Re-evaluation Decision RVD2020-14

Chlorpyrifos and Its Associated End-use Products (Environment)

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Table of contents

Re-evaluation decision for chlorpyrifos and associated end-use products (environment) 1
Re-evaluation decision for chlorpyrifos on the environment 2
Next steps 4
Other information 4
Science evaluation update 6
1.0 Revised environmental risk assessment 6
1.1 Fate and behaviour in the environment 6
1.2 Environmental toxicology 6
1.3 Environmental risk characterization 6
1.4 Environmental incident reports 9
2.0 Value assessment 9
3.0 Suitability of alternatives and implementation dates for certain cancelled uses 9
List of abbreviations 11
Appendix I Registered pest control products containing chlorpyrifos in Canada[1] 12
Table 1 Products requiring label amendments 12
Table 2 Products cancelled as a result of this re-evaluation 13
Table 3 Products that do not require amendments 13
Appendix II List of commenters to PRVD2019-05 14
Appendix III Comments and responses 16
Appendix IV 32
Table 1 Updated summary of all available, relevant Canadian chlorpyrifos water monitoring data (post-2000) for determining potential aquatic biota exposure 32
Table 2 Acute aquatic risk quotients using regionally specific modelled estimated environmental concentrations 33
Table 3 Chronic aquatic risk quotients using regionally specific modelled estimated environmental concentrations 35
Table 4 Refined risk assessment using mean nomogram values for birds and mammals at 240 g a.i./ha for uses on barley, wheat and oats – aerial and ground applications at medium spray quality 37
Table 5 Refined risk assessment using mean nomogram values for birds and mammals at 576 g a.i./ha for uses on flax, lentil, barley, wheat, oats, sunflower – aerial and ground applications at medium spray quality 38
Table 6 Refined risk assessment using mean nomogram values risk assessment for birds and mammals at 720 g a.i./ha × 1 for use on canola – aerial and ground applications at medium spray quality 39
Table 7 Refined risk assessment using mean nomogram values for birds and mammals at 1152 g a.i./ha for uses on corn, cole crops, celery cucumber, green pepper, rutabaga, sugar beet and potato – ground applications at medium spray quality 40
Table 8 Refined risk assessment using mean nomogram values risk for birds and mammals at 2304 g a.i./ha for uses on carrots and seedling onions – ground applications at medium spray quality 40
Table 9 Refined risk assessment using mean nomogram values risk for birds and mammals at 3360 g a.i./ha for use on Asian radish–ground applications at medium spray quality 41

Appendix V Label amendments for products containing chlorpyrifos 43
Appendix VI References considered following publication of PRVD2019-05..... 50

Re-evaluation decision for chlorpyrifos and associated end-use products (environment)

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 continue to meet current health and environmental standards and continue to 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.

Chlorpyrifos is a non-systemic group 1B organophosphate insecticide. It is registered for non-residential use and commercial production of cereals, grains (corn), oilseeds, pulses (lentil), nuts, stone fruits, strawberry, tobacco, turf and vegetables (bulb, cole, cucurbit, fruiting, root and stem/petiole). It is also registered for use on elms to control elm bark beetle (for Dutch elm disease control), lodge pole pine for mountain pine beetle control, ornamentals (greenhouse and outdoor), standing water to control mosquito larvae, outdoors for adult mosquitoes and to control non-residential structural pests (indoor and outdoor). Currently registered products containing chlorpyrifos can be found in the Pesticide Label Search and are in Appendix I.

The re-evaluation of chlorpyrifos in Canada is ongoing, and Health Canada has implemented several risk reduction measures over the years. In 2000, Health Canada concluded a re-evaluation of chlorpyrifos, focused on non-agricultural uses including uses in and around residential areas (REV2000-05). As a result, residential uses were removed from chlorpyrifos labels. The re-evaluation of chlorpyrifos continued with the examination of agricultural and forestry uses. A proposed re-evaluation decision was published for consultation in 2003 (PACR2003-03) based on the assessment on human health and the environment. Following the consultation, Health Canada implemented measures in 2007 (REV2007-01) to further protect human health, including new engineering controls, personal protective equipment, and restricted-entry intervals. In addition, the environment was further protected by implementing environmental precautions and spray buffer zones to the chlorpyrifos product labels. Health Canada also committed to update the environmental risk assessment.

On 31 May 2019, the Proposed Re-evaluation Decision PRVD2019-05, *Chlorpyrifos and Its Associated End-use Products: Updated Environmental Risk Assessment*,[1] containing the evaluation on the environment, value, and proposed decision, underwent a 90-day consultation period. In this PRVD, Health Canada also informed the public that new studies related to human health assessment have been generated, which, as indicated by various international jurisdictions, may inform the re-evaluation of chlorpyrifos. Based on the relevant new information, Health Canada will be updating the human health assessment, and it will be presented in a future publication.

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

PRVD2019-05 proposed to cancel most outdoor uses of chlorpyrifos due to environmental risks of concern (risks to beneficial arthropods, birds, mammals and all aquatic biota). The following uses were proposed for continued registration with required label changes:

- Standing water – temporary pools for larval mosquito control
- Outdoor adult mosquito control
- Structural indoor and outdoor (non-residential)
- Outdoor ornamentals (container stock only) for control of Japanese beetle larvae
- Greenhouse ornamentals

Health Canada received comments and additional information relating to the 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 environmental risk assessment (see Science evaluation update), but did not result in significant changes to the proposed re-evaluation decision as described in PRVD2019-05.

A reference list of information used as the basis for the proposed re-evaluation decision was included in PRVD2019-05, and additional information used in the re-evaluation decision is listed in Appendix VI of this RVD. Therefore, the complete reference list of all information used in this re-evaluation decision (related to the environmental assessment) includes both the information set out in PRVD2019-05 and the information set out in Appendix VI herein.

This document presents the re-evaluation decision[2] on the environment for chlorpyrifos, including the required amendments (risk mitigation measures) to protect the environment, and any label amendments required to bring labels to current standards. All products containing chlorpyrifos that are registered in Canada are subject to this re-evaluation decision.

Re-evaluation decision for chlorpyrifos on the environment

Under the authority of the *Pest Control Products Act* and based on the evaluation of currently available scientific information, Health Canada is cancelling outdoor uses of chlorpyrifos except those listed below, due to risks to the environment that have not been shown to be acceptable.

The following uses are acceptable from an environmental perspective with required mitigation measures:

- Standing water – temporary pools for larval mosquito control.
- Outdoor adult mosquito control.
- Structural indoor and outdoor (non-residential).

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

- Outdoor ornamentals (container stock root immersion only) for control of Japanese beetle larvae.
- Elm bark beetle and mountain pine beetle control.
- Greenhouse ornamentals*

* While this decision document was in the publication process, the technical registrant notified Health Canada of its decision to discontinue the greenhouse ornamental use and as a result, the greenhouse ornamental use will be removed from all chlorpyrifos end-use product labels.

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 this re-evaluation decision, are summarized below. Refer to Appendix V for details.

Environment

Cancellation of outdoor uses except those acceptable uses listed above.

To protect the environment, the following risk-reduction measures are required for the remaining uses on the label:

- Standard label statements to inform users of the potential toxic effects to sensitive biota.
- A label statement restricting the timing of application (air temperature ≤ 15°C) to reduce volatilization.
- Updated discharge of effluent statements.
- Updated storage statements.

Cancelled uses with an extended phase out schedule:

The following two cancelled uses were found to lack suitable alternatives:

- canola – for alfalfa looper control
- garlic – for darksided and redbacked cutworm

The implementation of this re-evaluation decision for these two cancelled uses will be delayed for an additional two years to allow growers to find pest management solutions. With the additional interim risk mitigation measures in place (outlined below), the risks to the environment can be reduced to a level that is considered acceptable over the two-year period of use extension.

Interim Mitigation Measures

- Canola for alfalfa looper control:
    - Buffer zones to protect sensitive aquatic biota.
    - Prohibition of application during bloom to protect pollinators.
- Garlic for darksided and redbacked cutworm control:
    - Reduce applications to one per season at the lower label rate of 576 g a.i./ha.
    - Buffer zones to protect sensitive aquatic biota.

Value

- Update structural claims as per the PMRA Guidance Document Structural Pest Control Products: label updates.
- Update tank mix statements.

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.

Certain chlorpyrifos products are to be cancelled since these product labels have no uses that are acceptable for continued registration as a result of this aspect of the re-evaluation. Products that are cancelled will be phased out following the implementation timeline outlined below:

- One (1) year of sale by registrant from the publication date of this decision document, followed by;
- One (1) year of sale by retailer from the last date of sale by registrant, followed by;
- One (1) year of permitted use from the last date of sale by retailer.

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

Other information

Any person may file a notice of objection[3] regarding this decision on chlorpyrifos and its associated end-use products within 60 days from the date of publication of this Re-evaluation Decision related to the environmental assessment and value. For more information regarding the basis for objecting (which must be based on scientific grounds), please refer to the Pesticides

[3] As per subsection 35(1) of the *Pest Control Products Act.*

section of the Canada.ca website (Request a Reconsideration of Decision) or contact the PMRA's Pest Management Information Service by phone (1-800-267-6315) or by e-mail (hc.pmra-info-arla.sc@canada.ca).

The relevant confidential test data on which the decision is based (as referenced in PRVD2019-05) are available for public inspection, upon application, in the PMRA's Reading Room (located in Ottawa). For more information, please contact the PMRA's Pest Management Information Service.

Science evaluation update

1.0 Revised environmental risk assessment

Comments and studies submitted during the consultation period for the Proposed Re-evaluation Decision (PRVD2019-05) have been considered in this re-evaluation decision for chlorpyrifos.

1.1 Fate and behaviour in the environment

No new information was submitted on the environmental fate and behaviour of chlorpyrifos in the environment. A summary of the fate and behaviour can be found in PRVD2019-05. Additional water monitoring data, either submitted during the consultation period or otherwise obtained by Health Canada since the publication of PRVD2019-05, has been considered in the current risk assessment.

1.2 Environmental toxicology

During the consultation period for PRVD2019-05, a number of field and semi-field toxicity studies were submitted on birds, mammals, pollinators and beneficial arthropods. A screening review of these studies indicated that they would not change the risk assessment or the risk mitigation measures proposed in PRVD2019-05. As a result, comprehensive reviews of these submitted studies were not conducted.

1.3 Environmental risk characterization

Aquatic organisms

Due to potential risks identified for aquatic organisms, the need for surface water monitoring data was first identified in PACR2003-03 and REV2007-01. Canadian surface water monitoring data on appropriate spatial and temporal scales with use information from the areas surrounding sample collection on crops representative of the major crop groups (grains, oilseeds and vegetables) was requested.

Despite the identified need for robust water monitoring data to refine the aquatic risk assessment, the only robust water monitoring data available was from the province of Quebec.

