
RAR	risk assessment report
REI	restricted-entry interval
RQ	risk quotient
RVD	Re-evaluation Decision Document
SA	surface area
SSD	species sensitivity distribution
SU	Suspension
TC	transfer co-efficient
TRV	toxicology reference values
UF	uncertainty factor
USA	United States of America
USEPA	United States Environmental Protection Agency
W	week
w/w	weight per weight
w/v	weight per volume

Appendix I Registered products containing abamectin in Canada¹

Table 1 Products containing abamectin requiring label amendments

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (%, g/L)
24484	Technical grade active ingredient	Syngenta Canada Inc.	Abamectin Technical	Dust Or Powder	Abamectin 92.1%
24485	Commercial	Syngenta Canada Inc.	Avid 1.9% EC Miticide/ Insecticide	Emulsifiable Concentrate Or Emulsion	Abamectin 19 g/L
24551	Commercial	Syngenta Canada Inc.	Agri-Mek 1.9% EC Insecticide/ Miticide	Emulsifiable Concentrate Or Emulsion	Abamectin 19 g/L
26896	Commercial	BASF Canada Inc.	Prescription Treatment Brand Avert Cockroach Bait Stations	Solid	Abamectin 0.05%
27864	Commercial	BASF Canada Inc.	Prescription Treatment Brand Avert Granular Carpenter Ant Bait	Granular	Abamectin 0.011%
27897	Commercial	BASF Canada Inc.	Prescription Treatment Brand Avert 360A Dual Choice Ant Bait Station	Paste	Abamectin 0.011%
28403	Commercial	BASF Canada Inc.	Prescription Treatment Brand Avert Dry Flowable Cockroach Bait	Dry Flowable	Abamectin 0.050%
31607	Commercial	Syngenta Canada Inc.	Agri-Mek SC	Suspension	Abamectin 84 g/L
33023	Commercial	Syngenta Canada Inc.	Minecto Pro	Suspension	Abamectin 28.5 g/L Cyantraniliprole 135 g/L
26645	Domestic	S. C. Johnson And Son Limited	Raid Max Roach Bait	Solid	Abamectin 0.05%

Registration number	Marketing class	Registrant	Product name	Formulation type	Active ingredient (%, g/L)
27249	Domestic	S. C. Johnson And Son Limited	Raid Max Ant Baits	Solid	Abamectin 0.05%
27250	Domestic	S. C. Johnson And Son Limited	Raid Ant Baits 3	Solid	Abamectin 0.05%
27731	Domestic	S. C. Johnson And Son Limited	Raid Double Control Roach Baits	Solid	Abamectin 0.05%
27761	Domestic	S. C. Johnson And Son Limited	Raid Double Control Ant Baits 2	Solid	Abamectin 0.05%
28347	Domestic	S. C. Johnson And Son Limited	Raid Outdoor Ant Spikes	Solid	Abamectin 0.05%
30597	Domestic	S. C. Johnson And Son Limited	Raid Max Double Control Ant Baits	Solid	Abamectin 0.05%
32316	Domestic	S. C. Johnson And Son Limited	Raid Ant Baits 4	Solid	Abamectin 0.05%
32317	Domestic	S. C. Johnson And Son Limited	Raid Max Double Control Ant Baits 2	Solid	Abamectin 0.05%
32318	Domestic	S. C. Johnson And Son Limited	Raid Max Ant Baits 2	Solid	Abamectin 0.05%

¹As of 14 April 2025, excluding discontinued products or products with a submission for discontinuation.

Appendix II List of commenters to PRVD2023-01

List of commenters' affiliations for comments submitted in response to PRVD2023-01.

Category	Commenter
Registrant	Syngenta Canada Inc. and S.C. Johnson and Son Limited
Agricultural Association	Ontario Fruit and Vegetable Growers' Association

Appendix III Comments and responses

Health Canada received 15 written comments during the public consultation for the abamectin 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

In response to the consultation for PRVD2023-01, comments related to the human health assessment were received from Syngenta Canada Inc., S. C. Johnson and Son Limited and the Ontario Fruit and Vegetable Growers' Association.

1.1 Comments related to occupational and non-occupational exposure

1.1.1 Comments concerning the application of abamectin via handheld airblast/mistblower application equipment on agricultural crops

Comment

Clarification was provided from the technical registrant, Syngenta Canada Inc (who had consulted with external stakeholders, including professional pest managers/applicators) that abamectin is not expected to be used/applied using handheld airblast/mistblower equipment, including on strawberries, hops, and pears. Therefore, inclusion of this application equipment in the occupational handler assessment for abamectin is not appropriate.

Health Canada response

The PMRA typically considers handheld airblast/mistblower application equipment when airblast application is likely to occur based on morphology of the crop and need for penetration into the canopy.

As the registrant has confirmed that application using handheld airblast/mistblower equipment is not expected to occur for currently registered uses of abamectin, handheld airblast/mistblower equipment has been removed from the final occupational mixer/loader/applicator exposure and risk assessment. A label statement prohibiting the use of handheld airblast/mistblower equipment will be added to the abamectin labels.

1.1.2 Comment concerning the postapplication exposure and risk assessment for greenhouse ornamentals grown for cut flower production

Comment

The PMRA did not include a previously submitted chemical-specific dislodgeable foliar residue study on greenhouse chrysanthemums. This study would be appropriate for consideration in the postapplication exposure and risk assessment for greenhouse ornamentals grown for cut flowers.

Health Canada response

Health Canada agrees with this comment and the submitted dislodgeable foliar residue study was reviewed and determined to be acceptable for use in the postapplication exposure assessment. The occupational postapplication risk assessment for the greenhouse uses of abamectin was updated to incorporate the chemical-specific dislodgeable foliar residue data. Using these data, occupational postapplication risks were not of concern on day 0 for all activities, including those for cut flowers.

As a result, the use of abamectin on ornamentals grown for cut flowers will not be cancelled, as proposed in the proposed re-evaluation decision. An restricted-entry interval of 12 hours will be required for all postapplication activities in greenhouse crops. Refer to Appendix V for more information.

1.1.3 Comment concerning transfer coefficient value used for the postapplication exposure and risk assessment for hops

Comment

A comment was submitted suggesting Health Canada use a transfer coefficient of 1400 cm²/hr in the occupational postapplication assessment for mechanically assisted harvesting in hops. This transfer coefficient value is consistent with the value recommended by the United States Environmental Protection Agency (USEPA) in the revised Exposure Science and Policy Council (ExpoSAC) Policy 3.

Health Canada response

The Agricultural Re-entry Task Force previously submitted a proposal to both the USEPA and Health Canada to reduce the transfer coefficient value for mechanically assisted hop harvesting from 19 300 cm²/hr to 1400 cm²/hr. The proposal noted that harvesting in hops is primarily an automated or mechanically assisted process in the US. To investigate this, a survey regarding the agricultural practices in hops in Canada was circulated to crop specialists. The survey results indicated that much of hop harvesting in Canada is still done by hand. In Canada, manual postapplication activities, such as loading bines into truck/trailer, loading bines on stripping table, and stripping by hand, result in high amount of contact between the worker and the treated bines.

As there is significantly less automation of hop harvesting in Canada versus the US, the transfer coefficient value for mechanically assisted hop harvesting was maintained in the postapplication exposure and risk assessment. Should hop harvesting practices evolve and become more automated in Canada, the transfer coefficient value for mechanically assisted hop harvesting may be revisited.

1.1.4 Comment concerning transfer coefficient value used for the postapplication exposure and risk assessment for onions

Comment

A comment was submitted suggesting Health Canada use a transfer coefficient of 4200 cm²/hr in the occupational postapplication assessment for hand weeding in onions (dry bulb and green). This transfer coefficient is consistent with the value recommended by the United States Environmental Protection Agency (USEPA) in the revised Science Advisory Council for Exposure (ExpoSAC) Policy 3.

Health Canada response

While most of the transfer coefficient values are harmonized between Health Canada and the USEPA, there are some differences due to study acceptability and availability, as well as differences in regards to the clustering of study data. For the waxy leaf field crops (in other words, onion), the USEPA clustered 3 cauliflower and cabbage studies into a medium-height cluster with a transfer coefficient of 4200 cm²/hr. This clustering scheme was not adopted by Health Canada as there were uncertainties regarding large differences in transfer coefficients between the clustered studies (for example, the transfer coefficient for cabbage weeding was more than 3 times higher than that of cabbage harvesting). Rather, these studies were used separately by Health Canada to determine individual transfer coefficients associated with the activities monitored in the studies.

The hand weeding transfer coefficient value used for field crops with waxy foliage (in other words, onion), was determined from the cabbage hand weeding study. While the value is similar to that used by the USEPA, it is based on different studies. At this time, no additional information has been received to address the concerns for clustering the waxy studies, therefore, the transfer coefficient value of 4400 cm²/hr for hand weeding in onions was maintained.

1.1.5 Comment concerning minor clarifications, errors and typos in the mixer, loader applicator and postapplication exposure and risk assessments

Comment

Comments were submitted regarding mismatched/incorrect inputs in PRVD2023-01. These are summarized below:

- The area treated per day value (ATPD) of 306 ha/day was reported for application of abamectin on potatoes and hops via groundboom (Custom Large Field Crop) equipment instead of the standard value of 360 ha/day.
- The transfer coefficient value of 110 cm²/hr was used in the occupational postapplication risk assessment for harvesting in celery, instead of the standard value of 1110 cm²/hr.
- A maximum application rate of 0.02226 kg a.i./ha was used in the occupational postapplication assessment rather than the maximum registered application rate of 0.021 kg a.i./ha.

- The transfer coefficient value of 30 cm²/hr was reported for canopy management and hand weeding postapplication activities in strawberries rather than the standard value of 70 cm²/hr.

Health Canada response

Health Canada agrees with the suggestions presented above. The occupational mixer/loader/applicator and postapplication risk assessments were updated to include these corrections. See Appendix V for the updated final risk assessment results.

1.1.6 Comment concerning Health Canada's standard dislodgeable foliar residue input values for postapplication exposure and risk assessments in greenhouses

Comment

A comment was submitted noting that the daily dissipation rate used in the abamectin postapplication risk assessment for greenhouse ornamentals of 2% differs from previous Health Canada risk assessments which used 2.3% for greenhouse ornamentals and 0% for greenhouse vegetables.

Health Canada response

The dissipation rates for greenhouse vegetables and greenhouse ornamentals were updated in 2019 to 2% per day following an analysis of a large database of greenhouse dislodgeable foliar residue studies that included both ornamental and vegetable crops. Based on this analysis, the daily dissipation rates previously used for greenhouse vegetable crops (0%) and greenhouse ornamentals (2.3%) were revised to 2% for all greenhouse uses. For the postapplication exposure and risk assessment for greenhouse vegetables and ornamentals outlined in the PRVD2023-01, a daily dissipation rate of 2% was used, which is reflective of current practices.

1.2 Comments related to incident reports

1.2.1 Comments concerning how incident reports are used in the risk assessment

Comment

Comments were received from S. C. Johnson and Son Limited involving the way incident reports were used and referenced in the proposed re-evaluation document as well as on the use of incident reporting information, in general, in the re-evaluation process given the limitations of information in incident reports.

Health Canada response

In accordance with the Pest Control Products Incident Reporting Regulations (IRR), pesticide registrants and applicants are required to report to Health Canada's Pest Management Regulatory Agency (PMRA) all incidents associated with their products. All pesticide incident reports submitted to us are made available to the public on our website through our Public Registry - Pesticide Product Information Database.

Health Canada uses incident report information to help identify hazards and characterize potential risks to humans, domestic animals and the environment from the use of pesticides. Potential risks are identified by searching the information provided in incident reports for trends, such as repeated effects or multiple incidents for a particular pesticide, or serious effects. The identification of a trend is not, by itself, proof of the association of a pesticide with a health or environmental risk but it triggers the need to further investigate a potential association. If a trend is identified, Health Canada will evaluate the information in conjunction with scientific literature. This incident report information is provided with the understanding that the data will be appropriately referenced and used in conjunction with the caveat statements as stated in the “limitations of information in incident reports” acknowledged on the Pesticide and pest management section of Canada.ca. Health Canada recognizes that limitations in incident reports must be taken into account during the pesticide incident evaluation process.

The objective of an incident evaluation is to establish if there is a potential risk to health or the environment from use of a pesticide. As such, all abamectin incidents were evaluated by taking into consideration the quality and quantity of information available in the incident report and the strength of the available scientific evidence (for example, supporting information available in other pesticide poisoning databases). Several factors were examined in the incident data such as, the likelihood that the exposure to the pesticide occurred; if the symptoms were reported in other cases of poisoning or toxicological studies related to the pesticide; the reported timing, route or other details of exposure relative to timing symptom onset; and if there were other credible factors in the incident that could explain the reported effect. All incident reports that had some association with the pesticide were evaluated further using a weight-of-evidence approach (for example, volume of incidents, severity of effects, incident reports in other jurisdictions) to characterize any potential risks. As outlined in PRVD2023-01, just over half of the 105 domestic animal incidents submitted to the PMRA had some association with exposure to abamectin. Most of these incidents occurred in Canada, with a few occurring in the US. The incidents highlighted a recurring issue of domestic animals mainly dogs gaining access to and ingesting abamectin present in ant/cockroach baits that were placed in and around homes. The reported effects in animals were mostly minor or moderate gastrointestinal or general effects. Overall, there are no health risks of concern in pets, however, there is evidence in the incident data of animals gaining access to and ingesting abamectin baits when used in and around homes. The statement “Keep out of reach of children and domestic animals” was therefore, proposed as a general label improvement to be added to all commercial class structural and domestic class end-use product labels, unless already present.

1.2.2 Comments concerning low rate of incidents reported for abamectin and the manner PMRA references incident reports

Comment

Comments were received from S. C. Johnson and Son Limited pointing out that the rate of incidents reported for abamectin, in the PMRA database, was very low in comparison to product sales and that the unqualified way in which incident reports are referenced by the PMRA could be misleading to the general public.

Health Canada response

Health Canada evaluates all available information from various sources. A low number of reported incidents compared to product sales cannot be used to imply an absence or lack of risk. Underreporting of incidents and barriers to reporting have been documented for pharmaceuticals,⁹ veterinary drugs¹⁰ and agriculture pesticides,¹¹ with estimates indicating that only 10% or less of adverse effects are reported. Hence, comparing rates of incidents to product sales could grossly underestimate the issue. 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 high value. For PRVD2023-01, Health Canada considered the abamectin incident information submitted to three regulators (in other words, Health Canada, United States Environmental Protection Agency and the California Department of Pesticide Regulation).

1.2.3 Comments related to proposed label amendments

Comment

A recommendation was received from S. C. Johnson and Son Limited to amend the proposed statement to “Keep out of reach of children and pets”.

Health Canada response

Although the statement “Keep out of reach of children and domestic animals” was proposed, Health Canada accepts S. C. Johnson and Son Limited recommendation to change the statement to “Keep out of reach of children and pets”.

2.0 Comments related to the environmental risk assessment

In response to the consultation of PRVD2023-01, comments related to the environmental assessment were received from Syngenta Canada Inc. and the Ontario Fruit and Vegetable Growers’ Association.

⁹ 2006. Lorna Hazzell and Saad A.W. Shakir. Under-reporting of adverse drug reactions. A systematic review Drug Safety 2006;29(5): 385-396.

¹⁰ 2015. Fresnay E, Laurentie S, Orand JP. Étude de cas d’événements indésirables dus aux médicaments vétérinaires. Bulletin des GTV, 2015, n°80, p 95-102.http://www.sngtv.org/4DACTION/NS2013_INDEX/5.

¹¹ 2005. Bell, E.M., Sandler, D.P., and Alavanja, M.C. High pesticide exposure events among farmers and spouses enrolled in the agricultural health study. Journal of Agricultural Safety and Health. 12(2): 101-116.

2.1 Comments concerning environmental toxicology studies

2.1.1 Comments received from Syngenta Canada Inc. regarding risk assessment refinement

Comment

The registrant submitted new environmental toxicology studies (reproduction study with northern bobwhite quail, acute oral toxicity study on mallard ducks, acute and chronic tests on *Daphnia* and outdoor mesocosm studies). The registrant also submitted a new study on the full life-cycle toxicity test with daphnids through the PMRA Incident Reporting Program.

Health Canada response

Health Canada reviewed and assessed the new studies. Valid toxicological endpoints were considered in the revised environmental risk assessment presented in this document (see section 3.0: Revised environmental risk assessment).

2.2 Comments concerning spray quality for groundboom applications

2.2.1 Comments received from Syngenta Canada Inc. regarding spray quality use

Comment

The refined environmental risk assessment (PRVD2023-01, Appendix IX, Tables 8–15) was conducted based on the maximum cumulative application rate on outdoor ornamentals (for example, 6×22.8 g a.i./ha at a 7-d interval) for both groundboom spray and airblast application methods, using fine spray quality as defined by the American Society of Agricultural and Biological Engineers (ASABE). The registrant requests label amendments to specify the use of medium ASABE spray quality for groundboom applications in order to reduce the potential for drift and subsequently reduce the width of aquatic spray buffer zones proposed. With the adoption of medium ASABE spray quality for ground applications, buffers reported in PRVD2023-01 can be reduced from the maximum proposed 45 m to 15 m for freshwater aquatic habitats and 25 m to 15 m for marine aquatic habitats less than 1 m in depth. Syngenta Canada Inc. requests that spray buffers be recalculated for ground spray applications to reflect the change from fine to medium ASABE spray quality and propose to update the labels accordingly.

Health Canada response

The spray buffer zones were re-calculated to reflect the change from Fine to Medium ASABE spray quality for groundboom applications as well as the new environmental toxicology studies. The revised required spray buffer zones are presented in Appendix X.

2.3 Comments concerning maximum cumulative application rate

2.3.1 Comments received from Syngenta Canada Inc. regarding minor rate structure updates

Comment

With the maximum cumulative application rate being reduced to 38.2 g a.i./ha, the registrant requests that minor rate structure updates be permitted where needed.