Since the publication of PRVD2019-05, some additional water monitoring data was obtained by Health Canada. A summary of available water monitoring information is presented in Appendix IV, Table 1. The results of the refined risk assessment using water monitoring data were reported in PRVD2019-05. In consecutive years for extended periods of time, acute and chronic endpoints of concern were shown to have been exceeded in several of the Quebec data sets. The additional water monitoring data received following publication of the PRVD2019-05, did not change the exposure conclusions as presented in PRVD2019-05.

Measures to mitigate risks were implemented in Quebec (by: le Pôle d'excellence en lutte intégrée and Le Ministère de l'Environnement et de la lutte contre les changements climatiques). The efforts included a move towards integrated pest management, sterile insect releases, changes

to application methodology to cole crops and installation of filter marshes or biofilters to capture chlorpyrifos before discharge. Decreases in concentrations were observed following the concerted efforts to mitigate and increase grower awareness.

The vast majority of the composite dataset of available water monitoring data was deficient on a spatial and temporal basis and is not suitable for use in refinement of the risk assessment. Given the lack of robust water monitoring data on a national scale, Health Canada is unable to further refine the aquatic risk assessment. The water monitoring data was deficient for the following reasons:

- Sampling frequency: In order to capture peak concentrations to which aquatic organisms may be acutely exposed to chlorpyrifos, frequent sampling at the same location is required. In addition, in order to refine the chronic risk assessment, frequent sampling is also required to allow the calculation of rolling averages over similar durations of exposure periods used in some chronic laboratory tests with aquatic organisms.
- Sample timing: Sampling during the growing season when chlorpyrifos is used is needed to capture peak concentrations.
- Ancillary data: Information on the use of chlorpyrifos in the watershed being sampled is particularly important when there are no-detections.
- Limit of detection: The analytical limit of detection in water must be more sensitive than the most sensitive toxicity endpoint for aquatic organisms. For water monitoring samples where concentrations were not detected in the laboratory analysis, Health Canada assumes a value of half the limit of detection for risk assessment purposes.
- Older data is less relevant for the current risk assessment: Changes to the use pattern for chlorpyrifos over the years would be expected to be reflected in the water monitoring data.

Where robust water monitoring data was lacking, Health Canada relied on extensive water modelling to determine estimated environmental concentrations (EECs) in water to which aquatic organisms may be exposed. Detailed regionally specific water modelling was conducted by Health Canada for PRVD2019-05, with 39 different scenarios being modelled using a wide range of regionally specific crops and a range of application rates (PRVD2019-05 Tables 19, 20).

The results of the aquatic risk assessment using modelled EEC values as described in PRVD2019-05 have been grouped according to the modelled crop/rate and region in Appendix IV, Tables 2 and 3. Irrespective of the crop, risk quotient (RQ) values exceed the LOC in almost all regional scenarios for the HC_5 (hazardous concentration to 5% of the species) for freshwater and marine invertebrates and all higher tier mesocosm endpoints for freshwater invertebrates and fish on a chronic basis. Some exceedances of the LOC are also observed on an acute basis, although to a lesser extent.

Birds and mammals

Health Canada has revised the bird and mammal risk assessment in response to the registrant's voluntary cancelation of the use of airblast application equipment on peach, nectarine and filbert. Comments received during the consultation period were also factored in. Revisions include the consideration of ground boom and aerial application methods and other application rates for a range of uses. A refined risk assessment was conducted for birds and mammals (Appendix IV, Tables 4–9). The refined risk assessment was conducted using mean nomogram values and for simplicity, the results are only presented for one feeding guild for each category of bird and mammal weights.

For all agricultural crops, potential on-field risks of concern were identified for all size groups of birds and mammals on an acute and reproductive basis for both ground boom and aerial applications at the screening level. For birds, off-field acute and reproductive risks from ground boom applications are limited; however, aerial applications pose potential risks on an acute and reproductive basis for small and medium sized birds at the highest aerial application rates. For mammals, potential off-field reproductive risk from ground boom applications may occur at higher application rates, whereas, for aerial application rates, the level of concern is exceeded at most application rates. Potential acute off-field risk to mammals from ground boom applications is only indicated for small mammals at the highest application rate tested and the acute mammal level of concern is not exceeded at any aerial application rate.

Potential risk to birds and mammals from soil drench applications for crops with multiple applications, such as Asian radish, are also expected. There are potentially three applications of 3360 g a.i./ha over the seeded rows, at 13- and 15-day intervals (7, 20 and 35 days after seeding). Although not technically a foliar application, the mean nomogram values can still be used as a conservative estimate of the expected exposure to birds and mammals. As indicated in Appendix IV, Table 9, the LOC is exceeded for almost every feeding guild and size category for birds and mammals.

Due to the inherent toxicity of chlorpyrifos to birds and mammals, label statements advising users of potential risks are required as was reported in PRVD2019-05. The potential on-field and off-field risks identified for birds and mammals in the refined risk assessment are difficult to mitigate; however, due to the reduced use pattern associated with this decision, these risks are considered acceptable for the remaining use pattern.

Environmental risks from the use of chlorpyrifos for elm bark beetle and mountain pine beetle control

Since the publication of PRVD2019-05, Health Canada has determined that the environmental exposure of chlorpyrifos use for elm bark beetle and mountain pine beetle control is expected to be low, because chlorpyrifos is directly applied to the lower portion of the tree trunk and is not broadcast into the surrounding environment. Inhalation exposure is not considered an environmental concern according to the USEPA (PMRA# 2824701). These uses are now considered to pose acceptable risks to the environment and will be retained.

1.4 Environmental incident reports

Since the publication of PRVD2019-05, no new incidents have been reported to Health Canada or the USEPA. For details, consult the summary of environmental incident report found in PRVD2019-05.

2.0 Value assessment

Chlorpyrifos provides control of various insects, across several agricultural and horticultural crops, including certain Canadian Food Inspection Agency (CFIA) regulated pests. It is important to growers who use it to manage season-long pest outbreaks, reduce the impact of insect damage on crop quantity or quality, and prevent resistance development in susceptible insect pests. For some crops, chlorpyrifos is the only approved insecticide to control a certain pest, making it a valuable pest management tool to producers.

During the consultation of PRVD2019-05, Health Canada received several comments relating to the value of chlorpyrifos. These comments are summarized in Appendix III along with the responses by Health Canada. Stakeholders emphasized that chlorpyrifos is of notable value to several sectors, as it controls major pests that can cause economic losses. Chlorpyrifos is of particular value for control of cabbage maggot, onion maggot and cutworms on vegetables, wireworm on seed potatoes in British Columbia, seed weevils on sunflower, native elm bark beetle which is the vector for Dutch elm disease, alfalfa looper on canola, and brown wheat mite in cereals.

3.0 Suitability of alternatives and implementation dates for certain cancelled uses

As per Subsection 21(3) of the *Pest Control Products Act* and Health Canada's cancellation policy (Regulatory Directive DIR2018-01*, Policy on Cancellations and Amendments Following Re-evaluation and Special Review*), a delay of the implementation date of re-evaluation decision (in other words, extended phase-out period of up to 2 years) may be considered for cancelled uses that have no suitable alternatives.

Some uses of chlorpyrifos have no suitable alternatives. In this case, an extended phase out period may be considered to allow growers to find pest management solutions, as long as the risks are acceptable for the period of extended phase out.

Based on a lack of suitable alternatives and consideration of the environmental risks, the cancelled uses below may continue to be used for two additional years due to the following rationales:

- Alfalfa looper on canola: The application rate for this use is in the lower range of registered uses and the aquatic risk assessment indicates lower RQ values for the prairie region (where most canola is grown in Canada) compared to the rest of Canada.
- Darksided and redbacked cutworm control on garlic: Due to the low cropped area (<900 ha), a single application per season with the lower rate during the extended phase out period is expected to result in reduced environmental exposure.

From an environmental perspective, an extended phase-out period for the above two uses are considered acceptable with the implementation of interim measures such as environmental precautions and buffer zones (Appendix V).

List of abbreviations

%	percent
>	greater than
<	less than
a.i.	active ingredient
ASABE	American Society of Agricultural and Biological Engineers
BMP	Best Management Practices
bw	body weight
CFIA	Canadian Food Inspection Agency
cm	centimetre(s)
EC	emulsifiable concentrate
EEC	estimated environmental concentration
EFSA	European Food Safety Agency
E/M	estuarine/marine
FW	freshwater
g	gram(s)
ha	hectare(s)
HC_5	hazardous concentration to 5% of the species
Invert	invertebrate
IRAC	Insecticide Resistance Action Committee
kg	kilogram(s)
LC_{50}	lethal concentration 50%
LD_{50}	lethal dose 50%
LOC	level of concern
LOD	limit of detection
LOEC	lowest observable effect concentrations
m	metre(s)
m^3	metre cubed
mg	milligram(s)
NOAEC	no observed adverse effect concentration
NOEC	no observable effect concentration
NOAEL	no observable adverse effect level
RQ	risk quotient
SSD	species sensitivity distribution
µg	micrograms
ULV	ultra low volume
USEPA	United States Environmental Protection Agency

Appendix I Registered pest control products containing chlorpyrifos in Canada[1]

Table 1 Products requiring label amendments

Registration Number	Marketing Class	Registrant	Product Name	Formulation Type	Guarantee
23621	Technical Grade Active Ingredient	Adama Agricultural Solutions Canada Ltd.	Pyrinex Technical Chlorpyrifos Insecticide	Solid	97%
31417		Agrogill Chemicals PTY Ltd.	Chlorpyrifos Agrogill Technical Grade Active Ingredient	Solid	98.6 %
19656		Dow AgroSciences Canada Inc.	Dursban FM Insecticidal Chemical	Liquid	97%
32694		Sharda Cropchem Limited	Sharda Chlorpyrifos Technical Insecticide	Solid	98.81%
33295		Newagco Inc.	Newagco Chlorpyrifos Technical	Solid	98.9%
14879	Commercial and Restricted	Dow AgroSciences Canada Inc.	Lorsban 4E Insecticide	Emulsifiable Concentrate	480g /L
29650			Lorsban NT Insecticide	Emulsifiable Concentrate	452 g/L
23704		Adama Agricultural Solutions Canada Ltd.	Pyrate 480 EC Insecticide	Emulsifiable Concentrate	480 g/L
32768		Sharda Cropchem Limited	Sharphos Insecticide	Emulsifiable Concentrate	480 g /L
21997	Commercial	Dow AgroSciences Canada Inc.	Dursban Water Soluble Insecticide	Soluble Powder	50%
23705		Adama Agricultural Solutions Canada Ltd.	Pyrinex 480EC For Food Crops	Emulsifiable Concentrate	480 g/L
33113			Pyrinex 450 LV EC		450 g/L
27479		Interprovincial Cooperative Limited	Citadel 480EC Insecticide	Emulsifiable Concentrate	480 g/L
33356		Newagco Inc.	MPOWER	Emulsifiable Concentrate	480 g/L

[1] as of 8 September 2020, excluding discontinued products or products with a submission for discontinuation.

Table 2 Products cancelled as a result of this re-evaluation

Registration Number	Marketing Class	Registrant	Product Name	Formulation Type	Guarantee
20944	Commercial and Restricted	Dow AgroSciences Canada Inc.	Lorsban 50W Insecticide	Wettable Powder	50%
16458	Commercial	Dow AgroSciences Canada Inc.	Lorsban 15G Insecticide	Granular	15%
25831		FMC Corporation	Nufos 4E Insecticide	Emulsifiable Concentrate	480 g/L
24648		Loveland Products Canada Inc.	Pyrifos 15G Insecticide	Granular	15%
29984		Loveland Products Inc.	Warhawk 480 EC Insecticide	Emulsifiable Concentrate	480 g/L
30985		Newagco Inc.	MPOWER Krypton	Emulsifiable Concentrate	480 g/L

[1] as of 8 September 2020, excluding discontinued products or products with a submission for discontinuation.

Table 3 Products that do not require amendments

Registration Number	Marketing Class	Registrant	Product Name	Formulation Type	Guarantee
20320	Manufacturing concentrate	Dow AgroSciences Canada Inc.	Dursban HF Insecticidal Concentrate	Solution	720 g/L
20407			Dursban W Insecticidal Concentrate	Dust or Powder	50%

Appendix II List of commenters to PRVD2019-05

List of commenters' affiliations for comments submitted in response to PRVD2019-05

Category	Commenter
Government Organization	British Columbia Ministry of Agriculture
	Saskatchewan Ministry of Environment
	City of Prince Albert, Saskatchewan
	Ministry of Agriculture, Saskatchewan
	Parks, City of Saskatoon
	Ontario Ministry of Agriculture, Food and Rural Affairs
Agricultural Associations and Growers	Canada Grains Council
	Canadian Canola Growers Association
	Pulse Canada
	Canadian Horticulture Council
	Cereals Canada
	Canadian Nursery landscape Association
	British Columbia Vegetable Marketing Commission
	British Columbia Certified Seed Potato Growers Association
	British Columbia Potato & Vegetable Growers Association
	Island Vegetable Co-operative Association, British Columbia
	Team Alberta
	Alberta Wheat Commission and Alberta Barley
	Saskatchewan Wheat Development Commission
	Saskatchewan Flax Development Commission
	Manitoba Sustainable Development
	Ontario Fruit & Vegetable Growers Association
	Associations des producteurs maraichers du Québec
	Prince Edward Island Horticultural Association
	Individual potato and vegetable growers from British Columbia
	Individual rutabaga and other vegetables growers from Quebec
Registrants	CropLife Canada
	Corteva
Non-Government Organization	Prevent Cancer Now
	David Suzuki Foundation Canadian Association of Physicians for the

Category	Commenter
	Environment Canadian Environmental Law Association Équiterre Environmental Defence
	Learning Disabilities Association of Canada
	Society to Prevent Dutch Elm Disease
General Public	Individual citizens

Appendix III Comments and responses

Health Canada received about 60 written comments during the public consultation for the chlorpyrifos proposed re-evaluation decision on the environment (PRVD2019-05). Commenters' affiliations are listed in Appendix II. These comments were considered during the decision phase of this re-evaluation related to the environmental and value assessments. Summarized comments and Health Canada's responses to them are provided below.

1.0 Comments related to the environmental risk assessment

1.1 General risk assessment assumptions and conclusions

1.1.1 Conservative assumptions are not realistic

The Alberta Wheat Board and Barley Commission and the Saskatchewan Ministry of Agriculture commented that decisions made using conservative assumptions are not reflective of the usage, application methods or real-life in-field data of actual farms, and are unreasonable in the scientific determination of risk. Farming operations vary greatly across provinces and across the whole of Canada.

Health Canada's response:

As presented in PRVD2019-05 (Appendix III, Tables 17–22), detailed water modelling was conducted for 39 different regional scenarios, taking into consideration a wide range of crops and application rates. This included modelling of single applications to crops, representative of use on the Prairies. The modelling identified acute and chronic risks to aquatic invertebrates and fish for both laboratory and higher-tiered mesocosm endpoints.

Despite Health Canada identifying the need for robust water monitoring data in order to refine the aquatic risk assessment, robust water monitoring data was not available for the Prairies. General deficiencies in the available water monitoring data are described in the science update section of this document.

Although there were a large number of samples from Alberta, many of these samples were taken during the fall and winter months when chlorpyrifos would not be expected to be present. Samples taken during the growing season are most relevant to the aquatic risk assessment. A large number of samples (3052) were obtained from a report (PRVD2019-05 PMRA# 1311118) that offered only a high-level summary of water monitoring results from Alberta from 1995–2002. On further consideration, this data was excluded as it represents older samples that may not reflect the current use. In addition, 2680 of the Alberta samples were from irrigation water (PMRA# 2839822) which may not be representative of creeks, rivers and wetlands that may be exposed to chlorpyrifos through runoff.

Additional water monitoring data was submitted by Saskatchewan during the consultation period, however much of the data submitted had already been considered in PRVD2019-05. Twenty-four additional sampling results were added to the available data from Saskatchewan. Most of the water monitoring data from Saskatchewan had a high limit of detection (2 µg a.i./L), which is not sensitive enough to capture the toxicological endpoints of concern.

Few monitoring sites in the Prairie Provinces were sampled more than once a month. Sites sampled monthly or less frequently are unlikely to have captured peak concentrations and are not suitable for refinement of acute or chronic exposure estimates.

With respect to the bird and mammal risk assessment, details of the refined risk assessment are presented in the science update section. Different crops and application rates were considered in this refined risk assessment in order to represent the diversity of agriculture across the country.

1.1.2 All relevant data should be considered

The Canadian Canola Growers Association commented that the work compiled in 2014 by Giesy and Solomon, in Ecological Risk Assessment for Chlorpyrifos in Terrestrial and Aquatic Systems in the United States, should be considered for Health Canada's decision.

Health Canada's response:

Health Canada confirms that the work of Giesy and Solomon (2014, PMRA# 2793562) was taken into consideration in PRVD2019-05.

The toxicity endpoint calculated for freshwater invertebrates (which includes crustaceans and insects) in PRVD2019-05 (HC_5 = 0.044 µg a.i./L)[4] is within the range of endpoints used in the analysis of Giesy and Solomon (2014, crustacean HC_5 = 0.034 µg a.i./L, insect HC_5 = 0.091 µg a.i./L, respectively). With respect to freshwater fish, the endpoint calculated by Health Canada (HC_5 = 5.94 µg a.i./L) is less sensitive than the endpoint used in the analysis of Giesy and Solomon (2014, HC_5 = 0.820 µg a.i./L). Health Canada and Giesy and Solomon (2014) used the same toxicity endpoint derived from five different mesocosm studies for aquatic biota (NOAEC of 0.1 µg a.i./L), although Health Canada bracketed the risk with a lower endpoint (NOAEC of 0.06 µg a.i./L) from one of these studies using measured concentrations, not nominal, as reported by Giesy and Solomon (2014).

It should be noted that the aquatic organism endpoints selected by Health Canada for PRVD2019-05 are also in general agreement with endpoints selected by other regulatory agencies (USEPA, European Commission, European Food Safety Agency (EFSA) and Australia (Australian Pesticide and Veterinary Medicines Authority).

The risk assessment conducted by Health Canada and the work of Giesy and Solomon (2014) diverge with respect to assumptions made regarding the estimated environmental concentrations found in the environment. Giesy and Solomon (2014) relied on refined surface water modelling focused on three American watersheds. They characterized the watersheds as being "…realistic but reasonable worst-case predictions of chlorpyrifos in runoff water…". While Giesy and Solomon (2014) used DT_{50} values of 28–96 days in soil, Health Canada relied on a larger fate database to calculate a half-life of 179 days (90th percentile confidence bound on mean of eight half-lives adjusted to 25°C as per the Health Canada and USEPA environmental risk assessment protocols). Giesy and Solomon (2014) modelled foliar, broadcast and T-band applications at rates of 0.56 to 6.3 kg a.i./ha, while Health Canada used Canadian registered application rates from 0.24 to 3.6 kg a.i./ha.

[4] Hazardous concentration to 5% of the species.

The maximum daily concentrations predicted by Giesy and Solomon (2014) for the California, Georgia, and Michigan watersheds were 3.2, 0.041, and 0.073 µg/L, respectively. Health Canada calculated estimated environmental concentration (EEC) values for different regions of the country that ranged from 0.23 to 44 µg/L.

For the bird risk assessment, Health Canada used an acute toxicity HC_5 of 6.6 mg a.i./kg diet obtained from 25 bird species and a chronic NOAEL of 2.88 mg a.i./kg bw/day for the chronic avian risk assessment. In comparison, Giesy and Solomon (2014) reported lethal dose 50% (LD_{50}) values ranging from 5.6 to 122 mg a.i./kg diet for the acute avian risk assessment and a NOEL of 2.99 mg a.i./kg bw/day for their chronic avian risk assessment. For the mammalian risk assessment, Health Canada used the most sensitive LD_{50} for the acute risk assessment (60 mg a.i./kg bw) and the most sensitive NOAEL for the chronic risk assessment (1.0 mg a.i./kg bw/day). Giesy and Solomon (2014) did not conduct a mammalian risk assessment. The bird and mammal endpoints used by Health Canada are similar to those chosen by other international regulatory bodies.

The environmental risk assessment presented in PRVD2019-05 takes into consideration additional information that was not available to or not considered by Giesy and Solomon (2014). This includes incident reports from 2010 to 2018 and water monitoring data.

1.1.3 EECs and RQs for aquatic risk assessment are miscalculated

The Saskatchewan Ministry of Agriculture commented on the following aspects of the aquatic risk assessment for chlorpyrifos:

- Due to low solubility in water, low mobility in soil, and short persistence in water, the presence of chlorpyrifos in water should be very limited. Health Canada has overestimated the potential exposure to water and risk to aquatic systems from drift and runoff by not using realistic application parameters, including the consideration of spray buffer zones. Lorsban 4E (PCP 14879) label already includes a minimum of a 30 m Buffer Zone Required for Protection of Aquatic Habitats. In order to conduct a realistic evaluation of risk, calculation of EECs must include realistic application scenarios, including recommended buffer zones.
- An aquatic incident based on a single, apparently off-label, application was reported as part of this evaluation.
- Physical/chemical characteristics of chlorpyrifos suggest that, unless chlorpyrifos is actually applied to aquatic systems, its presence in water should be very limited, and that once in water, persistence will be low.