Health Canada response

Registrants may update the labelled use pattern and/or application rates through pre-market submissions.

2.4 Comments concerning risk mitigation measures

2.4.1 Comments were received from the Ontario Fruit and Vegetable Growers' Association concerning risk mitigation for greenhouse uses

Comment

The grower group expressed concern that certain risk mitigation requirements are not appropriate for greenhouse uses (spray buffer zones, vegetative filter strips, maximum cumulative application rate). They requested confirmation as to what the greenhouse mitigation requirements would be.

Health Canada response

For use in greenhouses, growers will need to ensure effluent containing abamectin is not released to aquatic habitats. In addition, product labels will inform growers of the toxicity of abamectin to bees and beneficial arthropods used in greenhouse production as well as instructions for reducing exposure to these organisms when they are present in the treatment area. The restriction of the maximum cumulative application rate to 38.2 g a.i./ha applies to outdoor grown crops and is not a risk mitigation measure applicable to greenhouse uses. Similarly, spray buffer zones and vegetative filter strips are not mitigation measures applicable for greenhouse uses.

2.5 Comments concerning proposed spray buffers

2.5.1 Comment received from Syngenta Canada Inc. concerning spray buffer zone values

Comment

The registrant expressed concern that the proposed spray buffers for various registered uses appear to have errors or have been omitted from the buffer zone table in PRVD2023-01.

- Buffer zones for Agri-Mek® 1.9% EC (Reg. No. 24551) and Agri-Mek SC (Reg. No. 31607) on Page 105 of PRVD2023-01 require updating to reflect the registered use

pattern for field sprayer application on apples, pears grapes and celeriac. Buffer zones for Minecto Pro (Reg. No. 33023) on Page 109 of PRVD2023-01 require updating to reflect the registered use pattern for field sprayer application on bulb vegetables (Crop Group 3-07).

- The application rate used to model spray buffer zones for hops is wrong. Modelling should be updated using the proposed maximum cumulative rate of 38 g a.i./ha for hops (19 g a.i./ha × 2 applications).

Health Canada response

The spray buffer zone tables for Agri-Mek® 1.9% EC (Reg. No. 24551) and Agri-Mek SC (Reg. No. 31607) have been updated to reflect the registered use pattern for field sprayer applications on apples, pears grapes and celeriac. Also, the spray buffer zone table for Minecto Pro (Reg. No. 33023) has been updated to reflect the registered use pattern for field sprayer application on bulb vegetables (Crop Group 3-07).

With regards to the application rate used to model spray buffer zones for hops, the spray buffer zones for hops were updated using the proposed maximum cumulative rate of 38 g a.i./ha for hops (19 g a.i./ha × 2 applications, see Table 1, Appendix VII).

2.6 Comments concerning environmental toxicology studies and endpoints

2.6.1 Comments received from Syngenta Canada Inc. regarding mallard duck toxicity value

Comment

The registrant noted there is a discrepancy in the interpretation of the LD₅₀ from the 14-day acute oral mallard duck (*Anas platyrhynchos*) endpoint from the Fink et al. (1981) study. In the original report, the study author concluded that even though regurgitation was present at all treatment levels, there was a clear dose dependent effect with 10% mortality observed in the 56 mg a.i./kg treatment and 70% mortality in the 100 mg a.i./kg treatment. Based on the observed mortality, the study author concluded that the LD₅₀ was 85 mg a.i./kg bw.

The PRVD2023-01 reported a lower LD₅₀ (26 mg a.i./kg bw) based on corrections for regurgitation done by the European Commission. The European Commission determined that the reliability of the study was questionable because of the uncertainties arising from observed regurgitation. Subsequently, they arbitrarily lowered the endpoint to 26 mg a.i./kg bw by assuming 2/3 of the dose was vomited. The registrant believes that without quantifying the amount regurgitated and the percentage of dosing solution ingested, this creates a highly inaccurate and subjective endpoint.

The registrant agrees with the interpretation of the data by the study author and conclusion regarding the treatment level effects, even though regurgitation was present. The USEPA used an LD₅₀ of 85 mg a.i./kg bw in their ecological risk assessment (EPA-HQ-OPP-2013-0360-0031). The USEPA classifies the study as “supplemental” due to the regurgitation, but nonetheless classify the study and subsequent endpoints as valid. Therefore, Syngenta believes that the LD₅₀ should be 85 mg a.i./kg bw.

Health Canada response

The bird risk assessment presented in PRVD2023-01 was based on information from a foreign review (The European Food Safety Authority (EFSA)). The original study on the acute oral mallard duck (*Anas platyrhynchos*) was submitted to the PMRA during the consultation period. On review, the acute oral avian (mallard) study was found unacceptable for use in quantitative risk assessment. There was uncertainty in the exposure of the treated birds to abamectin due to regurgitation experienced by birds in all treatment levels.

Instead, in the absence of an acceptable acute oral study, an available acute dietary study was considered acceptable for use in the acute risk assessment for birds in lieu of the acute oral toxicity study as recommended by the USEPA OCSPP 850.2100 (2012) guideline: Guidance for Use When Regurgitation is Observed in Avian Acute Toxicity Studies with Passerine Species.

The 5-day acute dietary LC₅₀ of 383 mg a.i./kg diet (LD₅₀ of 44.03 mg a.i./kg bw/day) was used in the updated risk assessment.

For the final decision, neither the LD₅₀ of 85 mg a.i./kg bw as suggested by the registrant nor the LD₅₀ of 26 mg a.i./kg bw as used in the PRVD2023-01 were deemed appropriate for use in quantitative risk assessment.

As noted above, the acute endpoint used to conduct the avian risk assessment was changed based on further review of the submitted data. However, despite the change in endpoints, the risk conclusions remain the same as per the PRVD2023-01.

2.6.2 Comments received from Syngenta Canada Inc. regarding the northern bobwhite quail toxicity value

Comment

The registrant proposed an alternative endpoint to the northern bobwhite quail (*Colinus virginianus*) 22-week reproduction NOEC on the basis that no significant effects were seen across any treatment levels in the study (Mitchell et al. 2000). The study authors concluded that there were no treatment-related mortalities, overt signs of toxicity or treatment-related effects on adult body weight. Additionally, there were no treatment-related effects on any of the reproductive parameters measured at the 5, 10 or 20 mg a.i./kg diet test concentrations. This conclusion was also confirmed by the USEPA, which determined that no effects were seen in the study with the highest treatment level of 20 mg a.i./kg diet. The reference cited by the PMRA (European Commission) also stated “No statistically significant differences were found for any of the parameters measured.” The registrant believes that the lower NOEC used (10 mg/kg diet) is not scientifically justified and the appropriate NOEC should be 20 mg a.i./kg diet.

Health Canada response

The assessment in PRVD2023-01 was based on information in foreign reviews (European Commission) and the PMRA did not have access to the original study.

The study was submitted by the registrant during the consultation period for PRVD2023-01. On review, the PMRA agrees with the study author's conclusion that no statistically significant differences were observed in any of the parameters measured and agrees with the study author's NOEC of 20 mg a.i./kg diet (1.98 mg/kg bw/day).

This change does not affect the conclusions presented in PRVD2023-01, as a chronic NOEC for mallard ducks exposed to abamectin (0.7 mg/kg bw/day) was the most sensitive chronic endpoint for avian species.

2.6.3 Comments received from Syngenta Canada Inc. regarding use of species sensitivity distributions

Comment

The registrant agrees with the application of a species sensitivity distribution (SSD) approach for deriving the acute aquatic invertebrate endpoint, and further encourages the use of transparent data and relevance criteria for screening source data used to populate the SSD. However, the registrant suggests that using a weighted hazard concentration for 5% of affected species (HC₅) is more appropriate than basing the HC₅ on the log-normal model as determined in the proposed re-evaluation decision which does not have the best fit to the data.

The registrant generated an SSD using the SSD Toolbox (Version 1.0) from the USEPA with the same 14 freshwater invertebrate EC₅₀s (ranging from 0.12 to 4000 µg a.i./L) as those used in the proposed re-evaluation decision. This analysis incorporated the use of the following distributions in generating model estimates: log-normal, log-logistic, log-triangular, logGumbel, Weibull, Burr III and weighted AICc (Akaike information criterion corrected for small sample sizes). Based on model estimates, the Gumbel distribution provided the best overall fit and contributed the most to the weighted SSD with an HC₅ value of 0.0795 µg a.i./L (95% CI = 0.02–0.38). The overall weighted HC₅ for this dataset was 0.0606 µg a.i./L (95% CI = 0.0166–0.1218). Using the weighted AICc HC₅ integrates all models while applying different weights to each model depending on information retention value. The registrant believes this is a more inclusive and conservative approach as it accounts for variation, reduces uncertainty, and information loss associated with individual model selection. Overall, the use of a weighted HC₅ rather than selecting one distribution can improve the precision of the model. Therefore, the registrant believes the HC₅ should be 0.0606 µg a.i./L (95% CI = 0.0166–0.1218).

Health Canada response

The PMRA acknowledges the suggestion to use weighted HC₅ estimates derived from multiple statistical distributions and appreciates the value of model averaging in integrating information from various models to reduce uncertainty. However, the PMRA has determined that ETX 2.3 remains the preferred tool for deriving HC₅ values in regulatory risk assessments due to its unique ability to address inherent biases associated with low percentile estimates from small sample sizes, a common feature in ecotoxicological datasets.

1. Bias correction for HC₅ estimates:

ETX 2.3 incorporates extrapolation factors specifically designed to correct for biases in low percentile estimates, such as the HC₅, which are common when using parametric

distributions (for example, log-normal). These biases occur due to the direct use of quantile functions, particularly with small datasets where estimates can be skewed towards higher values (Aldenberg and Jaworska, 2000; Aldenberg and Slob, 1993). The correction factors applied by ETX 2.3 ensure that HC₅ estimates have an equal probability of over- and underestimation, addressing the key concern of bias that is not typically corrected by other SSD estimation tools.

2. Handling of small sample sizes:

In the context of SSD modelling, small sample sizes are often encountered, limiting the ability to reliably differentiate between various statistical distributions. ETX 2.3 employs a log-normal model that is robust under these conditions and applies corrections for sample size effects. This approach provides consistency and a standardized methodology that supports comparability across risk assessments. While weighted approaches, such as those using AICc-based model averaging, integrate information across multiple distributions, they do not inherently address the specific biases corrected by ETX 2.3.

3. Consistency and transparency in regulatory applications:

The use of ETX 2.3 provides a transparent and consistent approach to HC₅ estimation, aligning with the PMRA's regulatory requirements for sound scientific methodology. Despite its limitations, such as the focus on a single distribution and challenges with censored data, ETX 2.3's bias correction capabilities are critical for ensuring that the HC₅ values derived are both accurate and reliable for regulatory decision-making.

4. Ongoing evaluation of alternative methods:

The PMRA recognizes the evolving landscape of statistical tools and methodologies for SSD analysis and remains open to considering new approaches that demonstrate equivalent or superior statistical capabilities, including bias correction for small sample sizes. As new software becomes available, the PMRA will continue to evaluate their suitability for regulatory use in deriving HC₅ values from SSDs.

As a result, the HC₅ (0.025 µg a.i./L) based on the log-normal model remains the acute endpoint for aquatic invertebrates.

2.6.4 Comments received from Syngenta Canada Inc. regarding the use of a chronic aquatic invertebrate value

Comment

The chronic aquatic invertebrate NOEC (0.0082 ug a.i./L) is based on an EFSA derivation from "EFSA Renewal Assessment Report (RAR) on Ecotoxicology for Abamectin 1.8% EC, 2019". In their assessment, EFSA states that no reliable endpoint based on mean measured concentrations could be calculated. In addition, due to deficiencies in analytical verification, the scientific rigour of this study is questionable.

Health Canada response

A study investigating the full life cycle toxicity of technical grade abamectin to *Daphnia magna* under flow-through conditions (PMRA# 3465177) was submitted to the PMRA through the Incident Reporting Program. The study was reviewed and found to be acceptable. A 21-d NOEC

for F0 female mortality was calculated to be 0.0029 µg a.i./L (mean measured concentration; LOEC = 0.0063 µg a.i./L with a 31% increase in mortality relative to the controls). As a result, this new NOEC represents the most sensitive freshwater chronic endpoint for organisms exposed to abamectin.

2.6.5 Comments received from Syngenta Canada Inc. regarding use of mesocosm values

Comment

The registrant submitted arguments (PMRA# 3480117) that risks to the aquatic environment is likely to be minimal given the environmental fate parameters of abamectin that include rapid degradation and photolysis in water, high sediment binding capacity (PRVD2023-01, Appendix IX, Table 3) and the transient long-term effects on aquatic invertebrate communities. Despite the lower *Daphnia* chronic laboratory-based NOEC (PMRA# 3465177), the registrant argues that higher-tiered studies are more representative of potential risk to aquatic invertebrates in natural freshwater systems. The registrant feels that a chronic NOEC from a mesocosm study of 0.015 µg a.i./L (derived from PMRA# 3480119) would be protective of the most sensitive aquatic taxa and that this endpoint should be used to further refine potential risk of abamectin to aquatic invertebrates.

Health Canada response

The registrant referenced three mesocosm studies in support of their argument that endpoints used in the risk assessment should be less sensitive for aquatic invertebrates and that these studies demonstrated rapid recovery of communities from abamectin exposure (PMRA# 3480119, PMRA# 3480120, and PMRA# 3692840).

In general, the PMRA cites a number of deficiencies in the referenced mesocosm studies. These include but are not limited to:

- Poor representation of the most sensitive species (*Daphnia sp.* as identified in laboratory studies) in PMRA# 3480120 and PMRA# 3480119 and no representation in PMRA# 3692840.
- None of the mesocosm studies reported minimum detectable differences in their analysis. It has become common practice in the last decade or so for researchers to report on minimum detectable differences in mesocosm studies to characterize the variability and better interpret the results.
- These mesocosm studies had water depths of ≤1 m with exposure to direct sunlight, which would have resulted in degradation through photolysis. Laboratory data indicates photolysis is relatively rapid for abamectin (the PMRA estimated a DT₅₀ of 1.5 day in surface water with sunlight equivalent to Canadian growing regions). Photolysis will be less pronounced at depth, which would be expected to result in slower degradation of abamectin in deeper water bodies.
- In PMRA# 3692840 and PMRA# 3480120, the abundance data was pre-processed prior to statistical analysis in non-standard ways. In PMRA# 3692840, a “correction” was applied to sampling interval abundance proportions based on Day 0 proportions. In

PMRA# 3480120, instead of analyzing effects at each sampling interval, abundance values were averaged over long periods of the study (for example, Day 1 to 49 and Day 63 to 91).

- In PMRA# 3692840, precipitation and use of sediment in the test vessels were not reported and abamectin was not measured. In addition, as opposed to comparing treated to control tanks only, the statistical analysis employed compared all treatment groups to one another, which impacts the expected family-wise error rate.
- In PMRA# 3480120, 14 days after application, water in all tanks was circulated back to a supply pond, with a flow rate to the tanks from the supply pond of $\sim 1.7 \text{ m}^3$ per day (or 1700 L per day). This allowed for the potential movement of abamectin and/or its transformation products, as well as organisms relevant to the test to move between ponds.
- In PMRA# 3480119, Syngenta Canada Inc. proposes that the chronic NOEC of $0.015 \mu\text{g a.i./L}$ be used because it is protective of the most sensitive aquatic taxa. In this study, while *Daphnia longispina* were identified and assessed, mean abundance values in controls ranged from 0.07 to 3.76 individuals per liter for this species, which is likely too low to detect relevant adverse effects to this species. Therefore, the representation of *Daphnia* species in this study was not sufficient to conclude that NOEC established is protective of sensitive aquatic invertebrate communities. Furthermore, the $0.015 \mu\text{g a.i./L}$ concentration is an initial nominal concentration.

Given the deficiencies identified in the three referenced mesocosm studies, they cannot be used to adequately characterize effects and recovery of freshwater aquatic invertebrate communities following exposure to abamectin, in the context of a regulatory environmental risk assessment.

3.0 Comments related to the value assessment

In response to the consultation for the abamectin proposed re-evaluation decision, the following value comments were received from the Ontario Fruit and Vegetable Growers' Association and Syngenta Canada Inc.

3.1 Comments related to outdoor fruits and vegetables

3.1.1 Comments received from Ontario Fruit and Vegetable Growers' Association

Comment

The Ontario Fruit and Vegetable Growers' Association confirmed that for outdoor-grown fruits and vegetables, the proposed risk mitigation measures (for example, updated restricted-entry intervals for onions and grapes, pollinator label statements, spray buffer zones, vegetative filter strips and the maximum cumulative application rate for outdoor grown crops) are feasible while retaining the value of continued registration of abamectin.

Health Canada response

The PMRA acknowledges the value of abamectin as a pest management tool in fruits and vegetables. This type of information is critical in determining agronomic feasibility of proposed mitigation measures.

3.2 Comments related to typical application timing on select crops

3.2.1 Comments received regarding typical treatment periods on raspberries and potatoes

Comment

Use information was received from Nova Scotia (Perennia Food and Agriculture) and New-Brunswick (Dept. of Agriculture, Aquaculture and Fisheries) regarding the typical treatment period on raspberries. Use information was also received from Prince Edward Island (Department of Agriculture) regarding the typical treatment period for potatoes. The feedback from these stakeholders was submitted by Syngenta Canada Inc.

Health Canada response

This new information was taken into consideration in the revised water modelling used to determine estimated environmental concentrations. This change in the date range used for modelling, that was specific to potential field application timing, did not affect the risk assessment but provided the PMRA with valuable real world pesticide use information for abamectin.