Health Canada's response:

Lorsban 4E (PCP 14879) has required spray buffer zones of 30 to 60 m to protect aquatic habitats. These buffer zones will protect aquatic habitats from spray drift at the time of application but do not mitigate risks associated with runoff.

The risk assessment determined the maximum possible off-target exposure due to drift that occurs at field margins. As such, EEC from drift at 1 m off-field was used to back-calculate the buffer zone required to arrive at an EEC (equivalent to the toxicity endpoint of concern) that is environmentally acceptable. The inclusion of the drift EEC at 30 m downfield and comparing it

to the acceptable EEC would make the assessment needlessly complex. Additionally, the labelled 30 m buffer zone is not intended as a mitigation measure for surface runoff, as runoff can originate from anywhere in the treated field. Similar to the spray drift assessment, the EEC from surface runoff was determined for aquatic systems located at the field margins to characterize the maximum exposure from this mode of off-target transport.

Calculations of representative half-lives and the selection of fate input parameters for the modelling followed standard methodology. Fate inputs are summarized in Appendix III, Table 18 of PRVD2019-05. Model inputs reflect the description provided in the comment (low solubility in water, low mobility in soil and short persistence in water). In addition, this table shows that the representative half-life in aerobic soil is longer than in aquatic systems. With a longer half-life in soil and low mobility, chlorpyrifos bound to soil particles will remain in the top layer of the soil and can enter surface water through runoff as surface soil particles are dislodged due to rainfall. Concentrations entering surface water bodies from runoff were found to be of concern given the high toxicity of chlorpyrifos to aquatic life.

Health Canada is required to take into consideration any information that is received through the Incident Reporting Program. PRVD2019-05 reported on a number of incidents that occurred in both Canada and the United States, with the off-label incident mentioned in the comment being just one of many that were considered. This incident was not relevant to our risk assessment because of misuse and did not affect the conclusion of the re-evaluation. Incident reports are used in a weight-of-evidence approach in the risk assessment to determine the acceptability of a product.

1.1.4 The pollinator assessment does not account for risks to bees from spray drift

The David Suzuki Foundation, Canadian Association of Physicians for the Environment, Canadian Environmental Law Association, Équiterre, and Environmental Defence commented that Health Canada's pollinator assessment does not identify all potential risks to bees. Non-target plants growing in areas adjacent to where chlorpyrifos is sprayed may be exposed to residues from spray drift. If bee attractive - plants (in other words, wildflowers) are growing in adjacent areas, pollinators may be exposed to chlorpyrifos at levels that can cause mortality. Non-target plants often have different bloom cycles than the crops considered in the risk assessment; thus, application-timing restrictions are unlikely to reduce risks from this exposure pathway. Soil and soil-water exposure from foliar and granular applications have not been assessed and may present risks to ground-nesting native bees.[5] In addition, the commenter disagrees with the suggestion in PRVD2019-05 that risks deemed unacceptable to managed bees could be acceptable for wild pollinators for certain crop applications. Native bees in some cases may be more vulnerable.

[5] Cutler G.C., Purdy J., Giesy J.P., Solomon K.R. (2014), "Risk to Pollinators from the Use of Chlorpyrifos in the United States." In: Giesy J., Solomon K. (eds) Reviews of Environmental Contamination and Toxicology: vol. 231. Ecological Risk Assessment for Chlorpyrifos in Terrestrial and Aquatic Systems in the United States. Heidelberg New York Dordrecht London: Springer, Cham

Health Canada's response:

The main route of exposure for Apis and non-Apis bees to chlorpyrifos is expected to be from bees foraging on crops that are highly attractive, and directly sprayed. As such, Health Canada has proposed label mitigation measures to reduce this route of exposure, and potential drift. Health Canada recognizes there may be some exposure to bees from off-field drift of chlorpyrifos, although given the timing of application and label restrictions for application when bees are not foraging, any exposure is expected to be minimal. Residues on non-target plants (such as wildflowers) are expected to be reduced by between 26 and 89% compared to on-field foliar airblast and field applications. Restriction of application during bloom on a number of crops will further reduce residues on non-target plants during a significant portion of the season that bees are foraging. Since chlorpyrifos is not persistent in soil or on plant surfaces, residues are expected to be further reduced if they do reach non-target plants, or soil, where ground-dwelling native bees may reside. As chlorpyrifos is not systemic, no translocation from soil or leaves/stems to pollen and nectar is expected.

Based on the monitoring data presented in Cutler et al. (2014, as provided by the commenter) maximum residues were considered in comparison to acute laboratory LD_{50} values as presented in PRVD2019-05. Considering maximum pollen (from pollen traps) and honey residues (considered a surrogate for nectar) of 967 and 80 ppb, respectively, and acute oral adult and larvae LD_{50} values of 0.04 and 0.021 µg a.i./bee, respectively, the RQ (risk quotient) values were determined to be 0.6 for adults and 0.7 for larvae, slightly exceeding the level of concern of 0.4. The risk is much lower than predicted by the conservative Tier 1 assessment.

Therefore, based on field data of residue concentrations, the risk to non-Apis bees (such as ground-dwelling bees) is expected to be much lower than the conservative Tier I assessment based on predicted residues and laboratory endpoints for honeybees, which are used as a surrogate for bee toxicity. Residues in off-field plants are expected to be even lower than crops sprayed directly. The Cutler et al. (2014) study also concludes that based on higher tier studies, despite short-term lethal effects on honey bees, colonies should be able to survive such exposure with few long-term effects. The risk was reduced or eliminated if application was not made when flowers are open, since chlorpyrifos is not systemic and is not translocated to newly opened flowers. Overall, that study concluded that, provided label directions and good agricultural practices are followed, the use of chlorpyrifos in agriculture in Canada does not present an unacceptable risk to honeybees. The Davis and Williams (1990) paper based on European use patterns, spray drift data from the southern United States, Canada and the United Kingdom, and predicted deposition of residues on bees, suggests residues from drift would be present at toxic levels even when there is a "buffer zone" implemented. Health Canada recognizes there will be some residues on non-target plants, but this exposure scenario is considered much lower than target crops, and is expected to result in acceptable risk, for the reasons stated above.

1.1.5 Environmental risks from mosquito control uses have not been adequately assessed

The David Suzuki Foundation, Canadian Association of Physicians for the Environment, Canadian Environmental Law Association, Équiterre, Environmental Defence have commented that the environmental assessment for mosquito control in standing water and terrestrial areas does not fully characterise the risks to non-target aquatic and terrestrial organisms from direct application and spray drift. Risks to aquatic biota in temporary standing pools, non-target insects

(including pollinators) and birds from spray drift and leaching requires further examination. The commenter suggests that the PMRA concluded that the risks to non-target terrestrial and aquatic biota would be considered acceptable if ULV applications were used, but the commenters note that ULV applications are not required.

Health Canada's response:

Risk to non-target terrestrial and aquatic organisms were taken into consideration in PRVD2019-05. The rates used for mosquito control (13–53 g a.i./ha) are within the range of application rates examined for the drift risk assessment (12–2304 g a.i./ha × 3 applications). The results of this assessment are presented in Appendix III, Table 16 of PRVD2019-05.

The risk to pollinators and beneficial arthropods from adult mosquito control was quantitatively assessed in PRVD2019-05. Pollinators are not expected to be present in the evening or at night when chlorpyrifos is applied for mosquito control and beneficial insects are also not expected to be present while foraging during this time.

Regarding the risk to flying birds resulting from adult mosquito control, the duration of airborne drift and its rate of dispersal in the atmosphere as well as its deposition rate indicates this exposure is negligible and as such, is not considered by Health Canada. The USEPA (PMRA# 2824701) did state: "Toxicity data are not available for inhalation exposures involving birds; however, in an acute inhalation study with laboratory rats, no mortality was observed at 0.2 mg a.i./mL-air (200 mg/m^3) which is equivalent to >5,000 mg a.i./kg bw. Due to a lack of observed toxicity in this study, inhalation exposure is not considered to be of concern…".

Temporary pools are ephemeral in nature resulting from flooding of or drainage to low-lying areas and are not seasonal or permanent habitats. Health Canada acknowledges that while temporary pools may contain invertebrates and amphibians, their ecological function as a habitat is limited by their short duration during the growing season and as such do not require a separate risk assessment. In addition, it is not relevant to conduct a temporary pool risk assessment for drift or runoff resulting from adult mosquito control as chlorpyrifos is registered for direct application to such pools for mosquito larvae control.

Although PRVD2019-05 refers to ULV applications, Health Canada acknowledges that terminology should have been more specific. Ultra Low Volume (ULV), also known as aerosol generation or cold fogging is intended to generate a cloud of Extremely Fine (ASABE) droplets that will stay suspended in air long enough to come into contact with mosquitos in flight. The registered mosquito uses for chlorpyrifos specify the use of mist blowers. Mist blowers are designed to release Very Fine (ASABE) droplet sizes and generate a mist cloud that settles on surfaces to control adult mosquitos in cryptic habitat, such as the undersides of leaves, vegetation and structures where the gravid or engorged female mosquitos rest. Site characteristics, as specified on the labelled uses (in other words, shallow, grassy depressions; industrial parks; roadway ditches; railway marshalling yards; small temporary sloughs; flooded woodlands) will intercept the mist cloud and result in a reduction in exposure to non-target organisms.

1.1.6 Risks to birds from application of granular chlorpyrifos was negligible

The Canadian Horticultural Council indicated that granular applications of chlorpyrifos are highly valuable to many vegetable production systems. PRVD2019-05 states that the potential for effects to birds from exposure to chlorpyrifos granules is negligible.

Health Canada's response:

The environmental assessment for birds did indicate that granular applications were acceptable; however, granular applications could still result in runoff of chlorpyrifos to sensitive aquatic habitats and exposure to other biota. Robust water monitoring from vegetable-growing areas in Quebec indicates that chlorpyrifos can travel in runoff into aquatic systems and pose risks to sensitive aquatic organisms. Although the water monitoring data is robust, it does not allow for the determination of what application method (foliar vs. granular) is contributing to the high concentrations. Granular products can be used in corn, onion, rutabaga and cole crops, and is either applied in-furrow during planting or incorporated 2.5 cm into the soil. Exposure from granular uses was not modelled in the previous assessment reported in PRVD2019-05 given the magnitude of the risk to aquatic organisms, as it was not expected that these uses would lead to exposures below the toxicity thresholds.

1.1.7 Transformation products of chlorpyrifos are more toxic

A comment was received indicating that the breakdown products (oxons) of the three most commonly used organophosphorus, including chlorpyrifos, are 10–100 times more toxic to amphibians than their parent compounds, which are already highly toxic to amphibians.

Health Canada's response:

Transformation products of chlorpyrifos were considered in the environmental assessment. Formation of chlorpyrifos-oxon in environmental studies was shown to be very limited (up to 3% of applied chlorpyrifos). In addition, chlorpyrifos-oxon is non-persistent in soil (half-life = 0.02–0.10 days) due to rapid biotransformation. As concentrations of chlorpyrifos-oxon in the environment are expected to be low, the risks are expected to be accounted for in the chlorpyrifos risk assessment.

1.2 Use pattern

1.2.1 Filbert airblast/multiple application scenario is not representative of many other crops

The Canadian Horticultural Council, Canadian Potato Council, and Saskatchewan Ministry of Agriculture commented that the application scenario for filberts (airblast, cumulative application rate), in the risk assessment for chlorpyrifos is not representative of most critical horticultural uses in Canada and is inappropriate for assessing risks associated with chlorpyrifos use in Canadian fruit and vegetable production. Airblast applications are not used in vegetable production. To be reflective of real risk for fruits and vegetables, the risk assessment should be calculated to reflect the actual use of chlorpyrifos in Canada, whether the application is granular, ground applied, foliar, or airblast.

Health Canada's response:

An assessment for risks associated with spray drift was done using different application rates on cereals, fruit and vegetables as well as the amount of drift associated with ground boom and aerial application methods. The level of concern for aquatic organisms was exceeded for almost all aquatic organisms (PRVD2019-05, Appendix III, Table 16), resulting in the requirement for spray buffer zones to mitigate risk from drift. An assessment for risk to aquatic organisms from runoff was conducted using 11 different application rates and numerous regional crop scenarios, including onions and garlic (Appendix II, Tables 2 and 3 and also in PRVD2019-05 in Appendix III, Tables 19 and 20). The risk assessment indicated that there was risk for almost all modelled application rates and crops.

The bird and mammal risk assessment was revised to take into consideration the registrants voluntary cancellation of airblast applications and also multiple application rates; the risk assessment is discussed in the updated Science Section.

1.2.2 In-furrow and drenching applications in British Columbia

The British Columbia Ministry of Agriculture commented that chlorpyrifos is applied in-furrow during potato planting or up to four drenches to rutabaga and other listed leafy cole crops (not applied as foliar ground spray). The commenter indicated that these uses should be acceptable for potato, rutabaga, other brassica crops and cole crops because there was no risk to pollinators reported in PRVD 2019-05. They also commented that robust water monitoring was conducted in 2017 and 2018 in watersheds with high production of potato and vegetable crops; analyses of water for neonicotinoids indicated very low or few detections and that it would be expected that chlorpyrifos would also not be present.

Health Canada's response:

Health Canada confirms that soil drench and in-furrow applications in potato and cole crops at the time of planting do not result in risks of concern to pollinators when mitigation measures outlined in PRVD2019-05 are applied (restricting applications to certain crops, evening applications, etc.). However, as reported in PRVD2019-05 chlorpyrifos carried in runoff can result in risk to aquatic organisms. For a given rate, runoff modelling EECs are expected to be comparable for soil drench and foliar applications.

The monitoring information for the neonicotinoids is not considered relevant to the current chlorpyrifos assessment, in particular due to the differences in the physical-chemical and fate properties of neonicotinoids and chlorpyrifos. Neonicotinoids are highly soluble, not bound to soil and are expected to be susceptible to leaching. Chlorpyrifos is less soluble, more strongly bound to soil particles, and susceptible to runoff when bound to soil particles, but is not prone to leaching. Movement into surface water via runoff from soil-bound chlorpyrifos is highly probable. It cannot be assumed that chlorpyrifos is not present in surface water based on the absence of other active ingredients, especially given their vastly different physical-chemical properties.

1.2.3 Discrepancy between single application used for pollinator risk assessment and multiple applications for other organisms

The Saskatchewan Ministry of Agriculture commented that the pollinator risk assessment assumed single applications per season, whereas, other biota were assessed at multiple applications. Reduced exposure due to volatilization in-crop was not considered in drawing conclusions even though Health Canada's assessment reported that "field studies demonstrate that volatilization is significant (25–80 per cent of applied chlorpyrifos)."

Health Canada's response:

The pollinator risk assessment was conducted according to *Guidance for Assessing Pesticide Risks to Bees* (USEPA, PMRA, CDPR, 2014). That document indicates that the screening level pollinator risk assessment was conducted using a single application.

Volatilization is highly dependent on a number of factors, which includes air temperature at time of application, application method and crop. Volatilization is not a mitigation measure.

1.2.4 Concerns for micro encapsulated formulation

The Saskatchewan Ministry of Agriculture commented that there are no micro-encapsulated chlorpyrifos formulations in Canada.

Health Canada's response:

At the time the re-evaluation of chlorpyrifos was initiated in 1999, micro-encapsulated chlorpyrifos was registered for use. These products have since been discontinued by the registrants, and currently there are no Canadian registered micro-encapsulated formulations of chlorpyrifos.

1.3 Monitoring data

1.3.1 Detections of chlorpyrifos in the arctic

One comment indicated that chlorpyrifos is found in all Arctic media and therefore has the potential to persist and drift very long distances. ("Current use pesticides in Arctic media"; 2000–2007 Lisa Hoferkamp, Mark H. Hermanson, Derek C.G. Muir).

Health Canada's response:

Although details were limited in PRVD2019-05, the document states that "Although modelling suggests that chlorpyrifos would not be expected to be transported long distances, there is evidence indicating that chlorpyrifos is present in air, snow, seawater, precipitation, sediment and both aquatic and terrestrial Arctic biota." Hoferkamp et al. (2010, PMRA# 2914808) was not specifically referenced in the PRVD; however, it was considered as part of the line of evidence for long-range transport of chlorpyrifos.

1.4 Mitigation measures

1.4.1 Lack of consideration of mitigation strategies

The Saskatchewan Wheat Development Commission commented that there was a lack of consideration for risk mitigation strategies. A thorough development and assessment of effective risk mitigation measures should be agreed upon, with industry as a partner in this process. The commenter requested that additional time be taken to address these concerns through the collection and evaluation of additional data, including privately available data, prior to Health Canada issuing a final decision.

Health Canada's response:

The current decision document and PRVD2019-05 considered new data produced since the re-evaluation of chlorpyrifos was initiated in 1999. Health Canada has examined possible mitigation measures. Although vegetative filter strips should provide some mitigation, the magnitude of the reduction is uncertain. Health Canada is working with other regulatory jurisdictions and academics regarding the use of vegetative filter strips to reduce runoff of pesticides into waterbodies. In addition, the Health Canada risk assessment was conducted at a national level. Modelling demonstrates risks from runoff are expected to be lower in certain regions, however even the lowest application rates pose unacceptable risks in certain parts of the country.

1.4.2 Concentrations in surface water in Quebec have been reduced

The Association des producteurs maraîchers du Québec has commented that new provincial regulations have resulted in significant reductions in the use of chlorpyrifos in Quebec and, as a result, concentrations in surface water have been reduced. However, the producers still want to have chlorpyrifos available for use when alternative controls do not work.

Health Canada's response:

Health Canada is aware of the research in Quebec conducted on chlorpyrifos alternatives, as well as policy changes that have restricted its availability to growers. These changes appear to have reduced the use of chlorpyrifos on certain crops in Quebec. As a result, decreases in concentrations of chlorpyrifos in surrounding waterways have been apparent and exceedances of toxicity endpoints were reduced dramatically. The results of the studies and the strategies employed in Quebec indicate that there are alternative control measures available for certain uses of chlorpyrifos.

1.4.3 New application equipment to apply solution rather than granular formulations on potatoes

The British Columbia Vegetable Marketing Commission informed Health Canada that the British Columbia potato industry, in cooperation with other stakeholders through the Wireworm Taskforce, have developed innovative solutions for wireworm control that have reduced risks to wildlife. In 2004, the British Columbia potato industry converted their application equipment to enable use of liquid formulations of insecticides. The shift away from granules that can be mistakenly ingested by wildlife has helped prevent wildlife poisonings in British Columbia.

Health Canada's response:

Health Canada acknowledges the collaborative approach described by the commenter to replace the use of chlorpyrifos granules used for control of wireworms on potatoes with a liquid application, which resulted in reduced risks to birds and small wild mammals. However, potential ingestion of granular chlorpyrifos by wildlife is not the only environmental concern. Chlorpyrifos applied as liquid formulation can move into aquatic systems through runoff and can result in unacceptably high concentrations in aquatic habitats. As described in the updated Science Section of the document, the risks to aquatic biota from runoff have been determined to be unacceptable.

1.4.4 Greenhouse uses should be cancelled to prevent water contamination

The David Suzuki Foundation, Canadian Association of Physicians for the Environment, Canadian Environmental Law Association, Équiterre, and Environmental Defence have proposed that precautionary label statements for greenhouse use may not be effective to prevent water contamination.

Health Canada's response:

The technical registrant of chlorpyrifos informed Health Canada that they intend to discontinue the use of chlorpyrifos on greenhouse ornamentals. As a result, the greenhouse ornamental use will be removed from all chlorpyrifos end-use product labels.

1.4.5 Additional water monitoring studies should be completed

CropLife Canada commented that the registrant should be afforded the opportunity to provide further water monitoring studies. A significant amount of time has lapsed from the initiation of the re-evaluation, during which the registrant has stated that they were not permitted to discuss the risk assessment with Health Canada. Additional monitoring data could have been gathered and submitted prior to a final regulatory decision.

Health Canada's response:

Health Canada met with the registrant during the review to discuss chlorpyrifos environmental risk concerns.

In REV2007-01, Health Canada indicated the requirement for water monitoring: "Data on exposure levels for non-target wildlife (birds and aquatic organisms) are required. In particular, surface water monitoring data in Canada are required to characterize the contamination of surface waters resulting from chlorpyrifos use on crops representative of the major crop groups (grains and oilseeds and vegetables) on appropriate spatial and temporal scales." Since the publication of the REV2007-01, no robust water monitoring information was submitted by the registrant.

Since that time, robust water monitoring data has been collected by the provincial government in Quebec only, and it was not available from other regions of the country. As indicated in the Science Evaluation Section, Health Canada has considered the available relevant water monitoring information for the aquatic risk assessment.

Further delaying the decision on chlorpyrifos to allow for additional water monitoring to be collected is not reasonable given the risks identified, the need for additional risk mitigation.

1.4.6 Risks associated with foliar applications and drenches can be mitigated

Saskatchewan Flax Development Commission, Saskatchewan Ministry of Agriculture
The Saskatchewan Flax Development Commission, Saskatchewan Ministry of Agriculture commented that the risks associated with chlorpyrifos foliar applications and drenches can be mitigated by spray buffer zones and pollinator statements. Label statements could be strengthened for crops receiving multiple applications per year.