Appendix IV Revised dietary exposure and risk estimates for abamectin

Table 1 Summary of dietary acute exposure and risk from abamectin

Subpopulation	Food only – 95 th Percentile		Food and drinking water ¹ – 95 th Percentile	
	Exposure (mg/kg bw)	%ARfD ²	Exposure (mg/kg bw)	%ARfD ²
General population	0.000273	16.1	0.000298	17.5
All Infants (<1 year old)	0.000348	20.4	0.000409	24.0
Children 1–2 years old	0.000667	39.3	0.000681	40.1
Children 3–5 years old	0.000585	34.4	0.000609	35.8
Children 6–12 years old	0.000321	18.9	0.000342	20.1
Youth 13–19 years old	0.000193	11.3	0.000211	12.4
Adults 20–49 years old	0.000218	12.8	0.000246	14.5
Adults 50+ years old	0.000240	14.1	0.000266	15.6
Females 13–49 years old	0.000214	12.6	0.000239	14.0
¹ Estimated environmental concentrations (EECs) of abamectin in potential drinking water sources (groundwater and surface water) were modelled. The acute EEC used in this estimation is 0.9 µg/L (surface water, 90 th percentile of 1-day concentrations from each year) modelled using the highest cumulative application rate that the environmental risk assessment can support (38.2 g a.i./ha).				
² Acute Reference Dose (ARfD) of 0.0017 mg/kg bw.				

Table 2 Summary of dietary chronic exposure and risk from abamectin

Population Subgroup	Food only		Food and drinking water ¹	
	Exposure (mg/kg bw/day)	%ADI ²	Exposure (mg/kg bw/day)	%ADI ²
General Population	0.000023	5.7	0.000028	7.1
All Infants (<1 year old)	0.000051	12.8	0.000072	18.1
Children 1–2 years old	0.000081	20.4	0.000089	22.3
Children 3–5 years old	0.000054	13.5	0.000060	15.1
Children 6–12 years old	0.000029	7.2	0.000033	8.3
Youth 13–19 years old	0.000016	4.0	0.000020	5.0
Adults 20–49 years old	0.000018	4.5	0.000024	5.9
Adults 50+ years old	0.000019	4.7	0.000024	6.1
Females 13–49 years old	0.000017	4.3	0.000023	5.7
¹ Estimated environmental concentrations (EECs) of abamectin in potential drinking water sources (groundwater and surface water) were modelled. The chronic EEC used in this estimation is 0.28 µg/L (surface water, 90 th percentile of yearly average concentrations) modelled using the highest cumulative application rate that the environmental risk assessment can support (38.2 g a.i./ha).				
² Acceptable daily intake (ADI) of 0.0004 mg/kg bw/day.				

Appendix V Final occupational and residential exposure and risk assessment for abamectin

Details for the revised risk assessment are included in this appendix. Please refer to PRVD2023-01 for additional information.

Occupational exposure and risk assessment

The occupational mixer, loader, applicator and occupational postapplication exposure and risk assessments were updated to reflect information and comments received during the consultation period for PRVD2023-01.

The occupational mixer, loader and applicator exposure and risk assessment was updated to remove the handheld airblast/mistblower equipment as the use of abamectin with handheld airblast/mistblower equipment is not expected.

The occupational outdoor postapplication assessments were revised to incorporate the environmental risk mitigation measure limiting the maximum cumulative yearly application rate. As a result, some required restricted-entry intervals have changed from what was proposed in PRVD2023-01.

The occupational postapplication exposure and risk assessment for the greenhouse uses of abamectin presented in the PRVD2023-01 used standard inputs for peak dislodgeable foliar residue and daily dissipation rates. This resulted in risks of concern and unfeasible restricted-entry intervals for the use of abamectin on greenhouse ornamentals being grown for cut flowers and Health Canada proposed this use of abamectin for cancellation.

During the consultation for PRVD2023-01, a previously submitted chemical-specific dislodgeable foliar residue study in greenhouses was cited. The study was determined to be acceptable and well conducted, with some limitations.

The study measured residues of avermectin B1a and its delta 8, 9 isomer. Abamectin is a mixture of components with avermectin B1a (and isomer) comprising at least 80% of the mixture, and avermectin B1b (and isomer) making up at most 20% of the mixture. Residues of avermectin B1b (and isomer) were not measured, which may result in an underestimation of “abamectin” dislodgeable foliar residue residues (as not all of the applied abamectin was measured). Therefore, it was necessary to extrapolate the study data by applying a factor to account for the unmeasured avermectin B1b (and isomer) residues. Additionally, the study measured residues after two applications of abamectin, with a retreatment interval of 5 days. The Canadian abamectin use pattern for greenhouse ornamentals allows up to 5 applications, with a retreatment interval of 7 days. The dislodgeable foliar residue study data was extrapolated to account for the greater number of applications in the Canadian use pattern and is not expected to underestimate exposure.

When the study data were used in the postapplication exposure and risk assessment for greenhouse crops, margins of exposure were greater than the target margin of exposure and risks were shown to be acceptable with a restricted-entry interval of 12 hours. As a result, the use of abamectin on greenhouse ornamentals grown for cut flowers will not be cancelled.

Due to the revisions summarized above, some mitigation measures have been changed from what was proposed in PRVD2023-01.

Residential exposure and risk assessment

No changes were made to the residential risk assessment and risks continue to be acceptable.

Table 1 Mixer, loader, applicator occupational exposure and risk assessment

Crop ¹	Formulation	Application equipment		Max rate (kg a.i./ha)	ATPD (ha/day)	Dermal exposure ² (mg/kg bw/day)	Inhalation exposure ³ (mg/kg bw/day)	Dermal MOE ⁴	Inhalation MOE ⁴	Combined MOE ⁵
Baseline PPE: Single layer + Chemical resistant gloves										
Apples	EC/S	Airblast	0.0143	20	1.37E-04	3.47E-05			877	3460 699
Onion, dry bulb Green onion Subgroup 13-07A	EC/S	GB V and F	0.0228	26	6.22E-06	1.71E-05			19 300	7010 5140
Caneberries	EC/S	Airblast	0.019	20	1.82E-04	4.60E-05			660	2600 526
Celery	EC/S	GB V and F	0.021	26	6.00E-06	1.60E-05			20 960	7610 5580
Grapes	EC/S	Airblast	0.0226	20	2.13E-04	5.40E-05			563	2220 449
Pears	EC/S	Airblast	0.0286	20	2.74E-04	6.94E-05			438	1730 350
Hops	EC/S	Airblast	0.021	107	2.01E-04	5.10E-05			597	2350 476
Potatoes	EC	GB Farmer LFC	0.019	107	2.10E-05	5.90E-05			5630	2040 1500
		GB Custom LFC		360	7.20E-05	1.98E-04			1670	608 446
Strawberries	EC	GB V and F	0.019	26	5.00E-06	1.40E-05			23 200	8410 6170
Greenhouse Ornamentals	EC	MPHG	0.0228 g/L ⁶	3800 L/day	6.05E-05		1.64E-04			1980 734 536
		MPHW		150 L/day	4.03E-07		1.93E-06			298 000 62 100 400
		Backpack			2.33E-06		2.65E-06			51 500 45 200 24 100
Greenhouse Vegetables (peppers, cucumbers, and tomatoes)	EC	MPHG	0.0114 g/L ⁶	3800 L/day	3.02E-05		8.18E-05			3970 1470 1070
		MPHW		150 L/day	2.02E-07		9.66E-07			595 000 124 000 103 000
		Backpack			1.16E-06		1.33E-06			103 000 90 400 48 200

ATPD = area treated per day; MOE = margin of exposure; EC = Emulsifiable Concentrate; S = Suspension; GB = Groundboom; LFC = Large Field Crops; V and F = Vegetables and Fruit; PPE = Personal Protective Equipment; MPHG = Mechanically Pressurized Handgun; MPHWP = Manually Pressurized Handwand

¹ Crops that were recently added to abamectin labels were not included in the occupational re-evaluation as their risk assessments are up to date (for example, celeriac, cucurbit vegetables, fruiting vegetables, leafy greens, leaf petioles, tuberous and corn vegetables, and outdoor ornamentals (boxwood)).

² Dermal exposure (mg/kg bw/day) = (dermal unit exposure (µg/kg ai) × ATPD (ha/day or L/day) × maximum application rate (kg a.i./ha or g/L) × 1% dermal absorption × correction factor (1 mg/1000 µg)) ÷ 80 kg body weight.

³ Inhalation exposure (mg/kg bw/day) = (inhalation unit exposure (µg/kg ai) × ATPD (ha/day or L/day) × maximum application rate (kg a.i./ha or g/L)) ÷ 80 kg body weight.

⁴ Based on a Short-, Intermediate-Term NOAEL of 0.12 mg/kg bw/day from a developmental neurotoxicity study, target MOE = 300.

⁵ Combined MOE = NOAEL/(EXP_{derm}+EXP_{inh}), Short-Term, Target MOE = 300

⁶ g/L = maximum label rate (g a.i./ha) / spray volume (L/ha)

Table 2 Postapplication exposure and risk assessment

Duration	Crop ¹	Rate (kg/ha) ²	Number of applications ²	Application interval (days)	Activity	TC (cm ² /hr) ³	DFR Inputs		Peak DFR (µg/cm ²) ⁴	Dermal exposure (mg/kg bw/day) ⁵	Day 0 MOE ⁶	REI (days) ⁷
							% Rate	% Dissipation				
Short	Apple	0.0143	1	N/A	Hand Thinning	3000	25	10	0.04	0.11	1120	0.5
					Hand Harvesting	1400				0.05	2400	
					Hand Pruning, Scouting, Training	580				0.02	5790	
					Transplanting	230				0.01	14 600	
					Maintenance, Propping, Hand Weeding	100				0.00	33 600	
Short	Onion, dry bulb	0.0228	1	N/A	Hand Weeding	4400	25	10	0.06	0.25	478	0.5
					Irrigation (hand set)	1750				0.10	1200	
					Scouting, Hand Thinning	1300				0.07	1620	
	Green onion Subgroup 13-07A	0.0113	3	7	Hand Weeding	4400	25	10	0.05	0.21	566	0.5
					Irrigation (hand set)	1750				0.08	1420	
					Scouting, Hand	1300				0.06	1910	

Duration	Crop ¹	Rate (kg/ha) ²	Number of applications ²	Application interval (days)	Activity	TC (cm ² /hr) ³	DFR Inputs		Peak DFR (µg/cm ²) ⁴	Dermal exposure (mg/kg bw/day) ⁵	Day 0 MOE ⁶	REI (days) ⁷
							% Rate	% Dissipation				
					Thinning							
Short	Caneberries	0.019	2	7	Irrigation (hand set)	1750	25	10	0.07	0.12	977	0.5
					Hand Harvesting, Tying/Training (Full Foliage)	1400				0.10	1220	
					Hand Pruning, Scouting, Tying/Training (Min. Foliage), Hand Weeding	640				0.04	2670	
					Transplanting	230				0.02	7430	
Short	Celery	0.021	1	N/A	Irrigation (hand set)	1750	25	10	0.05	0.09	1306	0.5
					Hand Harvesting	1100				0.06	2080	
					Transplanting	230				0.01	9940	
					Scouting	210				0.01	10 880	
					Hand Thinning, Hand Weeding	70				0.00	32 700	
		0.0113	3	7	Irrigation (hand set)	1750			0.05	0.08	1420	0.5
					Hand Harvesting	1100				0.05	2260	
					Transplanting	230				0.01	10 820	
					Scouting	210				0.01	11 850	
					Hand Thinning, Hand Weeding	70				0.00	35 600	
Short	Grapes	0.02226	1	N/A	Girdling, Turning	19300	25	10	0.06	1.07	112	9
					Hand Harvesting, Hand Leaf Pulling, Tying/Training	8500				0.47	254	2
					Irrigation (hand set)	1750				0.10	1230	0.5
					Bird Control, Propagating,	640				0.04	3370	

Duration	Crop ¹	Rate (kg/ha) ²	Number of applications ²	Application interval (days)	Activity	TC (cm ² /hr) ³	DFR Inputs		Peak DFR (µg/cm ²) ⁴	Dermal exposure (mg/kg bw/day) ⁵	Day 0 MOE ⁶	REI (days) ⁷
							% Rate	% Dissipation				
					Hand Pruning, Scouting, Trellis Repair, Hand Weeding							
					Transplanting	230				0.01	9380	
Short	Hops	0.021	1	N/A	Mechanically-assisted Harvesting	19300	25	10	0.05	1.01	118	9
					Irrigation (hand set)	1750				0.09	1300	0.5
					Scouting, Stripping, Tying/Training, Hand Weeding	640				0.03	3570	
					Transplanting	230				0.01	9940	
		0.019	2	21	Mechanically-assisted Harvesting	19 300			0.05	1.02	118	9
					Irrigation (hand set)	1750				0.09	1300	0.5
					Scouting, Stripping, Tying/Training, Hand Weeding	640				0.03	3560	
					Transplanting	230				0.01	9900	
					Hand Thinning	3000			0.07	0.12	1020	0.5
		0.014136	2	21	Hand Harvesting	1400				0.05	2190	
					Hand Pruning, Scouting, Training	580				0.02	5280	
					Transplanting	230				0.01	13 300	
					Maintenance, Propping, Hand Weeding	100				0.00	30 600	
					Hand Thinning	3000				0.21	559	0.5
Short	Pears	0.0286	1	21	Hand Harvesting	1400			0.07	0.10	1200	
					Hand Pruning,	580				0.04	2900	

Duration	Crop ¹	Rate (kg/ha) ²	Number of applications ²	Application interval (days)	Activity	TC (cm ² /hr) ³	DFR Inputs		Peak DFR (µg/cm ²) ⁴	Dermal exposure (mg/kg bw/day) ⁵	Day 0 MOE ⁶	REI (days) ⁷
							% Rate	% Dissipation				
					Scouting, Training							
					Transplanting	230				0.02	7300	
					Maintenance, Propping, Hand Weeding	100				0.01	16 800	
Short	Potatoes	0.019	2	7	Irrigation (hand set)	1750	25	10	0.07	0.12	977	0.5
					Roguing	1100				0.08	1550	
					Scouting	210				0.01	8140	
					Hand Weeding	70				0.00	24 400	
Short	Strawberries	0.019	2	7	Hand Harvesting	1100	25	10	0.07	0.08	1554	0.5
					Transplanting	230				0.02	7430	
					Scouting	210				0.01	8140	
					Canopy Management, Hand Weeding	70				0.00	24 413	
Intermediate	GH Cucumbers, Peppers	0.0228	5	7	All activities	1400	N/A	N/A	0.08 ⁸	0.12	1010	0.5
Intermediate	GH Tomato	0.0228	2	7	All activities	1400	N/A	N/A	0.08 ⁸	0.12	1010	0.5
Intermediate	GH Ornamentals	0.0228	5	7	Disbudding, Hand Harvesting, Hand Pruning	4000	N/A	N/A	0.08 ⁸	0.34	354	0.5
					Container Moving, Pinching, Plant support/staking, Scouting, Transplanting, Hand Weeding,	230				0.02	6160	

GH = Greenhouse; TC = Transfer Coefficient; DFR = Dislodgeable Foliar Residue; MOE = Margin of Exposure; REI = Restricted-entry interval; N/A = Not applicable

¹ Crops that were recently added to abamectin labels were not included in the occupational re-evaluation as their risk assessments are up to date (for example, celeriac, cucurbit vegetables, fruiting vegetables, leafy greens, leaf petioles, tuberous and corn vegetables, and outdoor ornamentals (boxwood)).

² Based on the environmental risk assessment, the cumulative maximum rate for all non-greenhouse crops is now 38.2 g a.i./ha. See Appendix VIII for summary of changes to the application rates and applications timings for the abamectin use pattern.

³ Standard Agricultural Transfer Coefficient Values

⁴ Peak Dislodgeable Foliar Residue (DFR) on Day 0 after final application

⁵ Dermal Exposure = (DFR × TC × Duration × DA × CF) / BW

⁶ MOE = NOAEL/Exposure. Dermal MOEs for short-, to intermediate-term exposure durations are based on a NOAEL of 0.12 mg/kg bw/day from a developmental neurotoxicity study in the dog and a target MOE of 300. **Bolded cells** indicate the target not being met.

⁷ If the Target MOE is met on day 0, the REI is set at 12 hours (0.5 days).

⁸ Peak DFR determined from data from a DFR study on greenhouse chrysanthemums. The peaks in the study were determined to reflect the peak after 2 applications and were the used to model a 6 application scenario, with a 5 day retreatment interval.

Table 3 Residential exposure and risk assessment

Scenario	Lifestage	DFR ₀ (µg/cm ²) ¹	Weight unit conversion factor (mg/µ g)	Transfer coefficient (cm ² /hr) ²	Exposure time (hr)	Body weight (kg)	Dermal exposure (mg/kg bw/day) ³	Dermal MOE ⁴
Residential Fruit Trees	Adult	0.04	0.001	1700	1	80	1.49E-05	8070
	Children 6 < 11			930	0.5	32	1.02E-05	11 800

DFR = Dislodgeable foliar residue; MOE = Margin of Exposure

¹ Maximum modelled DFR (after 1 application at 0.0286 g a.i./ha (pears)). This rate reflects the currently supported use pattern

² TC = transfer coefficient. TCs from the USEPA Residential SOP, Section 4: Gardens and Trees (USEPA, 2012)

³ Dermal Exposure = DFR (µg/cm²) × 0.001 conversion factor × dermal absorption (1%) × TC × exposure time ÷ Body Weight

⁴ Short-term Dermal MOE = NOAEL mg/kg/day (0.12 mg/kg bw/day from a rat neurotoxicity study) ÷ Dermal exposure (mg/kg/day), target MOE of 300

Appendix VI Final aggregate exposure and risk assessment

The aggregate assessment was updated to reflect the changes to the dietary exposure. As described in PRVD2023-01, the residential scenarios considered for the aggregate risk assessment were: exposure to professionally treated fruit trees, exposure to ant and cockroach control applied professionally to cracks and crevices in and around residences, and exposure to enclosed bait stations. The crack and crevice treatments and enclosed bait stations were determined to have minimal exposure and do not need to be quantified in the aggregate exposure and risk assessment. The aggregate risk assessment for exposure to treated fruit trees was updated in Table 1.