Health Canada's response

The pollinator risk assessment was updated to current standards and with revised mitigation measures, risks to pollinators are acceptable when label directions indicated in PRVD 2019-05 are followed. However, risk to aquatic biota remains due to runoff. Spray buffer zones mitigate risk to aquatic organisms due to drift; however, they do not mitigate exposure due to runoff. Runoff mitigation options are limited for chemicals with physical chemical properties of chlorpyrifos.

2.0 Comments related to the value assessment

2.1 Control of cabbage maggot

Several stakeholders including government organizations, grower groups, the registrants and individual growers commented that chlorpyrifos is of value for control of cabbage maggot on cole crops, Asian radish, radish and rutabaga.

For some crops, there are few alternatives. The only alternative for most brassicas at-plant is cyantraniliprole. For root vegetables such as rutabaga, cyantraniliprole can only be applied once per season. The loss of chlorpyrifos would create insecticide resistant populations to the only remaining chemistry.

Health Canada's response:

Health Canada recognizes the need for effective pest control products and concurs that there are limited alternative active ingredients for the control of cabbage maggot. Health Canada also agrees that the development of insecticide resistance is a concern for cabbage maggot. However, risks of concern remain and the use of chlorpyrifos to control cabbage maggot will be cancelled.

2.2 Control of onion maggot

Several stakeholders commented that chlorpyrifos is of value for control of onion maggot on garlic, onions (bulb, green and pickling) and shallot. Onion maggot is one of the greatest pests of *Allium* crops. Chlorpyrifos provides a longer residual activity and consistent control of onion maggot larvae when applied at planting compared to the registered alternatives. There is concern of resistance developing in this pest.

Health Canada's response:

Health Canada recognizes the need for effective pest control products for the control of onion maggot in *Allium* vegetable crops. Both the adult and larval stage of this pest must be controlled. There are no alternative active ingredients registered to control onion maggot on garlic and shallot. Health Canada agrees there are limitations to the alternative active ingredients to control onion maggot larvae on onion. Alternative active ingredients are available for adult fly control (naled and cypermethrin) and they are used in conjunction with chlorpyrifos which controls the larvae. However, risks of concern remain and use of chlorpyrifos to control onion maggot will be cancelled.

2.3 Control of alfalfa looper on canola

Chlorpyrifos is of value for control of alfalfa looper, diamondback moth and *Lygus* bug on canola, based on its residual control, application method (aerial), and importance in resistance management for long term sustainable production practices.

Health Canada's response:

Health Canada recognises that aerial application is of value for treatment of large areas of canola in a short period of time and that for the control of alfalfa looper on canola, there are limitations to the use of the sole alternative active ingredient, *Autographa californica* nucleopolyhedrovirus FV11. This active ingredient may be applied using ground equipment only. Alternatives are available for diamondback moth (ground or aerial equipment) and Lygus bug (aerial).

Health Canada recognises the value of chlorpyrifos use on canola. However, risks of concern remain and use of chlorpyrifos will be cancelled.

2.4 Control of orange wheat blossom midge and brown wheat mite

Chlorpyrifos is of value for control of brown wheat mite on cereals (barley, oat, wheat) and orange wheat blossom midge on wheat. For brown wheat mite, there are no other efficacious options registered to control this pest. Access to chlorpyrifos is imperative in a severe outbreak situation. For orange wheat blossom midge, chlorpyrifos is the only option for controlling both eggs and adults, as alternatives only control adult populations, which is not sufficient for eradicating the pest to prevent continued outbreaks.

Health Canada's response:

Health Canada recognises that there may be no registered alternatives, or limitations to the registered alternatives for these uses. However, risks of concern remain and use of chlorpyrifos to control brown wheat mite on cereals (barley, oat, wheat) and orange wheat blossom midge on wheat will be cancelled.

2.5 Control of cutworms

Several stakeholders including government organizations, grower groups and registrants commented on the value of chlorpyrifos for control of cutworms on barley, oat, wheat, canola, carrot, celery, cole crops, corn, cucumber, flax, garlic, lentil, onion, potato, rutabaga and

sunflower. Concerns were expressed regarding the lack of alternatives, and the impact cancelling chlorpyrifos will have on production practices and sustainable resistance management.

Health Canada's response:

Health Canada recognizes that insecticide resistance is known in cutworms and that development of resistance is a concern. The PMRA agrees there is value to the use of chlorpyrifos to control cutworms. However, risks of concern remain and these uses of chlorpyrifos will be cancelled.

2.6 Control of armyworms

Several stakeholders including government organizations and grower groups commented on the value of chlorpyrifos for control of armyworms (true and Bertha) on cereals, canola and flax. The loss of chlorpyrifos will limit the ability of growers to rotate products to allow season-long control of these pests.

Health Canada's response:

Alternative active ingredients are registered for the control of Bertha armyworm on canola, and flax, and for the control of true armyworm on cereals (barley, oat, wheat). True armyworm is rarely a pest of canola and flax, as it primarily feeds on cereals and grasses. Health Canada recognises that there are no registered alternative active ingredients to control true armyworm if this pest infests canola or flax crops. However, risks of concern remain and use of chlorpyrifos on cereals, canola and flax will be cancelled.

2.7 Control of grasshoppers

Chlorpyrifos is of value for control of grasshoppers on cereals, canola and lentil, based on the effectiveness and residual activity of chlorpyrifos, and the impact cancellation will have on beneficial pest management practices and resistance management.

Health Canada's response:

For control of grasshoppers, alternatives from multiple Mode of Actions are available for insecticide resistance management. All alternatives may be applied by aerial equipment that allows for coverage of large areas in a short period. For these uses, risks of concern remain. Therefore, these uses of chlorpyrifos will be cancelled.

2.8 Control of wireworm and other potato insect pests

Several stakeholders commented on the value of chlorpyrifos for control of several pests on potato, specifically to control wireworm on seed potatoes produced in British Columbia. Currently, British Columbia has limited alternatives considering the use of phorate is restricted in the province, bifenthrin is being phased out and clothianidin, a neonicotinoid, only provides suppression when used as a seed treatment.

Health Canada's response:

Health Canada concurs there is value to chlorpyrifos for the control of wireworm on seed potatoes in British Columbia, and for control of wireworms in general. The end-use product Cimegra (containing bronflanilide) is an alternative to chlorpyrifos for use on seed potatoes in Canada including British Columbia. Prorate is an additional alternative that may be used in the rest of Canada. Health Canada determined that several alternatives to chlorpyrifos are currently registered for control of Colorado potato beetle, potato flea beetle, tarnished plant bug and cutworms. Risks of concern remain, and therefore the use of chlorpyrifos on potatoes will be cancelled.

2.9 Control of Japanese beetle on ornamentals

Grower groups commented on the value of chlorpyrifos for control of Japanese beetle larvae on ornamentals since it is a CFIA quarantine pest and must be controlled. To satisfy the CFIA directive on Japanese beetle, growers must have an ability to eliminate this pest after harvesting (note that for field-grown stock in the ground, control is achievable with existing alternatives).

Health Canada's response:

Health Canada acknowledges the need for control of both Japanese beetle adults and larvae in ornamentals. Chlorpyrifos is registered for the control of larvae only. Use of chlorpyrifos to control Japanese beetle larvae in container stock will remain on the registered labels. The use of chlorpyrifos to control larvae as a soil drench in fields will be cancelled, as risks of concern remain. Suitable alternatives to chlorpyrifos are currently available including chlorantraniliprole and *Bacillus thuringiensis var. galleriae.*

2.10 Control of seed weevils on sunflower

Governmental organizations commented on the value of chlorpyrifos for control of seed weevil on sunflower, as it is the only alternative to pyrethroids for seed weevil control in sunflower.

Health Canada's response:

The PMRA recognises the value of chlorpyrifos for control of seed weevils on sunflowers, and the limitations to the registered alternative, cypermethrin. Seed weevil adults must be controlled when flowers are blooming to prevent larval feeding on seeds. Cypermethrin is not permitted for application during bloom when control is required, which limits its effectiveness as an alternative to chlorpyrifos. However, risks of concern remain, and therefore this use of chlorpyrifos will be cancelled.

2.11 Control of native elm bark beetle, the vector for Dutch Elm Disease

Several stakeholders commented that chlorpyrifos is of value for control of native elm bark beetle, which is the vector for Dutch Elm Disease. Provinces and municipalities will have little ability to control Dutch Elm Disease within their jurisdictions or to slow its western spread in Canada.

Health Canada's response:

Based on the additional information received during consultation, Health Canada revised the environmental assessment. The risks of concern have been addressed and this use will remain in the registered use pattern.

3.0 Other comments

3.1 Re-evaluation process

CropLife commented that this re-evaluation for chlorpyrifos has deviated from the re-evaluation policy and the proposal only represents the assessment on environment, but not the full assessment.

Health Canada's response:

The re-evaluation of chlorpyrifos in Canada is on going, and Health Canada has implemented several risk reduction measures over the years. In 2000, Health Canada concluded a re-evaluation of chlorpyrifos, focused on non-agricultural uses including uses in and around residential areas (REV2000-05). As a result, residential uses were removed from chlorpyrifos labels. The re-evaluation of chlorpyrifos continued with the examination of agricultural and forestry uses. A proposed re-evaluation decision was published for consultation in 2003 (PACR2003-03) based on the assessment on human health and the environment. Following the consultation, Health Canada implemented measures in 2007 (REV2007-01) to further protect human health, including new engineering controls, personal protective equipment, and restricted-entry intervals. In addition, the environment was further protected by implementing environmental precautions and spray buffer zones on the chlorpyrifos product labels.

Also as indicated in REV2007-01, Health Canada committed to update the existing environmental risk assessment (completed in early 2000) with additional monitoring data and updated assessment methodology. PRVD2019-05 is the outcome of that commitment.

3.2 International activities on chlorpyrifos

Some stakeholders called for total ban of chlorpyrifos based on recent international reviews which identified risk to human health.

Health Canada's response:

Health Canada monitors regulatory activities in other countries on pesticides and take appropriate actions when warranted.

Health Canada previously conducted a human health assessment and implemented several restrictions as a result, including the removal of residential uses to protect the general public. As indicated in PRVD2019-05, Health Canada is aware of new scientific information cited in the recent international reviews, and will be updating the existing human health risk assessment in the near future. Implementation of the decision based on this environment assessment would also result in significantly reduced human exposure to chlorpyrifos.