Table 1 Aggregate exposure and risk assessment for abamectin

Scenario	Lifestage	Body weight (kg)	Dietary exposure ¹ (mg/kg bw/day)	Dermal exposure (mg/kg bw/day) ²	Aggregate MOE ³
Residential Fruit Trees	Adult	80	2.80E-05	1.49E-05	2800
	Children 6 < 11	32	3.60E-05	1.02E-05	2600

MOE = Margin of Exposure; DFR = Dislodgeable foliar residue; DA = Dermal absorption; TC = Transfer coefficient; NOAEL = No observed adverse effect level

¹ Dietary exposure estimates provided by the Exposure Re-evaluation Section following an update to the dietary exposure and risk assessment.

² Dermal Exposure = DFR ($\mu\text{g}/\text{cm}^2$) $\times$ 0.001 $\times$ DA (1%) $\times$ TC $\times$ exposure time $\div$ Body Weight.

³ Aggregate MOE = NOAEL mg/kg/day (0.12 mg/kg bw/day from a rat neurotoxicity study) $\div$ Dermal exposure (mg/kg/day), target MOE of 300.

Appendix VII Environmental risk assessment tables

Table 1 Ground use data used

Use Description	Sum of app rate (g a.i./ha)	Highest single app rate (g a.i./ha)	Soil EER ¹ (g a.i./ha)	Soil EEC ¹ (mg a.i./kg soil)	15 cm water EEC ¹ (mg a.i./L)	80 cm water EEC ¹ (mg a.i./L)	Foliar EEC ¹ (g a.i./ha)
Abamectin, 11.4 g a.i./ha × 3, 7-d interval; on ornamental boxwood Field (Medium).	34.2	11.4	30.4	0.014	0.022	0.0041	22.74
Abamectin, 11.4 g a.i./ha × 3, 7-d interval; on ornamental boxwood Early Airblast.	34.2	11.4	30.4	0.014	0.022	0.0041	22.74
Abamectin, 11.3 g a.i./ha × 3, 7-d interval; on Celery bulb onion 3-07 A and B Field (Medium).	33.9	11.3	30.2	0.013	0.021	0.0040	22.54
Abamectin, 19 g a.i./ha × 2, 7-d interval; on Caneberry, strawberry, celeriac Field (Medium).	38.0	19.0	35.8	0.016	0.025	0.0046	30.70
Abamectin, 19 g a.i./ha × 2, 7-d interval; on Caneberry, Early Airblast.	38.0	19.0	35.8	0.016	0.025	0.0046	30.70
Abamectin, 19.1 g a.i./ha × 2, 7-d interval; on Tuberous and corm, cucurbits, potatoes, leafy greens, bulb vegetables Field (Medium).	38.2	19.1	36.0	0.016	0.025	0.0047	30.86
Abamectin, 10.5 g a.i./ha × 3, 7-d interval; on Leaf petiole and Fruiting vegetable Field (Medium).	31.5	10.5	28.0	0.012	0.020	0.0037	20.94
Abamectin, 28.5 g a.i./ha × 1; on Pears Field (Medium).	28.5	28.5	28.5	0.013	0.019	0.004	28.50
Abamectin, 28.5 g a.i./ha × 1; on Pears Early Airblast.	28.5	28.5	28.5	0.013	0.019	0.0036	28.50
Abamectin, 14.3 g a.i./ha × 1; on Apples Field (Medium).	14.3	14.3	14.3	0.006	0.010	0.002	14.30
Abamectin, 14.3 g a.i./ha × 1; on Apples Early Airblast.	14.3	14.3	14.3	0.006	0.010	0.0018	14.30
Abamectin, 22.3 g a.i./ha × 1; on Grapes Field (Medium).	22.3	22.3	22.3	0.010	0.015	0.003	22.30

Use Description	Sum of app rate (g a.i./ha)	Highest single app rate (g a.i./ha)	Soil EER ¹ (g a.i./ha)	Soil EEC ¹ (mg a.i./kg soil)	15 cm water EEC ¹ (mg a.i./L)	80 cm water EEC ¹ (mg a.i./L)	Foliar EEC ¹ (g a.i./ha)
Abamectin, 22.3 g a.i./ha × 1; on Grapes Early Airblast.	22.3	22.3	22.3	0.010	0.015	0.0028	22.30
Abamectin, 19 g a.i./ha × 2, 21-d interval; on Hops Field (Medium).	38.0	19.0	32.2	0.014	0.023	0.004	23.43
Abamectin, 19 g a.i./ha × 2, 21-d interval; on Hops Early Airblast.	38.0	19.0	32.2	0.014	0.023	0.0044	23.43

EER = Estimated environmental rate; EEC = Estimated environmental concentration

¹EER and EECs in soil, in water and on leaves were respectively calculated using half-lives of 40, 91.3, 10 days; soil density and depth equal to 1.5 g/cm³ and 15 cm respectively; and seasonal and permanent water body depths equal to 15 and 80 cm respectively.

Table 2 Screening level EECs of abamectin in soil foliar and bodies of water (80 cm and 15 cm)

Use scenario	Terrestrial habitat		Aquatic habitat	
	EEC in 0-15 cm depth soil (mg a.i./kg)	Foliar EECs (g a.i./ha)	EEC in 15 cm depth (µg a.i./L)	EEC in 80 cm depth (µg a.i./L)
Maximum cumulative app. rate on potatoes (2 × 19.1 g a.i./ha)	0.016	30.86	25	4.7
Minimum single app. Rate on apple (14.3 g a.i./ha)	0.006	14.3	9.5	1.79

EEC = Estimated environmental concentration

Table 3 Runoff refinement EECs (in µg a.i./L) for the ecological risk assessment of abamectin

Use	Water depth	Water column (µg a.i./L)				Pore water (µg a.i./L)	
		Peak	24 hour	96 hour	21 day	Peak	21 day
14.3 g a.i./ha	15 cm	0.1	0.046	0.015	0.006	N/A	N/A
	80 cm	0.02	0.017	0.011	0.0055	0.0038	0.0038
28.5 g a.i./ha	15 cm	0.21	0.095	0.03	0.012	N/A	N/A
	80 cm	0.04	0.034	0.022	0.011	0.0077	0.0077
2 × 19.1 g a.i./ha with 7 day interval	15 cm	2.5	1.1	0.46	0.22	N/A	N/A
	80 cm	0.56	0.48	0.34	0.20	0.14	0.14

EEC = Estimated environmental concentration; N/A = Not applicable

Table 4 EECs (in µg a.i./L) for the drinking water risk assessment of abamectin

Use pattern	Groundwater (µg a.i./L)		Surface water (µg a.i./L)		
	Daily ¹	Yearly ²	Daily ³	Yearly ⁴	Overall ⁵
38.2 g abamectin/ha	N/A	N/A	0.90	0.28	0.24

EEC = Estimated environmental concentration; N/A = Not applicable

¹ 90th percentile of daily average concentrations² 90th percentile of 365-day moving average concentrations³ 90th percentile of the highest 1-day average concentration from each year⁴ 90th percentile of yearly average concentrations⁵ Average of all yearly average concentrations**Table 5 Maximum EEC in vegetation and insects after direct over-spray**

Matrix	EEC (mg a.i./kg fw)		Fresh / dry weight ratios	EEC (mg a.i./kg dw)	
	Maximum residues	Mean residues		Maximum residues	Mean residues
Short range grass	7	2	3.3	21.79	7.74
Long grass	3	1	4.4	13.31	4.34
Forage crops	4	1	5.4	20.16	6.67
Insects (Small and Large)	3	2	3.8	9.85	6.80
Grain and seeds	0	0	3.8	1.52	0.73
Fruit	0	0	7.6	3.05	1.45

EEC = Estimated environmental concentration

Table 6 Estimated daily exposure (EDE) for birds and mammals

Organism weight (g)	FIR (g dw diet/day) ¹	Feeding guild	Matrix	EEC (mg a.i./kg dw diet)	EDE (mg a.i./kg bw/day) ⁴
Birds					
20	5.1	Insectivore	Small insects ²	9.85	2.51
		Granivore	Grain and seeds ^c	1.52	0.39
		Frugivore	Fruit	3.05	0.78
100	19.9	Insectivore	Small insects	9.85	1.96
		Insectivore	Large insects ⁵	9.85	1.96
		Granivore	Grain and seeds ^c	1.52	0.30
		Frugivore	Fruit	3.05	0.61

Organism weight (g)	FIR (g dw diet/day) ¹	Feeding guild	Matrix	EEC (mg a.i./kg dw diet)	EDE (mg a.i./kg bw/day) ⁴
1000	58.1	Insectivore	Small insects	9.85	0.57
		Insectivore	Large insects ⁵	9.85	0.57
		Granivore	Grain and seeds ^c	1.52	0.09
		Frugivore	Fruit	3.05	0.18
		Herbivore	Short range grass ⁵	21.79	1.27
		Herbivore	Forage crops ⁵	13.31	0.77
		Herbivore	Long grass ⁵	20.16	1.17
Mammals					
15	2.2	Insectivore	Small insects	9.85	1.44
		Granivore	Grain and seeds	1.52	0.22
		Frugivore	Fruit	3.05	0.45
35	4.5	Insectivore	Small insects	9.85	1.27
		Granivore	Grain and seeds	1.52	0.20
		Frugivore	Fruit	3.05	0.39
		Herbivore	Short range grass ⁵	21.79	2.80
		Herbivore	Forage crops ⁵	20.16	2.59
		Herbivore	Long grass ⁵	13.31	1.71
1000	68.7	Insectivore	Small insects	9.85	0.68
		Granivore	Grain and seeds	1.52	0.10
		Frugivore	Fruit	3.05	0.21
		Herbivore	Short range grass ⁵	21.79	1.50
		Herbivore	Forage crops ⁵	20.16	1.39
		Herbivore	Long grass ⁵	13.31	0.91

¹ Food Ingestion Rates. For generic birds with body weight less than or equal to 200 g, the “passerine” equation was used; for generic birds with body weight greater than 200 g, the “all birds” equation was used:

Passerine Equation (body weight < or =200 g): $\text{FIR (g dry weight/day)} = 0.398(\text{bw in g})^{0.850}$

All birds Equation (body weight > 200 g): $\text{FIR (g dry weight/day)} = 0.648(\text{bw in g})^{0.651}$. For mammals, the “all birds” equation was used: $\text{FIR (g dry weight/day)} = 0.235(\text{bw in g})^{0.822}$

² Large insects not considered to be a relevant food source for small birds and mammals.

³ For granivorous species, only grains and seeds were considered as a relevant source of exposure (as opposed to seeds in pods, which were not considered).

⁴ EDE = Estimated dietary exposure; is calculated using the following formula: $(\text{FIR/bw}) \times \text{EEC}$. At the screening level, food items representing the most conservative EEC are used.

⁵ Additional food items that could be considered to further characterize the risk.

EEC = Estimated environmental concentration

FIR = Food ingestion rate

Table 7 Toxicity to non-target species updated for RVD

Organism	Exposure	Test substance	Endpoint value	Uncertainty Factor applied	Level of concern (LOC)	Degree of toxicity ¹	PMRA#
Terrestrial organisms							
Birds							
Northern Bobwhite quail, <i>Colinus virginianus</i>	14-d Acute oral	Abamectin (91% purity)	LD ₅₀ > 2000 mg a.i./kg bw	10	1	Practically non-toxic	1238968
	22-w Reproduction	Abamectin (90.2% purity)	22-d NOEC ≥ 1.98 mg a.i./kg diet/d	1	1	N/A	3480122
Mallard duck, <i>Anas platyrhynchos</i>	14-d Acute oral	Abamectin (91% purity)	LD ₅₀ not determined	10	1	Uncertainty caused by regurgitation in all levels of treatment	3480121
	5-d Dietary		LD₅₀ = 44.03 mg a.i./kg bw (corrected for purity)	10	1	Very highly toxic	1238970
	22-w Reproduction	Abamectin (94.7% purity)	22-w NOEC = 6 mg a.i./kg diet NOAEL = 0.7 mg a.i./kg diet/d LOAEL = 1.4 mg a.i./kg diet/d	1	1	N/A	1238972, 1238929
Mammals							
Rat, Sprague Dawley	Acute, oral	Abamectin	Male: LD ₅₀ = 8.7 mg a.i./kg bw	10	1	Very highly toxic	3019907
	2-generation reproduction	Abamectin	Offspring NOAEL = 0.12 mg	1	1	N/A	2529526

Organism	Exposure	Test substance	Endpoint value	Uncertainty Factor applied	Level of concern (LOC)	Degree of toxicity ¹	PMRA#
Terrestrial organisms							
	e toxicity study (gavage)		a.i./kg bw/day LOAEL = 0.2 mg/kg bw/day				
Aquatic Organisms							
Freshwater invertebrates							
Cladocera, <i>Daphnia magna</i>	21-d Chronic (flow through)	Abamectin (98.8 % purity)	NOEC = 0.0029 µg a.i./L (mean measured concentration)				3465177

¹ USEPA classification, where applicable; N/A = not applicable.

LD₅₀ = Lethal dose causing 50% mortality; NOAEL = No observed adverse effect level; NOEC = No observed effect concentration

Bold = Updates for RVD

Table 8 Effects metrics for non-target species used in risk assessment

Organism	Substance	Exposure	Endpoint	Value	Effects Metric	Uncertainty factor applied
Earthworm, <i>Eisenia fetida</i>	Avermectin B1a	14-d	14-d LC ₅₀	33 mg a.i./kg dw soil	16.5 mg a.i./kg dw soil	2
Springtail Collembolan, <i>Folsomia candida</i>	Abamectin 1.8% EC	28-d	28-d LC ₅₀	1.94 mg a.i./kg	0.97 mg a.i./kg	2
Earthworm, <i>Eisenia fetida</i>	Vertimec 0.18 EC	Reproduction	56-d NOEC	NOEC: 0.72 mg a.i./kg	0.72 mg a.i./kg	1
Springtail Collembolan, <i>Folsomia candida</i>	Abamectin	28-d	28-d NOEC	0.103 mg a.i./kg dw soil	0.103 mg a.i./kg dw soil	1
Honeybee, <i>Apis mellifera</i>	Abamectin	Acute contact	24-h LD ₅₀	0.001 µg a.i./bee	0.001 µg a.i./bee	1
	Abamectin	Acute oral	72-h LD ₅₀	0.007 µg a.i./bee	0.007 µg a.i./bee	1
	Abamectin SC (A1379610)	Acute larva	8-d LD ₅₀	0.00012 µg a.i./larva/d	0.00012 µg a.i./larva/day	1

Organism	Substance	Exposure	Endpoint	Value	Effects Metric	Uncertainty factor applied
	Abamectin	Chronic adult feeding (10-d exposure)	10-d NOED	0.000166 µg a.i./bee/d	0.000166 µg a.i./bee/day	1
	Abamectin 1.8% EC	Chronic adult	10-d NOED	0.000102 µg a.i./bee/d	0.000102 µg a.i./bee/d	1
	Abamectin		22-d NOED (pupal survival and adult emergence)	0.00001 µg a.i./bee	0.00001 µg a.i./bee	1
Parasitoid, <i>Aphidius rhopalosiphi</i>	Vertimec 018 EC	Acute, extended spray residues	48-h LR ₅₀	0.143 g a.i./ha	0.143 g a.i./ha	1
Predatory mite, <i>Typhlodromus pyri</i>	Abamectin EC	Acute, extended spray residues	14-d LR ₅₀	0.182 g a.i./ha	0.182 g a.i./ha	1
Mallard duck, <i>Anas platyrhynchos</i>	Abamectin	Acute Dietary	5-d LC ₅₀ (LD ₅₀)	383 mg a.i./kg diet (44.03 mg a.i./kg bw/day)	4.40 mg a.i./kg bw/day	10
	Abamectin	Reproduction	22-w NOED	0.7 mg a.i./kg bw/d	0.7 mg a.i./kg bw/day	1
Rat, Sprague Dawley	Abamectin	Acute	14-d LD ₅₀	8.7 mg a.i./kg bw (male)	0.87 mg a.i./kg bw	10
	Abamectin	2-generation Reproduction	NOAEL (F ₁ , offspring)	0.12 mg a.i./kg bw/d	0.12 mg a.i./kg bw/day	1
Terrestrial plants	Abamectin 1.8% EC	Vegetative vigour	14-d ER ₅₀	>49.5 g a.i./ha	>49.5 g a.i./ha	1
SSD of 14 freshwater invertebrates species Most sensitive species = Cladocera <i>Daphnia pulex</i>	Avermectin B1a	Acute	HC ₅	0.025 µg a.i./L ¹	0.025 µg a.i./L	1
Cladocera, <i>Daphnia magna</i>	Abamectin	Chronic	21-d NOEC (survival and young/adult)	0.0029 µg a.i./L	0.0029 µg a.i./L	1

Organism	Substance	Exposure	Endpoint	Value	Effects Metric	Uncertainty factor applied
			reproduction days)			
Rainbow trout, <i>Oncorhynchus mykiss</i>	Abamectin 1.8% EC	Acute	96-h LC ₅₀	2.6 µg a.i./L	0.26 µg a.i./L	10
Rainbow trout, <i>Oncorhynchus mykiss</i>	Abamectin	Early Life Stage	60-d NOEC	0.52 µg a.i./L	0.52 µg a.i./L	1
Amphibian (fish data as surrogate)	Abamectin	Acute	96-h LC ₅₀	2.6 µg a.i./L	0.26 µg a.i./L	10
Amphibian (amphibian data)	Abamectin	Chronic	21-d NOEC	9.6 µg a.i./L	9.6 µg a.i./L	1
Green alga, <i>Desmodesmus subspicatus</i>	Abamectin 1.8% EC	Acute	72-h EC ₅₀	518 µg a.i./L	259 µg a.i./L	2
Saltwater invertebrates Mysid shrimp, <i>Mysidopsis bahia</i>	Abamectin	Acute	96-h LC ₅₀	0.022 µg a.i./L	0.011 µg a.i./L	2
		Chronic	28-d NOEC (reproduction)	0.0022 µg a.i./L	0.0022 µg a.i./L	1
Saltwater fish Sheepshead minnow, <i>Cyprinodon variegatus</i>	Abamectin	34d-Chronic Early-life stage	NOEC (larval survival)	0.34 µg a.i./L	0.34 µg a.i./L	1
Saltwater algae Marine Diatom, <i>Skeletonema costatum</i>	Abamectin	Acute	72-h EC ₅₀ (area under the curve)	110 µg a.i./L	55 µg a.i./L	2

¹ SSD results for 14 freshwater invertebrates species: (*Daphnia pulex*, *Simocephalus* sp., *Daphnia magna*, *Daphnia longispina*, *Diaphanosoma* sp., *Daphnia galeata*, *Eudiaptomus graciloides* Cloeon sp., Fairy shrimp (*Eudiaptomus graciloides*), *Gammarus* sp., *Lymnaea stagnalis*, *Ostracoda*, *Chaoborus* sp., *Brachionus calyciflorus*)

EC₅₀ = Effective concentration causing 50% effect

LC₅₀ = Lethal concentration causing 50% mortality

HC₅ = Hazardous concentration for 5% of species

LR₅₀ = Lethal rate on 50% of the population

ER₅₀ = Effective rate on 50% of the population

LD₅₀ = Lethal dose causing 50% mortality

NOAEL = No observed adverse effect level

NOEC = No observed effect concentration

NOED = No observed effect dose

Table 9 Screening-level risk assessment for terrestrial organisms other than birds and mammals at the maximum cumulative application rate 38.2 g a.i./ha (2 applications of 19.1 g a.i./ha at a 7-day interval) and minimum single rate 14.3 g a.i./ha

Organism	Exposure	Effects Metric	EEC		RQ	LOC Exceeded? (Yes/No)
Maximum cumulative application rate 38.2 g a.i./ha (19.1 g a.i./ha × 2 at a 7-day interval)						
Terrestrial organisms						
Invertebrates						
Earthworm, <i>Eisenia fetida</i>	Acute	16.5 mg a.i./kg dw soil	0.016 mg a.i./kg		0.001	No
	Chronic	0.72 mg a.i./kg			0.02	No
Springtail Collembolan, <i>Folsomia candida</i>	Acute	0.97 mg a.i./kg			0.01	No
	Chronic	0.103 mg a.i./kg dw soil			0.2	No
Predatory arthropod	Contact	0.182 g a.i./ha	On-field	30.86 g a.i./ha	169.6	Yes
			Off-field 6%	1.85 g a.i./ha	10.2	Yes
			Off-field 74%	22.84 g a.i./ha	125.5	Yes
			Off-field 59%	18.21 g a.i./ha	100	Yes
Parasitic arthropod	Contact	0.143 g a.i./ha	On-field	30.86 g a.i./ha	215.8	Yes
			Off-field 6%	1.85 g a.i./ha	12.9	Yes
			Off-field 74%	22.84 g a.i./ha	159.7	Yes
			Off-field 59%	18.21 g a.i./ha	127.3	Yes
Vascular plants						
Vascular plant	Vegetative vigour	>49.5 g a.i./ha	30.86 g a.i./ha		<0.6	No
Minimum single application rate (14.3 g a.i./ha)						
Terrestrial organisms invertebrates						
Earthworm, <i>Eisenia fetida</i>	Acute	16.5 mg a.i./kg dw soil	0.006 mg a.i./kg		0.0004	No
	Chronic	0.72 mg a.i./kg			0.008	No
Springtail Collembolan,	Acute	0.97 mg a.i./kg			0.006	No
	Chronic	0.103 mg			0.06	No

Organism	Exposure	Effects Metric	EEC		RQ	LOC Exceeded? (Yes/No)
<i>Folsomia candida</i>		a.i./kg dw soil				
Predatory arthropod	Contact	0.182 g a.i./ha	On-field	14.3 g a.i./ha	78.6	Yes
			Off-field 6%	0.86 g a.i./ha	4.7	Yes
			Off-field 74%	10.58 g a.i./ha	58.1	Yes
			Off-field 59%	8.44 g a.i./ha	46.4	Yes
Parasitic arthropod	Contact	0.143 g a.i./ha	On-field	14.3 g a.i./ha	100	Yes
			Off-field 6%	0.86 g a.i./ha	6	Yes
			Off-field 74%	10.58 g a.i./ha	74	Yes
			Off-field 59%	8.44 g a.i./ha	59	Yes
Vascular plants						
Vascular plant	Vegetative vigour	>49.5 g a.i./ha	14.3 g a.i./ha		<0.29	No

EEC = Estimated environmental concentration

RQ = Risk quotient

LOC = Level of concern

Table 10 Screening level risk assessment for birds and mammals at the maximum cumulative application 38.2 g a.i./ha (2 applications of 19.1 g a.i./ha at a 7-day interval)

Organism/Exposure	Toxicity (mg a.i./kg bw/d)	Feeding guild (food item)	EDE (mg a.i./kg bw)	RQ	LOC exceeded? (Yes/No)
Small bird (0.02 kg)					
Acute dietary	4.40	Insectivore	2.51	0.57	No
Reproduction	0.70	Insectivore	2.51	3.59	Yes
Medium-sized bird (0.1 kg)					
Acute dietary	4.40	Insectivore	1.96	0.45	No
Reproduction	0.70	Insectivore	1.96	2.80	Yes
Large-sized bird (1 kg)					
Acute dietary	4.40	Herbivore (short grass)	1.27	0.29	No
Reproduction	0.70	Herbivore (short grass)	1.27	1.81	Yes
Small mammal (0.015 kg)					
Acute oral	0.87	Insectivore	1.44	1.66	Yes

Organism/Exposure	Toxicity (mg a.i./kg bw/d)	Feeding guild (food item)	EDE (mg a.i./kg bw)	RQ	LOC exceeded? (Yes/No)
Reproduction	0.12	Insectivore	1.44	12.04	Yes
Medium-sized mammal (0.035 kg)					
Acute oral	0.87	Herbivore (short grass)	2.80	3.22	Yes
Reproduction	0.12	Herbivore (short grass)	2.80	23.35	Yes
Large-sized mammal (1 kg)					
Acute oral	0.87	Herbivore (short grass)	1.50	1.72	Yes
Reproduction	0.12	Herbivore (short grass)	1.50	12.48	Yes

EDE = Estimated daily exposure

RQ = Risk quotient

LOC = Level of concern

Table 11 Screening level risk assessment for aquatic organisms at the maximum cumulative application rate of 38.2 g a.i./ha (2 applications of 19.1 g a.i./ha at a 7-day interval) and minimum single rate of 14.3 g a.i./ha

Organism	Exposure	Effects metric	EEC	RQ	LOC exceeded? (Yes/No)
Maximum cumulative application rate 38.2 g a.i./ha (19.1 g a.i./ha × 2 at a 7-day interval)					
Aquatic Organisms – Freshwater Invertebrates					
SSD results for 14 freshwater invertebrates species: Most sensitive species: <i>Daphnia pulex</i>	Acute	HC ₅ = 0.025 µg a.i./L ¹	4.7 µg a.i./L	188	Yes
<i>Daphnia magna</i>	Chronic	NOEC = 0.0029 µg a.i./L		1620.7	Yes
Fish					
Rainbow trout, <i>Oncorhynchus Mykiss</i>	Acute	LC ₅₀ /10 = 0.26 µg a.i./L		18.1	Yes
	Chronic	NOEC: 0.52 µg a.i./L		9.0	Yes
Bluegill sunfish	Acute	LC ₅₀ /10 = 0.67 µg a.i./L		7.0	Yes
Amphibians					
Amphibians	Acute (Surrogate endpoint from rainbow trout)	LC ₅₀ /10 = 0.26 µg a.i./L	25 µg a.i./L	96.2	Yes
	Chronic	NOEC = 9.6 µg a.i./L		2.6	Yes

Organism	Exposure	Effects metric	EEC	RQ	LOC exceeded? (Yes/No)
Algae					
Freshwater alga, <i>Desmodesmus subspicatus</i>	Acute	EC ₅₀ /2 = 259 µg a.i./L	4.7 µg a.i./L	0.02	No
Marine species					
Crustacean Mysid shrimp, <i>Mysidopsis bahia</i>	Acute	EC ₅₀ /2 = 0.011 µg a.i./L	4.7 µg a.i./L	427.3	Yes
	Chronic	NOEC = 0.0022 µg a.i./L		2136.4	Yes
Fish Sheepshead minnow, <i>Cyprinodon variegatus</i>	Acute	EC ₅₀ /2 = 7.5 µg a.i./L		0.6	No
	Chronic	NOEC = 0.34 µg a.i./L		13.8	Yes
Marine alga, <i>Skeletonema costatum</i>	Acute	EC ₅₀ /2 = 55 µg a.i./L		0.09	No
Minimum single application rate (14.3 g a.i./ha)					
Aquatic Organisms – Freshwater Invertebrates					
SSD results for 14 freshwater invertebrates species: Most sensitive species: <i>Daphnia pulex</i>	Acute	HC ₅ = 0.025 µg a.i./L ¹	1.79 µg a.i./L	71.6	Yes
<i>Daphnia magna</i>	Chronic	NOEC = 0.0029 µg a.i./L		617.2	Yes
Fish					
Rainbow trout, <i>Oncorhynchus Mykiss</i>	Acute	LC ₅₀ /10 = 0.26 µg a.i./L		6.9	Yes
	Chronic	NOEC: 0.52 µg a.i./L		3.4	Yes
Bluegill sunfish	Acute	LC ₅₀ /10 = 0.67 µg a.i./L		2.7	Yes
Amphibians					
Amphibians	Acute (Surrogate endpoint from rainbow trout)	LC ₅₀ /10 = 0.26 µg a.i./L	9.53 µg a.i./L	36.7	Yes
	Chronic	NOEC = 9.6 µg a.i./L		1.0 [0.99]	No
Algae					
Freshwater	Acute	EC ₅₀ /2 = 259 µg	1.79 µg a.i./L	0.007	No

Organism	Exposure	Effects metric	EEC	RQ	LOC exceeded? (Yes/No)
alga, <i>Desmodesmus subspicatus</i>		a.i./L			
Marine species					
Crustacean Mysid shrimp, <i>Mysidopsis bahia</i>	Acute	EC ₅₀ /2 = 0.011 µg a.i./L	1.79 µg a.i./L	162.7	Yes
	Chronic	NOEC = 0.0022 µg a.i./L		813.6	Yes
Fish Sheepshead minnow, <i>Cyprinodon variegatus</i>	Acute	EC ₅₀ /2 = 7.5 µg a.i./L		0.2	No
	Chronic	NOEC = 0.34 µg a.i./L		5.3	Yes
Marine alga, <i>Skeletonema costatum</i>	Acute	EC ₅₀ /2 = 55 µg a.i./L		0.03	No

¹ SSD results for 14 freshwater invertebrates species: (*Daphnia pulex*, *Simocephalus* sp., *Daphnia magna*, *Daphnia longispina*, *Diaphanosoma* sp., *Daphnia galeata*, *Eudiaptomus graciloides* Cloeon sp., Fairy shrimp (*Eudiaptomus graciloides*), *Gammarus* sp., *Lymnaea stagnalis*, *Ostracoda*, *Chaoborus* sp., *Brachionus calyciflorus*)

EEC = Estimated environmental concentration

NOEC = No observed effect concentration

LC₅₀ = Lethal dose causing 50% mortality

HC₅ = Hazardous concentration causing 5% effect on species

EC₅₀ = Effective concentration causing 50% effect.

RQ = Risk quotient

LOC = Level of concern

Table 12 Refined risk assessment for terrestrial organisms other than birds and mammals at the maximum cumulative application rate 38.2 g a.i./ha (19.1 g a.i./ha × 2 at a 7-day interval) and minimum single application rate (14.3 g a.i./ha)

Organism	Exposure	Effects metric	Refined EEC (off-field) (µg a.i./L)	RQ	LOC exceeded? (Yes/No)
Maximum cumulative application rate (19.1 g a.i./ha x 2 at a 7 day interval)					
Terrestrial Organisms					
Parasitic arthropod, <i>Aphidius rhopalosiphi</i>	2 × 19.1 × 7	0.143 g a.i./ha	Field sprayer: 0.19 g a.i./ha	1.3	Yes
			Early airblast: 2.28 g a.i./ha	16	Yes
			Late airblast: 1.82 g a.i./ha	12.7	Yes
Minimum single application rate (14.3 g a.i./ha)					
Parasitic arthropod,	1 × 14.3	0.143 g a.i./ha	Field sprayer: 0.09 g a.i./ha	0.6	No
			Early airblast: 1.06 g a.i./ha	7.4	Yes

Organism	Exposure	Effects metric	Refined EEC (off-field) (µg a.i./L)	RQ	LOC exceeded? (Yes/No)
<i>Aphidius rhopalosiphi</i>			Late airblast: 0.84 g a.i./ha	5.9	Yes

Refined EEC off-field:

field sprayer: $0.19 \text{ g a.i./ha} = 30.859 \text{ g a.i./ha}$ ($19.1 \text{ g a.i./ha} \times 2 \times 10 \text{ days foliar half-life} \times 7 \text{ days interval}$) $\times 6\%$ spray drift $\times 0.1$ (vegetation distribution factor).

early airblast: $2.28 \text{ g a.i./ha} = 30.859 \text{ g a.i./ha}$ ($19.1 \text{ g a.i./ha} \times 2 \times 10 \text{ days foliar half-life} \times 7 \text{ days interval}$) $\times 74\%$ spray drift $\times 0.1$ (vegetation distribution factor).

late airblast: $1.82 \text{ g a.i./ha} = 30.859 \text{ g a.i./ha}$ ($19.1 \text{ g a.i./ha} \times 2 \times 10 \text{ days foliar half-life} \times 7 \text{ days interval}$) $\times 59\%$ spray drift $\times 0.1$ (vegetation distribution factor).

EEC = Estimated environmental concentration

RQ = Risk quotient

LOC = Level of concern

Table 13 Refined risk assessment to birds and mammals at the maximum cumulative application rate 38.2 g a.i./ha (19.1 g a.i./ha $\times$ 2 applications with a 7-day interval)

Organism/ Exposure	Toxicity (mg a.i./kg bw/d)	Food guild (food item)	Maximum nomogram residues				Mean nomogram residues			
			On-field		Off-field		On-field		Off-field	
			EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./k g bw)	RQ	EDE (mg a.i./k g bw)	RQ	EDE (mg a.i./k g bw)	RQ
Small bird (0.02 kg)										
Reproduction	0.70	Insectivore	2.51	3.6	1.86	2.7	1.73	2.48	1.28	1.83
	0.70	Granivore (grain and seeds)	0.39	0.6	0.29	0.4	0.19	0.26	0.14	0.20
	0.70	Frugivore (fruit)	0.78	1.1	0.58	0.8	0.37	0.53	0.27	0.39
Medium-sized bird (0.1 kg)										
Reproduction	0.70	Insectivore	1.96	2.8	1.45	2.1	1.35	1.93	1.00	1.43
	0.70	Granivore (grain and seeds)	0.30	0.4	0.22	0.3	0.14	0.21	0.11	0.15
	0.70	Frugivore (fruit)	0.61	0.9	0.45	0.6	0.29	0.41	0.21	0.31
Large-sized bird (1 kg)										
Reproduction	0.70	Insectivore	0.57	0.8	0.42	0.6	0.40	0.56	0.29	0.42
	0.70	Granivore (grain and seeds)	0.09	0.1	0.07	0.1	0.04	0.06	0.03	0.04
	0.70	Frugivore (fruit)	0.18	0.3	0.13	0.2	0.08	0.12	0.06	0.09
	0.70	Herbivore (short grass)	1.27	1.8	0.94	1.3	0.45	0.64	0.33	0.48

Organism/ Exposure	Toxicity (mg a.i./kg bw/d)	Food guild (food item)	Maximum nomogram residues				Mean nomogram residues			
			On-field		Off-field		On-field		Off-field	
			EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./k g bw)	RQ	EDE (mg a.i./k g bw)	RQ	EDE (mg a.i./k g bw)	RQ
	0.70	Herbivore (long grass)	0.77	1.1	0.57	0.8	0.25	0.36	0.19	0.27
	0.70	Herbivore (Broadleaf plants)	1.17	1.7	0.87	1.2	0.39	0.55	0.29	0.41
Small mammal (0.015 kg)										
Acute	0.87	Insectivore	1.44	1.6 6	1.07	1.23	1.00	1.15	0.74	0.85
	0.87	Granivore (grain and seeds)	0.22	0.2 6	0.17	0.19	0.11	0.12	0.08	0.09
	0.87	Frugivore (fruit)	0.45	0.5 1	0.33	0.38	0.21	0.25	0.16	0.18
Reproduction	0.20	Insectivore	1.44	7.2 2	1.07	5.35	1.00	4.99	0.74	3.69
	0.20	Granivore (grain and seeds)	0.22	1.1 2	0.17	0.83	0.11	0.53	0.08	0.39
	0.20	Frugivore (fruit)	0.45	2.2 4	0.33	1.65	0.21	1.07	0.16	0.79
Medium-sized mammal (0.035 kg)										
Acute	0.87	Insectivore	1.27	1.4 6	0.94	1.08	0.87	1.01	0.65	0.74
	0.87	Granivore (grain and seeds)	0.20	0.2 3	0.15	0.17	0.09	0.11	0.07	0.08
	0.87	Frugivore (fruit)	0.39	0.4 5	0.29	0.33	0.19	0.21	0.14	0.16
	0.87	Herbivore (short grass)	2.80	3.2 2	2.07	2.38	1.00	1.14	0.74	0.85
	0.87	Herbivore (long grass)	1.71	1.9 7	1.27	1.46	0.56	0.64	0.41	0.48
	0.87	Herbivore (forage crops)	2.59	2.9 8	1.92	2.21	0.86	0.99	0.63	0.73
Reproduction	0.20	Insectivore	1.27	6.3 3	0.94	4.69	0.87	4.37	0.65	3.24
	0.20	Granivore (grain and seeds)	0.20	0.9 8	0.15	0.73	0.09	0.47	0.07	0.35
	0.20	Frugivore (fruit)	0.39	1.9 6	0.29	1.45	0.19	0.93	0.14	0.69
	0.20	Herbivore (short grass)	2.80	14. 01	2.07	10.37	1.00	4.98	0.74	3.68
	0.20	Herbivore (long grass)	1.71	8.5 5	1.27	6.33	0.56	2.79	0.41	2.07