Appendix IV Water monitoring and risk to the environment

Table 1 Updated summary of all available, relevant Canadian chlorpyrifos water monitoring data (post-2000) for determining potential aquatic biota exposure

Region	# samples	# detects	% detection	Maximum Detection (µg a.i./L)
Atlantic Region (2003, 2009, 2014–2015)[1]	103	3	3	0.09
Quebec (2002–2017)[2]	2819	387	14	44
Ontario (2002–2015)	1435	289	20	0.52
Manitoba (2001–2015)[3]	928	1	<1	0.02
Saskatchewan (2000–2011)[4]	449	1	<1	0.96
Alberta (2000–2005)[5]	1701	2	<1	0.005
British Columbia (2004–2014)[6]	454	161	35[7]	1.1
Canada	7786	841	11	44

[1] 24 additional samples from Prince Edward Island, 53 new samples from the Atlantic region

[2] 781 new samples from Quebec. Short intervals between sampling conducted at the same location throughout the growing season results in robust data that is more likely to detect peak concentrations and allows for analysis of chronic exposure.

[3] 127 new samples from Manitoba

[4] 24 new samples from Saskatchewan. The limit of detection for 94% of the Saskatchewan data was 2 µg/L, making interpretation of non-detections difficult and usefulness of the data limited.

[5] PRVD2019-05 included Alberta samples found in a summary report from 1995-2002 which have been excluded from the revised analysis. In addition, sample from irrigation water that were included in PRVD2019-05 have been excluded from the revised analysis, as they may not represent water from rivers, creeks and wetlands. As a result, 5732 samples that were reported in PRVD2019-05 from Alberta have been removed from the revised assessment.

[6] 181 new samples from British Columbia. Much of the sampling took place in the early spring or late fall with limited sampling being done during the growing season.

[7] The limit of detection for samples from British Columbia ranged from 0.0000005–0.1 µg/L, which results in a much higher detection frequency as compared to other provinces.

Table 2 Acute aquatic risk quotients using regionally specific modelled estimated environmental concentrations

Use Pattern (application rate g a.i./ha)	Region	96-h EEC (80-cm / 15-cm) µg a.i./L	FW Invertebrate SSD HC_5 = 0.044 µg a.i./L	FW Invertebrate Most Sensitive Mesocosm NOEC = 0.06 µg a.i./L (measured concentration)	FW Invertebrate Mesocosm NOEC = 0.1 µg a.i./L (nominal concentration)	FW Fish SSD HC_5 = 5.94 µg a.i./L	FW Fish mesocosm NOEC = 0.25 µg a.i./L	FW Fish Mesocosm 1/2 LC_{50} = 1.34 µg a.i./L	Amphibian SSD HC05 = 20 µg a.i./L	E/M* Invertebrate SSD HC_5 = 0.034 µg a.i./L	E/M Fish SSD HC_5 = 0.79 µg a.i./L
Canola											
1 × 720	Atlantic	6.7/10	**152**	**112**	**67**	**1.13**	**26.8**	**5**	0.5	**197**	**8.5**
1 × 720	Quebec	2.6/3.8	**59**	**43.3**	**26**	0.44	**10.4**	**1.9**	0.2	**76**	**3.3**
1 × 720	Prairies	2.3/3.2	**52**	**38.3**	**23**	0.39	**9.2**	**1.7**	0.2	**68**	**2.9**
1 × 240	Atlantic	2.2/3.5	**50**	**36.7**	**22**	0.37	**8.8**	**1.6**	0.2	**65**	**2.8**
1 × 720	Ontario	1.4/2.1	**32**	**23.3**	**14**	0.24	**5.6**	**1**	0.1	**41**	**1.8**
1 × 240	Quebec	0.86/1.3	**20**	**14.3**	**8.6**	0.14	**3.4**	0.6	0.1	**25**	**1.1**
1 × 240	Prairies	0.75/1.1	**17**	**12.5**	**7.5**	0.13	**3**	0.6	0.1	**22**	0.9
1 × 720	British Columbia	0.87/1.3	**20**	**14.5**	**8.7**	0.15	**3.5**	0.6	0.1	**26**	**1.1**
1 × 240	Ontario	0.47/0.71	**11**	**7.8**	**4.7**	0.08	**1.9**	0.4	0.04	**14**	0.6
1 × 240	British Columbia	0.29/0.44	**6.6**	**4.8**	**2.9**	0.05	**1.2**	0.2	0.02	**8.5**	0.4
Cereals											
1 × 576	Atlantic	5.5/8.5	**125**	**91.7**	**55**	0.93	**22**	**4.1**	0.4	**162**	**7**
1 × 240	Atlantic	2.3/3.5	**52**	**38.3**	**23**	0.39	**9.2**	**1.7**	0.2	**68**	**2.9**
1 × 576	Quebec	2.2/3.1	**50**	**36.7**	**22**	0.37	**8.8**	**1.6**	0.2	**65**	**2.8**
1 × 576	Ontario	1.1/1.7	**25**	**18.3**	**11**	0.19	**4.4**	0.8	0.1	**32**	**1.4**
1 × 240	Quebec	0.92/1.3	**21**	**15.3**	**9.2**	0.15	**3.7**	0.7	0.1	**27**	**1.2**
1 × 576	Saskatchewan	1.0/1.5	**23**	**16.7**	**10**	0.17	**4**	0.7	0.1	**29**	**1.3**
1 × 576	Manitoba	0.91/1.2	**21**	**15.2**	**9.1**	0.15	**3.6**	0.7	0.1	**27**	**1.2**
1 × 240	Ontario	0.47/0.70	**11**	**7.8**	**4.7**	0.08	**1.9**	0.4	0.04	**14**	0.6
1 × 576	British Columbia	0.36/1.0	**8.2**	**6**	**3.6**	0.06	**1.4**	0.3	0.1	**11**	0.5
1 × 240	Saskatchewan	0.43/0.61	**9.8**	**7.2**	**4.3**	0.07	**1.7**	0.3	0.03	**13**	0.5
1 × 240	Manitoba	0.38/0.51	**8.6**	**6.3**	**3.8**	0.06	**1.5**	0.3	0.03	**11**	0.5
1 × 240	British Columbia	0.28/0.43	**6.4**	**4.7**	**2.8**	0.05	**1.1**	0.2	0.02	**8.2**	0.4

Use Pattern (application rate g a.i./ha)	Region	96-h EEC (80-cm / 15-cm) µg a.i./L	FW Invertebrate SSD HC_5 = 0.044 µg a.i./L	FW Invertebrate Most Sensitive Mesocosm NOEC = 0.06 µg a.i./L (measured concentration)	FW Invertebrate Mesocosm NOEC = 0.1 µg a.i./L (nominal concentration)	FW Fish SSD HC_5 = 5.94 µg a.i./L	FW Fish mesocosm NOEC = 0.25 µg a.i./L	FW Fish Mesocosm 1/2 LC_{50} = 1.34 µg a.i./L	Amphibian SSD HC05 = 20 µg a.i./L	E/M* Invertebrate SSD HC_5 = 0.034 µg a.i./L	E/M Fish SSD HC_5 = 0.79 µg a.i./L
Corn											
1 × 1476	Prairies	6.4/8.7	**145**	**107**	**64**	**1.08**	**25.6**	**4.8**	0.4	**188**	**8.1**
Garlic											
2 × 1680	British Columbia	3.1/4.5	**70**	**51.7**	**31**	0.52	**12.4**	**2.3**	0.2	**91**	**3.9**
Lentils											
1 × 576	Prairies	2.0/2.8	**45**	**33.3**	**20**	0.34	**8**	**1.5**	0.1	**59**	**2.5**
1 × 576	Quebec	1.0/1.5	**23**	**16.7**	**10**	0.17	**4**	0.7	0.1	**29**	**1.3**
1 × 576	Ontario	1.2/1.7	**27**	**20**	**12**	0.2	**4.8**	0.9	0.1	**35**	**1.5**
1 × 278	Prairies	0.96/1.4	**22**	**16**	**9.6**	0.16	**3.8**	0.7	0.1	**28**	**1.2**
1 × 278	Quebec	0.48/0.71	**11**	**8**	**4.8**	0.08	**1.9**	0.4	0.04	**14**	0.6
1 × 278	Ontario	0.57/0.83	**13**	**9.5**	**5.7**	0.1	**2.3**	0.4	0.04	**17**	0.7
1 × 576	British Columbia	0.30/0.42	**6.8**	**5**	**3**	0.05	**1.2**	0.2	0.02	**8.8**	0.4
1 × 278	British Columbia	0.14/0.20	**3.2**	**2.3**	**1.4**	0.02	0.6	0.1	0.01	**4.1**	0.2
Onion											
1 × 2400	Atlantic	30/47	**682**	**500**	**300**	**5.05**	**120**	**22.4**	**2.4**	**882**	**38**
1 × 2400	Quebec	5.5/7.9	**125**	**91.7**	**55**	0.93	**22**	**4.1**	0.4	**162**	**7**
1 × 2400	Ontario	6.3/9.2	**143**	**105**	**63**	**1.06**	**25.2**	**4.7**	0.5	**185**	**8**
Turf											
2 × 1120	Atlantic	27/42	**614**	**450**	**270**	**4.55**	**108**	**20.1**	**2.1**	**794**	**34.2**
2 × 1120	Quebec	7.1/11	**161**	**118**	**71**	**1.2**	**28.4**	**5.3**	0.6	**209**	**9**
2 × 1120	Ontario	5.5/8.4	**125**	**91.7**	**55**	0.93	**22**	**4.1**	0.4	**162**	**7**
2 × 1120	British Columbia	3.7/5.0	**84**	**61.7**	**37**	**0.62**	**14.8**	**2.8**	0.3	**109**	**4.7**

*E/M = estuarine/marine

Table 3 Chronic aquatic risk quotients using regionally specific modelled estimated environmental concentrations