Organism/ Exposure	Toxicity (mg a.i./kg bw/d)	Food guild (food item)	Maximum nomogram residues				Mean nomogram residues			
			On-field		Off-field		On-field		Off-field	
			EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./k g bw)	RQ	EDE (mg a.i./k g bw)	RQ	EDE (mg a.i./k g bw)	RQ
	0.20	Herbivore (Broadleaf plants)	2.59	12.96	1.92	9.59	0.86	4.28	0.63	3.17
Large-sized mammal (1 kg)										
Acute	0.87	Insectivore	0.68	0.78	0.50	0.58	0.47	0.54	0.35	0.40
	0.87	Granivore (grain and seeds)	0.10	0.12	0.08	0.09	0.05	0.06	0.04	0.04
	0.87	Frugivore (fruit)	0.21	0.24	0.15	0.18	0.10	0.11	0.07	0.08
	0.87	Herbivore (short grass)	1.50	1.72	1.11	1.27	0.53	0.61	0.39	0.45
	0.87	Herbivore (long grass)	0.91	1.05	0.68	0.78	0.30	0.34	0.22	0.25
	0.87	Herbivore (Broadleaf plants)	1.39	1.59	1.03	1.18	0.46	0.53	0.34	0.39
Reproduction	0.20	Insectivore	0.68	3.38	0.50	2.50	0.47	2.34	0.35	1.73
	0.20	Granivore (grain and seeds)	0.10	0.52	0.08	0.39	0.05	0.25	0.04	0.18
	0.20	Frugivore (fruit)	0.21	1.05	0.15	0.77	0.10	0.50	0.07	0.37
	0.20	Herbivore (short grass)	1.50	7.49	1.11	5.54	0.53	2.66	0.39	1.97
	0.20	Herbivore (long grass)	0.91	4.57	0.68	3.38	0.30	1.49	0.22	1.10
	0.20	Herbivore (Broadleaf plants)	1.39	6.93	1.03	5.13	0.46	2.29	0.34	1.69

Bolded = LOC exceeded

EDE = Estimated daily exposure

RQ = Risk quotient

Table 14 Spray drift risk assessment for aquatic organisms at the maximum cumulative application rate 38.2 g a.i./ha (2 applications of 19.1 g a.i./ha at a 7-day interval) and minimum single application rate 14.3 g a.i./ha

Organism	Exposure	Effects metric	Refined EEC	RQ	LOC exceeded? (Yes/No)
Maximum cumulative application rate 38.2 g a.i./ha (19.1 g a.i./ha × 2, 7 day interval)					
Aquatic Organisms – Freshwater Invertebrates					
SSD results for 14 freshwater invertebrates species: Most sensitive species: <i>Daphnia pulex</i>	Acute	HC ₅ = 0.025 µg a.i./L ¹	Field sprayer: 0.3 µg a.i./L	11.3	Yes
			Early airblast: 3.5 µg a.i./L	139.1	Yes
			Late airblast: 2.8 µg a.i./L	110.9	Yes
<i>Daphnia magna</i>	Chronic	NOEC = 0.0029 µg a.i./L	Field sprayer: 0.3 µg a.i./L	97.2	Yes
			Early airblast: 3.5 µg a.i./L	1206.9	Yes
			Late airblast: 2.8 µg a.i./L	955.2	Yes
Fish					
Rainbow trout, <i>Oncorhynchus Mykiss</i>	Acute	LC ₅₀ /10 = 0.26 µg a.i./L	Field sprayer: 0.3 µg a.i./L	1.1	Yes
			Early airblast: 3.5 µg a.i./L	13.4	Yes
			Late airblast: 2.8 µg a.i./L	10.7	Yes
	Chronic	NOEC = 0.52 µg a.i./L	Field sprayer: 0.3 µg a.i./L	0.5	No
			Early airblast: 3.5 µg a.i./L	6.7	Yes
			Late airblast: 2.8 µg a.i./L	5.3	Yes
Bluegill sunfish	Acute	LC ₅₀ /10 = 0.67 µg a.i./L	Field sprayer: 0.3 µg a.i./L	0.4	No
			Early airblast: 3.5 µg a.i./L	5.2	Yes
			Late airblast: 2.8 µg a.i./L	4.1	Yes
Amphibians					
Amphibians	Acute (Surrogate endpoint from rainbow trout)	LC ₅₀ /10 = 0.26 µg a.i./L	Field sprayer: 1.5 µg a.i./L	5.8	Yes
			Early airblast: 18.5 µg a.i./L	71.2	Yes
			Late airblast: 14.8 µg a.i./L	56.7	Yes

Organism	Exposure	Effects metric	Refined EEC	RQ	LOC exceeded? (Yes/No)
	Chronic	NOEC = 9.6 µg a.i./L	Field sprayer: 1.5 µg a.i./L	0.2	No
			Early airblast: 18.5 µg a.i./L	1.9	Yes
			Late airblast: 14.8 µg a.i./L	1.5	Yes
Marine species (refinement of EEC based on maximum single application rate of 28.5 g a.i./ha)					
Crustacean Mysid shrimp, <i>Mysidopsis bahia</i>	Acute	EC ₅₀ /2 = 0.01 µg a.i./L	Field sprayer: 0.2 µg a.i./L	19.5	Yes
			Early airblast: 2.6 µg a.i./L	240.2	Yes
			Late airblast: 2.1 µg a.i./L	191.5	Yes
Minimum single application rate (14.3 g a.i./ha)					
Aquatic Organisms – Freshwater Invertebrates					
SSD results for 14 freshwater invertebrates species: Most sensitive species: <i>Daphnia pulex</i>	Acute	HC ₅ = 0.025 µg a.i./L ¹	Field sprayer: 0.1 µg a.i./L	4.3	Yes
			Early airblast: 1.3 µg a.i./L	53.0	Yes
			Late airblast: 1.1 µg a.i./L	42.2	Yes
<i>Daphnia magna</i>	Chronic	NOEC = 0.0029 µg a.i./L	Field sprayer: 0.1 µg a.i./L	37	Yes
			Early airblast: 1.3 µg a.i./L	456.8	Yes
			Late airblast: 1.1 µg a.i./L	364.2	Yes
Fish					
Rainbow trout, <i>Oncorhynchus Mykiss</i>	Acute	LC ₅₀ /10 = 0.26 µg a.i./L	Field sprayer: 0.1 µg a.i./L	0.4	No
			Early airblast: 1.3 µg a.i./L	5.1	Yes
			Late airblast: 1.1 µg a.i./L	4.1	Yes
	Chronic	NOEC = 0.52 µg a.i./L	Field sprayer: 0.1 µg a.i./L	0.2	No
			Early airblast: 1.3 µg a.i./L	2.5	Yes
			Late airblast: 1.1 µg a.i./L	2.0	Yes
Bluegill sunfish	Acute	LC ₅₀ /10 = 0.67 µg a.i./L	Field sprayer: 0.1 µg a.i./L	0.2	No
			Early airblast: 1.3 µg a.i./L	2.0	Yes

Organism	Exposure	Effects metric	Refined EEC	RQ	LOC exceeded? (Yes/No)
			Late airblast: 1.1 µg a.i./L	1.6	Yes
Amphibians					
Amphibians	Acute (Surrogate endpoint from rainbow trout)	LC ₅₀ /10 = 0.26 µg a.i./L	Field sprayer: 0.6 µg a.i./L	2.2	Yes
			Early airblast: 7.1 µg a.i./L	27.1	Yes
			Late airblast: 5.6 µg a.i./L	21.6	Yes
	Chronic	NOEC = 9.6 µg a.i./L	Field sprayer: 0.6 µg a.i./L	0.1	No
			Early airblast: 7.1 µg a.i./L	0.7	No
			Late airblast: 5.6 µg a.i./L	0.6	No

¹ SSD results for 14 freshwater invertebrates species: (*Daphnia pulex*, *Simocephalus* sp., *Daphnia magna*, *Daphnia longispina*, *Diaphanosoma* sp., *Daphnia galeata*, *Eudiaptomus graciloides* Cloeon sp., Fairy shrimp (*Eudiaptomus graciloides*), *Gammarus* sp., *Lymnaea stagnalis*, *Ostracoda*, *Chaoborus* sp., *Brachionus calyciflorus*)

EEC = Estimated environmental concentration

NOEC = No observed effect concentration

LC₅₀ = Lethal concentration causing 50% mortality

HC₅ = Hazardous concentration causing 5% effect on species

EC₅₀ = Effective concentration causing 50% effect

RQ = Risk quotient

LOC = Level of concern

Table 15 Runoff risk assessment of abamectin for aquatic organisms

Organism	Exposure	Effects metric (µg a.i./L)	Refined EEC (µg a.i./L)*	RQ	Level of concern exceeded? (Yes/No)
Freshwater species at the maximum cumulative application rate (38.2 g a.i./ha)					
SSD for 14 freshwater invertebrates species ¹ :	Acute	HC ₅ = 0.025 ¹	0.48	19.2	Yes
Most sensitive species: <i>Daphnia pulex</i>					
Cladocera <i>Daphnia magna</i>	Chronic	NOEC = 0.0029	0.20	69	Yes
Rainbow trout, <i>Oncorhynchus</i>	Acute	LC ₅₀ /10 = 0.26	0.34	1.3	Yes

Organism	Exposure	Effects metric (µg a.i./L)	Refined EEC (µg a.i./L)*	RQ	Level of concern exceeded? (Yes/No)
<i>Mykiss</i>	Chronic	NOEC = 0.52	0.20	0.2	No
Amphibians	Acute (rainbow trout as surrogate)	LC ₅₀ /10 = 0.26	0.46	1.8	Yes
	Metamorphosis assay as chronic	NOEC = 9.6	0.22	0.02	No
Freshwater species at the minimum single application rate (14.3 g a.i./ha)					
SSD for 14 freshwater invertebrates species ¹ : Most sensitive species: <i>Daphnia pulex</i>	Acute	HC ₅ = 0.025 ¹	0.017	0.68	No
Cladocera, <i>Daphnia magna</i>	Chronic	NOEC = 0.0029	0.0055	1.9	Yes
Rainbow trout, <i>Oncorhynchus mykiss</i>	Acute	LC ₅₀ /10 = 0.26	0.011	0.04	No
	Chronic	NOEC = 0.52	0.0055	0.01	No
Amphibians	Acute (rainbow trout as surrogate)	LC ₅₀ /10 = 0.26	0.015	0.06	No
	Metamorphosis assay as chronic	NOEC = 9.6	0.006	0.001	No
Marine species at the maximum cumulative application rate (38.2 g a.i./ha)					
Crustacean Mysid shrimp, <i>Mysidopsis bahia</i>	Acute	LC ₅₀ /2 = 0.011	0.48	43.6	Yes
	Chronic	NOEC = 0.0022	0.20	90.9	Yes
Sheepshead minnows, <i>Cyprinodon variegatus</i>	Chronic - ELS	NOEC = 0.34	0.20	0.6	No
Marine species at the minimum single application rate (14.3 g a.i./ha)					
Crustacean Mysid shrimp, <i>Mysidopsis bahia</i>	Acute	LC ₅₀ /2 = 0.011	0.017	1.6	Yes
	Chronic	NOEC = 0.0022	0.0055	2.5	Yes

*EECs representing the 90th percentile of 96-hour concentration (acute assessment) and 21-day concentration (chronic assessment) as predicted by PWC.

¹ SSD results for 14 freshwater invertebrates species: (*Daphnia pulex*, *Simocephalus* sp., *Daphnia magna*, *Daphnia longispina*, *Diaphanosoma* sp., *Daphnia galeata*, *Eudiaptomus graciloides*, *Cloeon* sp., Fairy shrimp (*Thamnocephalus platyurus*), *Gammarus* sp., *Lymnaea stagnalis*, *Ostracoda*, *Chaoborus* sp., *Brachionus calyciflorus*)

EEC = Estimated environmental concentration.

LC₅₀ = Lethal concentration causing 50% mortality.

PWC = Pesticide in water calculator.

NOEC = No observed effect concentration.

HC₅ = Hazardous concentration causing 5% effect on species.

RQ = Risk quotient.

ELS = Early Life Stage.

Appendix VIII Registered commercial uses of abamectin

Table 1 Registered commercial uses of abamectin including the maximum cumulative rate of 38.2 g a.i./ha proposed in PRVD2023-01^{1,2,3}

Site	Pests	Formulations	Application method and equipment	Maximum single application rate (g a.i./ha)	Maximum cumulative application rate per year (g a.i./ha)	Maximum number of applications per year	Minimum interval between applications (Days)
Use-site category 5 – Greenhouse Food Crops							
Greenhouse peppers	Two-spotted spider mite, tomato psyllid	Emulsifiable concentrate	[Vertical boom sprayer (high-volume sprayer), robotics, or backpack/spot spray]	[22.8]	114 per crop cycle	(5 per year) • 5 per crop cycle • [1 crop cycle per year]	[7]
Greenhouse cucumbers	Two-spotted spider mite, leafminers	Emulsifiable concentrate	[Vertical boom sprayer (high-volume sprayer), robotics, or backpack/spot spray]	[22.8]	114 per crop cycle	(20 per year) • 5 per crop cycle • [4 crop cycles per year]	[7]
Greenhouse tomatoes	Two-spotted spider mite, tomato psyllid, leafminers	Emulsifiable concentrate	[Vertical boom sprayer (high-volume sprayer), robotics, or backpack/spot spray]	[22.8]	45.6 per crop cycle	[4 per year] • [2 per crop cycle] • [2 crop cycles per year]	[7]
Use-site category 6 – Greenhouse Non-Food Crops							
Greenhouse ornamentals	Spider mites, leafminers	Emulsifiable concentrate	[Vertical boom sprayer (high-volume sprayer), robotics, or backpack/spot spray]	[22.8]	[114 per crop cycle]	[15 per year] • [5 per crop cycle] • [3 crops of ornamentals per year is typical]	[7]
Use-site category 14 – Terrestrial Food Crops							
Bulb onion sub-group Crop group 3-07A ⁴	Onion thrips	Emulsifiable concentrate Suspension	[Ground application equipment]	22.8	38.2	• 3 at the minimum rate	7

Site	Pests	Formulations	Application method and equipment	Maximum single application rate (g a.i./ha)	Maximum cumulative application rate per year (g a.i./ha)	Maximum number of applications per year	Minimum interval between applications (Days)
						• 1 at the maximum rate	
Caneberries Subgroup 13-07A ⁵	Two-spotted spider mites	Emulsifiable concentrate Suspension	[Field sprayer (ground application)]	19	38.2	2	7
Celery	Pea leafminers	Emulsifiable concentrate Suspension	[Field sprayer (ground application)]	21	38.2	• 3 at the minimum rate • 1 at the maximum rate	7
Grapes	Spider mites including: two-spotted spider mites and European red mites	Emulsifiable concentrate Suspension	[Ground application (field sprayer or airblast)]	22.3	38.2	• 2 at the minimum rate • 1 at the maximum rate	21
Green onion Subgroup 3-07B ⁶	Onion thrips	Emulsifiable concentrate Suspension	[Field sprayer (ground application)]	22.8	38.2	• 3 at the minimum rate • 1 at the maximum rate	7
Hops	Spider mites, including two-spotted spider mite	Emulsifiable concentrate Suspension	[Ground application (field sprayer or airblast)]	21	38.2	• 2 at the minimum rate • 1 at the maximum rate	21
Strawberries	Cyclamen mite, two-spotted spider mite, McDaniel spider mite	Emulsifiable concentrate Suspension	[Ground application (field sprayer)]	19	38	2	[7]
Use-site category 13/14 – Terrestrial Feed/Food Crops							
Apples	Two-spotted spider mite, McDaniel mite, European red mite, spotted tentiform leafminer, Western	Emulsifiable concentrate Suspension	[Ground-airblast]	14.3	14.3	1	Not applicable

Site	Pests	Formulations	Application method and equipment	Maximum single application rate (g a.i./ha)	Maximum cumulative application rate per year (g a.i./ha)	Maximum number of applications per year	Minimum interval between applications (Days)
	tentiform leafminer, codling moth, Oriental fruit moth, oblique-banded leafroller, three-lined leafroller, fruittree leafroller, European leafroller, eyespotted bud moth, tufted apple bud moth, European apple sawfly						
Pears	Two-spotted spider mite, McDaniel mite, European red mite, pear rust mite, yellow mite, pear psylla, codling moth, Oriental fruit moth, spotted tentiform leafminer, Western tentiform leafminer, oblique-banded leafroller, three-lined leafroller, fruittree leafroller, European leafroller,	Emulsifiable concentrate Suspension	[Application equipment is (Ground-airblast)]	28.6	28.6	• 2 at the minimum rate • 1 at the maximum rate	10

Site	Pests	Formulations	Application method and equipment	Maximum single application rate (g a.i./ha)	Maximum cumulative application rate per year (g a.i./ha)	Maximum number of applications per year	Minimum interval between applications (Days)
	eyespotted bud moth, tufted apple bud moth, European apple sawfly, green peach aphid, rosy apple aphid, white apple leafhopper, apple maggot, plum curculio, Japanese beetle						
Potatoes	Spider mite (including two-spotted spider mite), potato psyllid, Colorado potato beetle, European corn borer, flea beetle	Emulsifiable concentrate Suspension	[Ground application (field sprayer)]	19.1	38.2	• 3 at the minimum rate • 2 at the maximum rate	7
Celeriac	Spider mites (including two-spotted spider mite), flea beetle	Suspension	(Ground - field sprayer)	21.1	38.2	1	7
Cucurbit Vegetables (Crop group 9) ⁷	Cabbage looper, armyworm, fall armyworm, cutworm, spider mites, corn earworm	Suspension	(Ground - field sprayer)	19.1	38.2	• 3 at the minimum rate • 2 at the maximum rate	7

Site	Pests	Formulations	Application method and equipment	Maximum single application rate (g a.i./ha)	Maximum cumulative application rate per year (g a.i./ha)	Maximum number of applications per year	Minimum interval between applications (Days)
Fruiting Vegetables (Crop group 8-09) ⁸	Cabbage looper, armyworm, beet armyworm, fall armyworm, cutworm, European corn borer, <i>Liriomyza</i> leafminers, flea beetle, broad mite, spider mites, tomato russet mite, tomato psyllid, tomato fruitworm (corn earworm), suppression of tobacco hornworm, suppression of tomato hornworm, Colorado potato beetle	Suspension	(Ground - field sprayer)	21.1	38.2	• 3 at the minimum rate • 1 at the maximum rate	7
Leafy Greens (Crop subgroup 4-13A) ⁹	Cabbage looper, armyworm, beet armyworm, fall armyworm, cutworm, Carmine spider mite, two-spotted spider mite, corn earworm	Suspension	(Ground - field sprayer)	19.1	38.2	• 3 at the minimum rate • 1 at the maximum rate	7
Leaf Petioles (Crop subgroup 22B) ¹⁰	Cabbage looper, armyworm, beet armyworm,	Suspension	(Ground - field sprayer)	21.1	38.2	• 3 at the minimum rate • 1 at the maximum	7

Site	Pests	Formulations	Application method and equipment	Maximum single application rate (g a.i./ha)	Maximum cumulative application rate per year (g a.i./ha)	Maximum number of applications per year	Minimum interval between applications (Days)
	fall armyworm, cutworm, pea leafminers, corn earworm, Carmine spider mite, two-spotted spider mite					rate	
Tuberous and Corm Vegetables (Crop subgroup 1C) ¹¹	Cabbage looper, armyworm, beet armyworm, fall armyworm, variegated cutworm, European corn borer, spider mites, flea beetle, corn earworm, suppression of tobacco hornworm, suppression of tomato hornworm	Suspension	(Ground - field sprayer)	19.1	38.2	• 3 at the minimum rate • 2 at the maximum rate	7 days
Use-site category 20 – Structural							
Indoor and Outdoor: Residential and Non-residential Structures (including food handling facilities and modes of transport)	Cockroaches	Solid	Bait station	0.0009 g/m ²	0.011 g/m ² per year	[12 (1/month)]	[Approximately every 3 months] (1 month)

Site	Pests	Formulations	Application method and equipment	Maximum single application rate (g a.i./ha)	Maximum cumulative application rate per year (g a.i./ha)	Maximum number of applications per year	Minimum interval between applications (Days)
Indoor and Outdoor: Residential and Non-residential Structures (including food handling facilities and modes of transport)	Ants (including pharaoh and carpenter)	Granular	Indoor: Appropriate application device to place the product into crevices or voids. Child resistant bait stations. Outdoor: Child resistant bait stations that are secured in place.	Indoor: [0.0102 g a.i./m] Outdoor: [42.5 g a.i./ant colony] (0.0044 g a.i./m ²)	Indoor: 0.122 g a.i./m per year Outdoor: (0.0528 g a.i./m ²)	[12]	[1 (month)] [Typical is 3 months, however it can be 1 month]
Indoor: Residential and Non-residential Structures (including Food Handling Facilities) and Modes of Transport)	Ants (including pharaoh and carpenter)	Paste	Bait station	[0.011 g a.i. / house]	0.132 g a.i./house per year	[12]	[1 month]
Indoor: Residential and Non-residential Structures (including Food Handling Facilities) and Modes of Transport)	Cockroaches	Dry Flowable	Indoor: Appropriate application device to place the product into crevices or voids.	[0.0002 g a.i./ m ²]	0.0024 g a.i./m ²	[12]	[1 month]
Use-site category 27 – Outdoor Ornamentals							
Outdoor ornamentals	Leafminers	Emulsifiable Concentrate	Ground application equipment	22.8	38.2	• 3 at the minimum rate • 1 at the maximum rate	7 days

Site	Pests	Formulations	Application method and equipment	Maximum single application rate (g a.i./ha)	Maximum cumulative application rate per year (g a.i./ha)	Maximum number of applications per year	Minimum interval between applications (Days)
Boxwood	Boxwood psyllid	Emulsifiable Concentrate	Ground application equipment - field sprayer	22.8	38.2	• 3 at the minimum rate • 1 at the maximum rate	7 days

¹ As of 27 January 2025, excluding discontinued products or products with a submission for discontinuation.

² All information is derived from registered product labels, except for information provided by registrants which is indicated by [], and data calculated by the PMRA which is indicated by ().

³ Since the initiation of the re-evaluation of abamectin, the following use pattern expansions have been registered:

addition of use on outdoor ornamentals and boxwood, for the control of leafminers and boxwood psyllid respectively, to the Avid 1.9% EC Miticide label (24485) - (Category C.6.3 submission 2019-1016; Evaluation Report PMRA# 3024876);

addition of use on Bulb Vegetables (Crop Group 3-07) for control of thrips and leafminer. The group is comprised of the following crops: bulb garlic, great-headed bulb garlic, leek, bulb onion, green onion, Welsh onion tops, bulb shallot, fresh leaves shallot, potato bulb onion, Chinese bulb onion, tree onion tops, fresh leaves chives, Chinese fresh leaves chives, bulb daylily, hosta elegans, fritillaria, serpent bulb garlic, kurrat, lady's leek, lily, Beltsville bunching onion, fresh onion, macrostemon onion, pearl onion and wild leek. **Note that:** the crops within this group are currently registered within crop sub-groups 3-07A or 3-07B at the same rates.

⁴ Bulb Onions (Crop Subgroup 3-07A): bulb daylily, fritillaria, bulb garlic, great-headed bulb garlic, serpent bulb garlic, lily, bulb onion, Chinese bulb onion, pearl onion, potato bulb onion, bulb shallot.

⁵ Caneberries (Crop Subgroup 13-07A): blackberry, loganberry, black and red raspberry, wild raspberry and cultivars, varieties and/or hybrids of these.

⁶ Green Onions (Crop Subgroup 3-07B): Chinese fresh leaves chives, fresh leaves chives, hosta elegans, fritillaria, kurrat, lady's leek, leek, Beltsville bunching onion, fresh onion, green onion, macrostemon onion, tree onion tops, Welsh onion tops, fresh leaves shallot and wild leek.

⁷ Cucurbit Vegetables (Crop Group 9): Cucumber (including gherkins), Gourd (Chinese waxgourd/Chinese preserving melon and edible gourds including hyotan, cucuzza, hechima and Chinese okra), Melons (citron, muskmelon including true cantaloupe, cantaloupe, casaba, crenshaw, golden pershaw, honeydew, honey balls, mango, Persian, pineapple, Santa Claus and snake, watermelon), Momordica spp. (including balsam apple, balsam pear, bitter melon, Chinese cucumber), pumpkin and Squash including summer (including crookneck, scallop, straightneck squash, vegetable marrow, and zucchini) and winter (including butternut, calabaza, hubbard, acorn, and spaghetti).

⁸ Fruiting Vegetables (Crop Group 8-09): eggplant (including African, pea and scarlet), garden huckleberry, goji berry, groundcherry, martynia, okra, pea eggplant (pea and scarlet), pepino, pepper (bell and non-bell), sunberry, tomatillo, tomato (including currant).

⁹ Leafy Greens (Crop Subgroup 4-13A): Chinese amaranth, leafy amaranth, Indian aster, blackjack, cat's whiskers, cham-chwi, chamnamul, chervil (fresh leaves), chipilin, garland chrysanthemum, cilantro (fresh leaves), corn salad, cosmos, dandelion, dang-gwi, dillweed (fresh leaves), dock, dolnamul ebolo, endive, escarole, fameflower, feather cockscomb, good King Henry, huauzontle, jute leaves, lettuce (bitter, head, leaf, Romaine), orach, parsley (fresh leaves), buckhorn plantain, English primrose, purslane (garden, winter), radicchio (red chicory), spinach (including Malabar, New Zealand, tree, tanier), Swiss chard, Chinese violet.

¹⁰ Leaf Petioles (Crop Subgroup 22B): cardoon, celery (including Chinese), fuki, rhubarb, udo and zuiki.

¹¹ Tuberous and Corm Vegetables (Crop Subgroup 1C): arracacha, arrowroot, Chinese artichoke, Jerusalem artichoke, edible canna, chufa, dasheen (taro), sweet potato, true yam.

Appendix IX Registered domestic uses of abamectin

Table 1 Registered domestic uses of abamectin^{1,2}

Site	Pest(s)	Formulations	Application method and equipment	Maximum single application rate (g a.i./ha)	Maximum cumulative application rate per year (g a.i./ha)	Maximum number of applications per year	Minimum interval between applications (Days)
Use-site category 20 – Structural							
Indoor	Cockroaches	Solid	Bait stations	0.012 g a.i. / kitchen 0.0032 g a.i. / bathroom (when stated)	0.048 g a.i. / kitchen per year 0.0128 g a.i. / bathroom per year (when stated)	[4]	[3 months]
Indoor/Outdoor	Ants	Solid	Bait stations	Indoor: 0.013 g a.i. / kitchen 0.0034 g a.i. / bathroom (when stated) Outdoor: 0.0045 g a.i. / 1.5 m (when stated)	Indoor: 0.052 g a.i. / kitchen per year 0.014 g a.i. / bathroom per year (when stated) Outdoor: 0.018 g a.i. / 1.5 m (when stated)	[4]	[3 months]

¹ As of 27 January 2025, excluding discontinued products or products with a submission for discontinuation.

² All information is derived from registered product labels, except for information provided by registrants which is indicated by [], and data calculated by the PMRA which is indicated by ().

Appendix X Label amendments for products containing abamectin

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. Information on labels of currently registered products should not be removed unless it contradicts the following label statements.

1.0 Label amendments for abamectin technical grade active ingredient product

The following statement is required under the “Environmental Precautions” section of the abamectin technical insecticide label:

Delete:

“This pesticide is toxic to fish and wildlife.”

Replace with:

“Toxic to aquatic organisms.”

Under STORAGE

Delete:

“(see ENVIRONMENTAL HAZARDS)”

Replace with:

“(see ENVIRONMENTAL PRECAUTIONS)”

Add the following statement under DIRECTIONS FOR USE

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

The following statement is required under the “DISPOSAL” section of the abamectin technical label:

“Canadian manufacturers should dispose of unwanted active ingredients and containers in accordance with municipal and provincial or territorial regulations. For additional details and cleanup of spills, contact the registrant and the provincial or territorial regulatory agency.”

2.0 Label amendments for abamectin commercial and domestic end-use products

The following statement is required under the “Directions for Use” section for commercial class use products used outdoor:

“**DO NOT** exceed a maximum cumulative application rate of 38.2 g a.i./ha/per year.”

The following label statement is required to be added to all commercial class structural and domestic class end-use product labels, unless already present:

“Keep out of reach of children and pets.”

2.1 Label amendments for AGRI-MEK 1.9% EC Insectide/Miticide (Reg. No. 24551) / AGRI-MEK SC (Reg. No. 31607) / AVID® 1.9% EC MITICIDE/INSECTICIDE (Reg. No. 24485)

2.1.1 General label improvements

Add/Ensure on label:

“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.”

2.1.2 General directions for use

Under PRECAUTIONS

Add:

“**DO NOT** apply using handheld mistblower/airblast or handheld fogging equipment.”

Add:

“For handheld application, wear eye, head and respiratory protection when applying above waist height, including overhead.”

Under DIRECTIONS FOR USE

Replace:

“**DO NOT** enter or allow worker entry into treated areas during the restricted entry interval (REI) of 12 hours.”

OR

“**DO NOT** enter area until sprays have dried.”

With the following, where appropriate:

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

Crop	Pre-harvest Interval (PHI)	Postapplication Activity	REI
Apple	28 days	All activities	12 hours

Crop	Pre-harvest Interval (PHI)	Postapplication Activity	REI
Onion, dry bulb	30 days	All activities	12 hours
Caneberries Subgroup 13-07A	7 days	All activities	12 hours
Celery	14 days	All activities	12 hours
Grapes	28 days	Girdling, turning	9 days
		Hand harvesting, Leaf pulling by hand, Tying/Training	2 days
		All other activities	12 hours
Green onion Subgroup 3-07B	7 days	All activities	12 hours
Greenhouse cucumbers/peppers	3 days	All activities	12 hours
Greenhouse tomatoes	1 days	All activities	12 hours
Hops	28 days	Mechanically-assisted harvesting	9 days
		All other activities	12 hours
Pears	28 days	All activities	12 hours
Potatoes	14 days	All activities	12 hours
Strawberries	3 ¹ days	All activities	12 hours
Greenhouse Ornamentals	N/A	All activities	12 hours

REI = Restricted-entry interval; PHI= pre-harvest interval; N/A = Not applicable.

¹Pre-harvest application of abamectin, PHI = 3 days. Post-harvest application of abamectin, PHI = 10 months.

2.2 Additional label amendments for Agri-Mek 1.9% EC Miticide/Insecticide (Reg. No. 24551) and Agri-Mek SC Miticide/Insecticide (Reg. No. 31607)

2.2.1 The following statements are required under the “Environmental Precautions” section:

Delete:

“Toxic to aquatic organisms, fish and wildlife.

Toxic to bees. Bees may be exposed through direct spray, spray drift, and residues on/in 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.canada.ca/pollinators). Follow crop specific directions for application timing.

Toxic to certain beneficial arthropods (which may include predatory and parasitic insects, spiders, and mites). Minimize spray drift to reduce harmful effects on beneficial arthropods in habitats next to the application site such as hedgerows and woodland.

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.”

Replace with:

“Toxic to aquatic organisms. Observe spray buffer zones and vegetative filter strips specified under DIRECTIONS FOR USE.

Toxic to birds and small wild mammals.

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. **DO NOT** apply during the crop blooming period where indicated in crop-specific directions. Avoid applications when bees are foraging in the treatment area in ground cover containing blooming weeds. When using managed bees for pollination services, **DO NOT** apply during the crop blooming period. 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.canada.ca/pollinators). Follow use-specific and crop-specific directions for application timing

Toxic to certain beneficial arthropods (which may include predatory and parasitic insects, spiders, and mites). Minimize spray drift to reduce harmful effects on beneficial arthropods in habitats next to the application site such as hedgerows and woodland. Care should be taken when using this product in an integrated pest management program where users are relying on the presence of beneficial arthropods.

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. To reduce risk to aquatic organisms from runoff, a vegetative filter strip of at least 10 metres wide between the application area edge and adjacent, downhill aquatic habitats must be observed, as specified under DIRECTIONS FOR USE.”

Under STORAGE

Delete:

“Do not contaminate water, food or feed by storage or disposal.”

Replace with:

“Store this product away from food or feed.”

2.2.2 The following statements are required under the “Directions for Use” section:

Include the following statements under the crop-specific use directions:

For apple, pear and caneberries (Crop Subgroup 13-07A):

Pollinator Protection: Toxic to bees. **DO NOT** apply during the crop blooming period (onset of flowering until after petal fall is complete).

For strawberry, potato, grape and hops:

Pollinator Protection: Toxic to bees. 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. When using managed bees for pollination services, **DO NOT** apply during the crop blooming period.

Include the following statements under the main DIRECTIONS FOR USE heading:

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.

A Vegetative Filter Strip (VFS) of at least 10 metres wide must be constructed and maintained. The VFS is required between the application area edge and adjacent, downhill aquatic habitats to reduce risk to aquatic organisms from runoff. Aquatic habitats include, but are not limited to, lakes, reservoirs, rivers, permanent streams, marshes or natural ponds, and estuaries. The VFS is to be composed of grasses and may also include shrubs, trees, or other vegetation. Both VFS and spray buffer zones, if applicable, must be observed. Additional guidance can be found on the Runoff Mitigation portion of the Canada.ca website.

Field sprayer application: **DO NOT** apply when wind speed is less than 1 km/h. Avoid application of this product when winds are gusty. **DO NOT** apply with sprays finer than the American Society of Agricultural and Biological Engineers (ASABE) S572 (572.1 to 572.3) Medium classification. Boom height must be 60 cm or less above the crop or ground.

Airblast application: **DO NOT** apply during periods of dead calm. Avoid application of this product when winds are gusty. **DO NOT** direct spray above plants to be treated. Turn off outward pointing nozzles at row ends and outer rows. **DO NOT** apply when wind speed is greater than 16 km/h at the application site as measured outside of the treatment area on the upwind side.

DO NOT apply by air.

The spray buffer zones specified in the table below are required between the point of direct application and the closest downwind edge of sensitive terrestrial habitats (such as grasslands, forested areas, shelter belts, woodlots, hedgerows, riparian areas and shrublands), 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		Spray Buffer Zones (metres) Required for the Protection of:				
			Freshwater Habitat of Depths:		Estuarine/Marine Habitat of Depths:		Terrestrial Habitat:
			Less than 1 m	Greater than 1 m	Less than 1 m	Greater than 1 m	
Field sprayer	Caneberries (crop subgroup 13-07A), Potatoes, Strawberries, Celeriac		40	20	5	4	0
	Celery, Bulb onions (crop subgroup 3-07A), Green onions (crop subgroup 3-07B)		35	15	5	2	0
	Apples		15	10	5	3	0
	Grapes		25	10	10	4	0
	Hops		35	15	5	4	0
	Pears		30	15	10	5	0
Airblast	Grapes	Early growth stage	55	45	45	35	0
		Late growth stage	45	35	35	25	0
	Hops	Early growth stage	60	50	40	30	0
		Late growth stage	50	40	30	25	0

Method of application	Crop		Spray Buffer Zones (metres) Required for the Protection of:				
			Freshwater Habitat of Depths:		Estuarine/Marine Habitat of Depths:		Terrestrial Habitat:
			Less than 1 m	Greater than 1 m	Less than 1 m	Greater than 1 m	
	Pears	Early growth stage	60	50	45	35	0
		Late growth stage	50	40	35	25	0
	Apples	Early growth stage	50	45	40	30	0
		Late growth stage	40	35	30	20	0

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

The spray buffer zones for application of this product with conventional application equipment can be modified based on weather conditions and spray equipment configuration by accessing the Spray Buffer Zone Calculator on the Drift Mitigation portion of the Canada.ca website.

2.3 Additional label amendments for Avid 1.9% EC Miticide/Insecticide (Reg. No. 24485)

2.3.1 The following statements are required under the “Environmental Precautions” section:

Delete:

“This pesticide is toxic to fish and wildlife

DO NOT contaminate water when disposing of equipment washwater and rinsate.
DO NOT allow effluent or runoff from greenhouses containing this product to enter lakes, streams, ponds or other waters.

This product is highly toxic to bees exposed to direct treatment or residues on blooming crops or weeds. DO NOT apply this product or allow drift to blooming crops or weeds if bees are visiting the treatment area.

AVID® 1.9% EC Miticide/Insecticide is toxic to predatory mites, which come in direct contact with spray. Use with caution in a pest management program using these beneficial arthropods.”

Replace with:

“Toxic to aquatic organisms. Observe spray buffer zones and vegetative filter strips specified under DIRECTIONS FOR USE.

Toxic to birds and small wild mammals.

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. **DO NOT** apply during the crop blooming period where indicated in crop-specific directions. Avoid applications when bees are foraging in the treatment area in ground cover containing blooming weeds. When using managed bees for pollination services, **DO NOT** apply during the crop blooming period. 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.canada.ca/pollinators). Follow use-specific and crop-specific directions for application timing.

Toxic to certain beneficial arthropods (which may include predatory and parasitic insects, spiders, and mites). Minimize spray drift to reduce harmful effects on beneficial arthropods in habitats next to the application site such as hedgerows and woodland. Care should be taken when using this product in an integrated pest management program where users are relying on the presence of beneficial arthropods.

Greenhouse use: Toxic to bees and other beneficial arthropods (which may include predatory and parasitic insects, spiders, and mites). May harm bees and other beneficial arthropods, including those used in greenhouse production. Avoid application when bees or other beneficial arthropods are in the treatment area.

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. To reduce risk to aquatic organisms from runoff, a vegetative filter strip of at least 10 metres wide between the application area edge and adjacent, downhill aquatic habitats must be observed, as specified under DIRECTIONS FOR USE.”

Under STORAGE

Delete:

“Do not contaminate water, food or feed by storage or disposal.”

Replace with:

“Store this product away from food or feed.”

2.3.2 The following statements are required under the “Directions for Use” section:

Include the following statement under the crop-specific use directions

For boxwood:

Pollinator Protection: Toxic to bees. **DO NOT** apply during the crop blooming period.

For outdoor ornamentals:

Pollinator Protection: Toxic to bees. **DO NOT** apply during the crop blooming period (onset of flowering until after petal fall is complete). (Excludes ornamental grasses and coniferous evergreens: pine, fir, juniper, spruce, arborvitae, hemlock, cypress, yew).

For greenhouse:

Pollinator Protection: Toxic to bees and other beneficial arthropods (which may include predatory and parasitic insects, spiders, and mites). May harm bees and other beneficial arthropods, including those used in greenhouse production. Avoid application when bees or other beneficial arthropods are in the treatment area.

Include the following statements under the main DIRECTIONS FOR USE heading:

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.

A Vegetative Filter Strip (VFS) of at least 10 meters wide must be constructed and maintained. The VFS is required between the application area edge and adjacent, downhill aquatic habitats to reduce risk to aquatic organisms from runoff. Aquatic habitats include, but are not limited to, lakes, reservoirs, rivers, permanent streams, marshes or natural ponds, and estuaries. The VFS is to be composed of grasses and may also include shrubs, trees, or other vegetation. Both VFS and spray buffer zones, if applicable, must be observed. Additional guidance can be found on the Runoff Mitigation portion of the Canada.ca website.

For greenhouse use: DO NOT allow releases, effluent or runoff from greenhouses containing this product to enter lakes, streams, ponds or other waters.

Field sprayer application: **DO NOT** apply when wind speed is less than 1 km/h. Avoid application of this product when winds are gusty. **DO NOT** apply with sprays finer than the American Society of Agricultural and Biological Engineers (ASABE) S572 (572.1 to

572.3) Medium classification. Boom height must be 60 cm or less above the crop or ground.

Airblast application: **DO NOT** apply when wind speed is less than 1 km/h. Avoid application of this product when winds are gusty. **DO NOT** direct spray above plants to be treated. Turn off outward pointing nozzles at row ends and outer rows. **DO NOT** apply when wind speed is greater than 16 km/h at the application site as measured outside of the treatment area on the upwind side.

DO NOT apply by air.

The spray buffer zones specified in the table below are required between the point of direct application and the closest downwind edge of sensitive terrestrial habitats (such as grasslands, forested areas, shelter belts, woodlots, hedgerows, riparian areas and shrublands), 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		Spray Buffer Zones (metres) Required for the Protection of:				
			Freshwater Habitat of Depths:		Estuarine/Marine Habitat of Depths:		Terrestrial Habitat:
			Less than 1 m	Greater than 1 m	Less than 1 m	Greater than 1 m	
Field sprayer	Outdoor ornamentals (non-specific), Boxwood		35	15	5	2	0
Airblast	Outdoor ornamentals	Early growth stage	60	50	35	25	0
		Late growth stage	50	40	25	20	0

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

The spray buffer zones for application of this product with conventional application equipment can be modified based on weather conditions and spray equipment configuration by accessing the Spray Buffer Zone Calculator on the Drift Mitigation portion of the Canada.ca website.

2.4 Label amendments for Minecto Pro (co-formulation of cyantraniliprole and abamectin) (Reg. No. 33023)

2.4.1 The following statements are required under the “Environmental Precautions” section of Minecto Pro:

Delete:

“TOXIC to aquatic organisms and non-target terrestrial plants”

Replace with:

“Toxic to aquatic organisms and non-target terrestrial plants. Observe spray buffer zones and vegetative filter strips specified under DIRECTIONS FOR USE.

Toxic to birds and small wild mammals.

Toxic to bees. Bees may be exposed through direct spray, spray drift, and residues on/in leaves, pollen and nectar in flowering crops and weeds. Cyantraniliprole is systemic and bees can be exposed to product residues in flower, leaves, pollen and/or nectar resulting from soil applications. Minimize spray drift to reduce harmful effects on bees in habitats close to the application site. **DO NOT** apply during the crop blooming period or during the pre-bloom period where indicated in crop-specific directions. Avoid applications when bees are foraging in the treatment area in ground cover containing blooming weeds. When using managed bees for pollination services, **DO NOT** apply during the crop blooming period. 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.canada.ca/pollinators). Follow use-specific and crop-specific directions for application timing.

Toxic to certain beneficial arthropods (which may include predatory and parasitic insects, spiders, and mites). Minimize spray drift to reduce harmful effects on beneficial arthropods in habitats next to the application site such as hedgerows and woodland. Care should be taken when using this product in an integrated pest management program where users are relying on the presence of beneficial arthropods.

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. To reduce risk to aquatic organisms from runoff, a vegetative filter strip of at least 10 metres wide between the application area edge and adjacent, downhill aquatic habitats must be observed, as specified under DIRECTIONS FOR USE.”

Under STORAGE

Delete:

“Do not contaminate water, food or feed by storage or disposal.”

Replace with:

“Store this product away from food or feed.”

2.4.2 The following statements are required under the “Directions for Use” Section:

Include the following statements under the crop-specific use directions:

For apple and pear:

Pollinator Protection: Toxic to bees. **DO NOT** apply during the crop blooming period (onset of flowering until after petal fall is complete).

For cucurbit vegetables:

Pollinator Protection: Toxic to bees. Avoid application during the crop blooming period. If applications must be made during the crop blooming period, restrict applications to the evening after flower petals have closed. When using managed bees for pollination services, **DO NOT** apply during the crop blooming period.

For fruiting vegetables and potato:

Pollinator Protection: Toxic to bees. 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. When using managed bees for pollination services, **DO NOT** apply during the crop blooming period.

For tuberous and corm vegetables (statements required for potato and sweet potato):

Pollinator Protection for Potato and Sweet Potato: Toxic to bees. 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. When using managed bees for pollination services, **DO NOT** apply during the crop blooming period.

Include the following statements under the main DIRECTIONS FOR USE heading:

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.

A Vegetative Filter Strip (VFS) of at least 10 metres wide must be constructed and maintained. The VFS is required between the application area edge and adjacent, downhill aquatic habitats to reduce risk to aquatic organisms from runoff. Aquatic

habitats include, but are not limited to, lakes, reservoirs, rivers, permanent streams, marshes or natural ponds, and estuaries. The VFS is to be composed of grasses and may also include shrubs, trees, or other vegetation. Both VFS and spray buffer zones, if applicable, must be observed. Additional guidance can be found on the Runoff Mitigation portion of the Canada.ca website.

Field sprayer application: **DO NOT** apply when wind speed is less than 1 km/h. Avoid application of this product when winds are gusty. **DO NOT** apply with sprays finer than the American Society of Agricultural and Biological Engineers (ASABE) S572 (572.1 to 572.3) Medium classification. Boom height must be 60 cm or less above the crop or ground.

Airblast application: **DO NOT** apply during periods of dead calm. Avoid application of this product when winds are gusty. **DO NOT** direct spray above plants to be treated. Turn off outward pointing nozzles at row ends and outer rows. **DO NOT** apply when wind speed is greater than 16 km/h at the application site as measured outside of the treatment area on the upwind side.

DO NOT apply by air.

The spray buffer zones specified in the table below are required between the point of direct application and the closest downwind edge of sensitive terrestrial habitats (such as grasslands, forested areas, shelter belts, woodlots, hedgerows, riparian areas and shrublands), 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	Spray Buffer Zones (metres) Required for the Protection of:				
		Freshwater Habitat of Depths:		Estuarine/Marine Habitat of Depths:		Terrestrial Habitat:
		Less than 1 m	Greater than 1 m	Less than 1 m	Greater than 1 m	
Field sprayer	Cucurbit vegetables (crop group 9), Leafy greens (crop subgroup 4-13A), Potatoes, Tuberous and Corm vegetables (crop subgroup 1C), Celeriac	40	20	5	4	1

Method of application	Crop		Spray Buffer Zones (metres) Required for the Protection of:				
			Freshwater Habitat of Depths:		Estuarine/Marine Habitat of Depths:		Terrestrial Habitat:
			Less than 1 m	Greater than 1 m	Less than 1 m	Greater than 1 m	
	Fruiting vegetables (crop group 8-09), Leaf petioles (crop group 22-B)		30	15	5	2	1
	Bulb vegetables (crop group 3-07)		35	15	5	2	1
Airblast	Apples	Early growth stage	50	45	40	30	0
		Late growth stage	40	35	30	20	0
	Pears	Early growth stage	60	50	45	35	1
		Late growth stage	50	40	35	25	1

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

The spray buffer zones for application of this product with conventional application equipment can be modified based on weather conditions and spray equipment configuration by accessing the Spray Buffer Zone Calculator on the Drift Mitigation portion of the Canada.ca website.

2.5 Label amendments for Prescription Treatment® Brand Avert Granular Carpenter Ant Bait (Reg. No. 27864)/Prescription Treatment® Brand Avert Dry Flowable Cockroach Bait (Reg. No. 28403)/Prescription Treatment Brand Avert Cockroach Bait Stations (Reg. No. 26896)/Prescription Treatment Brand Avert 360A Dual Choice Ant Bait Station (Reg. No. 27897).

2.5.1 General label improvements

Under PRECAUTIONS

Ensure on label:

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

“**DO NOT** remove bait from the station.

DO NOT place on food preparation items/surfaces or directly over food”

2.6 Additional label amendments for Prescription Treatment® Brand Avert Granular Carpenter Ant Bait (Reg. No. 27864)/Prescription Treatment® Brand Avert Dry Flowable Cockroach Bait (Reg. No. 28403)/General directions for use

2.6.1 General label improvements

Prescription Treatment® Brand Avert Granular Carpenter Ant Bait (Reg. No. 27864):

Under PRECAUTIONS

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.”

Indoor structural sites

As per the Agency’s Guidance Document *Structural Pest Control Products: Label Updates*; 2020, with the exception of bait stations, application type definitions for structural products are required on the label.

Prescription Treatment® Brand Avert Granular Carpenter Ant Bait (Reg. No. 27864):

1. Under the “FOR INDOOR USE” section of the label, add the definition for the following application types: crack and crevice and void.

Prescription Treatment® Brand Avert Dry Flowable Cockroach Bait (Reg. No. 28403):

1. Under the general directions for use section of the label, add the definition for a crack and crevice treatment.

2. *Based on clarifications provided by the registrant:*

Add to the label, immediately after “For heavy infestations, a minimum of 12 - 24 bait points is recommended per 9 m² of treatment area.”: “One bait point is equivalent to 0.15 g of product”.

2.7 Label amendments for RAID Max Roach Bait (Reg. No. 26645)/Raid MAX Ant Baits (Reg. No.27249)/Raid Ant Baits 3 (Reg. No. 27250)/ RAID Double Control Roach Baits (Reg. No 27731)/ Raid Double Control Ant Baits 2 (Reg. No. 27761)/ Raid MAX Double Control Ant Baits (Reg. No. 30597)/ RAID Ant Baits (Reg. No. 32316)/ RAID Max Double Control Ant Baits 2 (Reg. No. 32317)/ RAID Max Ant Baits 2 (Reg. No. 32318)

2.7.1 General label improvements

Under PRECAUTIONS

Ensure on label:

“**DO NOT** remove bait from the station.

DO NOT place on food preparation items/surfaces or directly over food”

2.8 Label amendments for Raid Outdoor Ant Spikes (Reg. No. 28347)

2.8.1 General label improvements

Under PRECAUTIONS

Ensure on label:

“**DO NOT** remove bait from the station.”

Appendix XI References considered following publication of PRVD2023-01

Note that the following includes only references that were not previously considered in PRVD2023-01.

A. Information considered in the Updated Occupational and Residential Risk Assessments

List of studies/Information submitted by registrant

PMRA Document Number	Title
1238591	1986, Foliar Dislodgeable Residue Data in Support of the Use Of AVID 0.15 EC on Greenhouse - Grown Ornamentals, DACO: 5.1
3480114	2023, Abamectin - Occupational Risk Assessment Comments Response to PMRA PRVD2023-01, DACO: 5.1
3480115	2023, Occupational Risk Assessment for Abamectin Response to PMRA PRVD2023-01, DACO: 5.2,5.3,5.6
3480113	2023, Re-evaluation of Abamectin Public Comment Response to the Proposed Decision for Abamectin (PRVD2023-01), DACO: 0.8.25
3480108	2023, Public Comment Response to the Proposed Re-evaluation Decision for Abamectin and its Associated End-Use Products (PRVD2023-01), DACO: 0.8

Studies/Information provided by task forces

PMRA Document Number	Title
2463743	2013, Estimated Transfer Coefficient for Hops Harvest, DACO: 5.6,5.9

Additional information considered

Unpublished information

PMRA Document Number	Title
3622295	2023, Ontario Fruit and Vegetable Growers' Association, Proposed Re-evaluation Decision PRVD2023-01, Abamectin and Its Associated End-use Products. Ontario Fruit and Vegetable Growers' Association, DACO: 0.8

B. Information considered in the updated environmental assessment

List of studies/Information submitted by registrant

PMRA Document Number	Title
1238970	1983, An eight-day dietary LC50 in mallard ducks with MK-936 (abamectin), DACO: 9.6.2.5
3465177	2016, Abamectin - Full Life Cycle Toxicity Test with Water Fleas (<i>Daphnia magna</i>) Under Flow-Through Conditions, DACO: 9.3.3
3480119	2002, Assessment of the Effects of Abamectin 018 EC (A8612A) in Outdoor Microcosms, DACO: 9.4.7
3480120	1999, Assessment of the potential biological effects of Abamectin (MK936, 018 EC) (A-8612 A) exposures on aquatic ecosystems as measured in an outdoor microcosm tank system, DACO: 9.4.7
3480121	1981, Acute oral LD ₅₀ - Mallard ducks L-676, 683-00V50 (MK-936), DACO: 9.6.2.2
3480122	2000, MK936 - A Reproduction Study with the Northern Bobwhite, DACO: 9.6.3.1

Additional information considered

Published information

PMRA Document Number	Title
3692840	1997, Ecotoxicological effects of abamectin (MK-936) on natural populations of selected invertebrates in man-made ponds, DACO: 9.4.7
3695796	Health Canada's Water Monitoring Pilot Program for Pesticides (abamectin), downloaded 12 Feb 2025, Published Pilot Program Data and sites on abamectin (2022-2023), DACO: 8.6
3695804	California Department of Pesticide Regulation, downloaded Feb 2025, CA_DPR published data on abamectin, DACO: 8.6
3695805	Ontario Open Data Portal, Ontario Pesticide Concentration in Stream Water (2012-2022), DACO: 8.6
3704432	2024, U.S. Environmental Protection Agency, Ecological Mitigation Support Document to Support Endangered Species Strategies, DACO: 12.5.8

Unpublished information

PMRA Document Number	Title
3695803	2025, Health Canada`s Canadian Water Monitoring Program for Pesticides, received up to 26 Feb 2025, Unpublished abamectin CWMPP data on Abamectin 2024-25, DACO: 8.6