Use Pattern (application rate)	Region	21-d EEC (80/15 cm) µg a.i./L	Chronic FW Invertebrate LOEC = 0.005 µg a.i./L	Chronic FW Invertebrate Mesocosm NOEC = 0.1 µg a.i./L (may not be protective)	Chronic FW Fish NOEC = 0.14 µg a.i./L	Chronic Amphibian NOEC = 0.88 µg a.i./L	Chronic E/M* Invertebrate LOEC = <0.0046 µg a.i./L	Chronic E/M Fish NOEC = 0.28 µg a.i./L
Canola								
1 × 720	Atlantic	3.3/3.9	**660**	**33**	**24**	**4.4**	**717**	**11.8**
1 × 720	Quebec	1.4/1.6	**280**	**14**	**10**	**1.8**	**304**	**5**
1 × 720	Prairies	1.2/1.4	**240**	**12**	**8.6**	**1.6**	**261**	**4.3**
1 × 240	Atlantic	1.1/1.3	**220**	**11**	**7.9**	**1.5**	**239**	**3.9**
1 × 720	Ontario	0.63/0.75	**126**	**6.3**	**4.5**	0.9	**137**	**2.3**
1 × 240	Quebec	0.48/0.57	**96**	**4.8**	**3.4**	0.6	**104**	**1.7**
1 × 240	Prairies	0.40/0.46	**80**	**4**	**2.9**	0.5	**87**	**1.4**
1 × 720	British Columbia	0.35/0.41	**70**	**3.5**	**2.5**	0.5	**76**	**1.3**
1 × 240	Ontario	0.21/0.25	**42**	**2.1**	**1.5**	0.3	**46**	0.8
1 × 240	British Columbia	0.12/0.15	**24**	**1.2**	0.9	0.2	**26**	0.4
Cereals								
1 × 576	Atlantic	3.3/3.9	**660**	**33**	**24**	**4.4**	**717**	**11.8**
1 × 240	Atlantic	1.4/1.7	**280**	**14**	**10**	**1.9**	**304**	**5.0**
1 × 576	Quebec	1.2/1.4	**240**	**12**	**8.6**	**1.6**	**261**	**4.3**
1 × 576	Ontario	0.5/0.60	**100**	**5**	**3.6**	0.7	**109**	**1.8**
1 × 240	Quebec	0.48/0.55	**96**	**4.8**	**3.4**	0.6	**104**	**1.7**
1 × 576	Saskatchewan	0.43/0.49	**86**	**4.3**	**3.1**	0.6	**93**	**1.5**
1 × 576	Manitoba	0.42/0.47	**84**	**4.2**	**3.0**	0.5	**91**	**1.5**
1 × 240	Ontario	0.21/0.25	**42**	**2.1**	**1.5**	0.3	**46**	0.8
1 × 576	British Columbia	0.19/0.37	**38**	**1.9**	**1.4**	0.4	**41**	0.7
1 × 240	Saskatchewan	0.18/0.20	**36**	**1.8**	**1.3**	0.2	**39**	0.6
1 × 240	Manitoba	0.17/0.20	**34**	**1.7**	**1.2**	0.2	**37**	0.6
1 × 240	British	0.12/0.14	**24**	**1.2**	0.9	0.2	**26**	0.4

Use Pattern (application rate)	Region	21-d EEC (80/15 cm) µg a.i./L	Chronic FW Invertebrate LOEC = 0.005 µg a.i./L	Chronic FW Invertebrate Mesocosm NOEC = 0.1 µg a.i./L (may not be protective)	Chronic FW Fish NOEC = 0.14 µg a.i./L	Chronic Amphibian NOEC = 0.88 µg a.i./L	Chronic E/M* Invertebrate LOEC = <0.0046 µg a.i./L	Chronic E/M Fish NOEC = 0.28 µg a.i./L
	Columbia							
Corn								
1 × 1476	Prairies	2.8/3.4	**560**	**28**	**20**	**3.9**	**609**	**10**
Garlic								
2 × 1680	British Columbia	1.2/1.4	**240**	**12**	**8.6**	**1.6**	**261**	**4.3**
Lentils								
1 × 576	Prairies	0.97/1.2	**194**	**9.7**	**6.9**	**1.4**	**211**	**3.5**
1 × 576	Quebec	0.51/0.62	**102**	**5.1**	**3.6**	0.7	**111**	**1.8**
1 × 576	Ontario	0.50/0.59	**100**	**5**	**3.6**	0.7	**109**	**1.8**
1 × 278	Prairies	0.47/0.56	**94**	**4.7**	**3.4**	0.6	**102**	**1.7**
1 × 278	Quebec	0.25/0.30	**50**	**2.5**	**1.8**	0.3	**54**	0.9
1 × 278	Ontario	0.24/0.28	**48**	**2.4**	**1.7**	0.3	**52**	0.9
1 × 576	British Columbia	0.14/0.16	**28**	**1.4**	**1**	0.2	**30**	0.5
1 × 278	British Columbia	0.066/0.076	**13**	**0.66**	0.5	0.1	**14**	0.2
Onion								
2 × 2400	Atlantic	18/21	**3600**	**180**	**129**	**23.9**	**3913**	**64.3**
2 × 2400	Quebec	2.8/3.5	**560**	**28**	**20**	**4.0**	**609**	**10**
2 × 2400	Ontario	2.7/3.2	**540**	**27**	**19**	**3.6**	**587**	**9.6**
Turf								
2 × 1120	Atlantic	17/19	**3400**	**170**	**121**	**21.6**	**3696**	**60.7**
2 × 1120	Quebec	4.0/4.6	**800**	**40**	**29**	**5.2**	**870**	**14.3**
2 × 1120	Ontario	2.5/2.9	**500**	**25**	**18**	**3.3**	**543**	**8.9**
2 × 1120	British Columbia	1.8/2.0	**360**	**18**	**13**	**2.3**	**391**	**6.4**

*E/M = estuarine/marine

Table 4 Refined risk assessment using mean nomogram values for birds and mammals at 240 g a.i./ha for uses on barley, wheat and oats – aerial and ground applications at medium spray quality

	Toxicity (mg a.i./kg bw/d)	Feeding Guild (food item)	Aerial and Ground Screening Level RQ	Ground Application		Aerial Application	
				On-Field RQ	Off-Field RQ	On-Field RQ	Off-Field RQ
Small Bird (0.02 kg)							
Acute	6.6	Insectivore	**3**	**2**	0.1	**2**	0.5
Reproduction	2.88	Insectivore	**6.8**	**4.7**	0.3	**4.7**	**1.1**
Medium Sized Bird (0.1 kg)							
Acute	6.6	Insectivore	**2.3**	**1.6**	0.1	**1.6**	0.4
Reproduction	2.88	Insectivore	**5.3**	**3.7**	0.2	**3.7**	0.8
Large Sized Bird (1 kg)							
Acute	6.6	Herbivore (short grass)	**1.5**	0.5	0.03	0.5	0.1
Reproduction	2.88	Herbivore (short grass)	**3.4**	**1.2**	0.07	**1.2**	0.3
Small Mammal (0.015 kg)							
Acute	6	Insectivore	**1.9**	**1.3**	0.08	**1.3**	0.3
Reproduction	1	Insectivore	**11**	**7.8**	0.47	**7.8**	**1.8**
Medium Sized Mammal (0.035 kg)							
Acute	6	Herbivore (short grass)	**3.6**	**1.3**	0.07	**1.3**	0.3
Reproduction	1	Herbivore (short grass)	**22**	**7.8**	0.46	**7.8**	**1.8**
Large Sized Mammal (1 kg)							
Acute	6	Herbivore (short grass)	**1.9**	0.7	0.04	0.7	0.16
Reproduction	1	Herbivore (short grass)	**12**	**4.1**	0.25	**4.1**	0.95

Table 5 Refined risk assessment using mean nomogram values for birds and mammals at 576 g a.i./ha for uses on flax, lentil, barley, wheat, oats, sunflower – aerial and ground applications at medium spray quality

	Toxicity (mg a.i./kg bw/d)	Feeding Guild (food item)	Aerial and Ground Screening Level RQ	Ground Application		Aerial Application	
				On-Field RQ	Off-Field RQ	On-Field RQ	Off-Field RQ
Small Bird (0.02 kg)							
Acute	6.6	Insectivore	**7.1**	**4.9**	0.3	**4.9**	**1.1**
Reproduction	2.88	Insectivore	**16**	**11**	0.7	**11**	**2.6**
Medium Sized Bird (0.1 kg)							
Acute	6.6	Insectivore	**5.5**	**3.8**	0.2	**3.8**	0.9
Reproduction	2.88	Insectivore	**13**	**8.8**	0.5	**8.8**	**2.0**
Large Sized Bird (1 kg)							
Acute	6.6	Herbivore (short grass)	**3.6**	**1.3**	0.08	**1.3**	0.3
Reproduction	2.88	Herbivore (short grass)	**8.2**	**2.9**	0.2	**2.9**	0.7
Small Mammal (0.015 kg)							
Acute	6	Insectivore	**4.5**	**3.1**	0.2	**3.1**	0.7
Reproduction	1	Insectivore	**27**	**19**	**1.1**	**19**	**4.3**
Medium Sized Mammal (0.035 kg)							
Acute	6	Herbivore (short grass)	**8.7**	**3.1**	0.2	**3.1**	0.7
Reproduction	1	Herbivore (short grass)	**52**	**19**	**1.1**	**19**	**4.3**
Large Sized Mammal (1 kg)							
Acute	6	Herbivore (short grass)	**4.7**	**1.7**	0.1	**1.7**	0.4
Reproduction	1	Herbivore (short grass)	**28**	**9.9**	0.6	**9.9**	**2.3**

Table 6 Refined risk assessment using mean nomogram values risk assessment for birds and mammals at 720 g a.i./ha × 1 for use on canola – aerial and ground applications at medium spray quality

	Toxicity (mg a.i./kg bw/d)	Feeding Guild (food item)	Aerial and Ground Screening Level RQ	Ground Application		Aerial Application	
				On-Field RQ	Off-Field RQ	On-Field RQ	Off-Field RQ
Small Bird (0.02 kg)							
Acute	6.6	Insectivore	**8.9**	**6.1**	0.4	**6.1**	**1.4**
Reproduction	2.88	Insectivore	**20**	**14**	0.8	**14**	**3.2**
Medium Sized Bird (0.1 kg)							
Acute	6.6	Insectivore	**6.9**	**4.8**	0.3	**4.8**	**1.1**
Reproduction	2.88	Insectivore	**16**	**11**	0.7	**11**	**2.5**
Large Sized Bird (1 kg)							
Acute	6.6	Herbivore (short grass)	**4.5**	**1.6**	0.1	**1.6**	0.4
Reproduction	2.88	Herbivore (short grass)	**10**	**3.6**	0.2	**3.6**	0.8
Small Mammal (0.015 kg)							
Acute	6	Insectivore	**5.6**	**3.9**	0.2	**3.9**	0.9
Reproduction	1	Insectivore	**34**	**23**	**1.4**	**23**	**5.4**
Medium Sized Mammal (0.035 kg)							
Acute	6	Herbivore (short grass)	**11**	**3.9**	0.2	**3.9**	0.9
Reproduction	1	Herbivore (short grass)	**65**	**23**	**1.4**	**23**	**5.3**
Large Sized Mammal (1 kg)							
Acute	6	Herbivore (short grass)	**5.8**	**2.1**	0.1	**2.1**	0.5
Reproduction	1	Herbivore (short grass)	**35**	**12**	0.7	**12**	**2.9**

Table 7 Refined risk assessment using mean nomogram values for birds and mammals at 1152 g a.i./ha for uses on corn, cole crops, celery cucumber, green pepper, rutabaga, sugar beet and potato – ground applications at medium spray quality

	Toxicity (mg a.i./kg bw/d)	Feeding Guild (food item)	Aerial and Ground Screening Level RQ	Ground Application	
				On-Field RQ	Off-Field RQ
Small Bird (0.02 kg)					
Acute	6.6	Insectivore	**14**	**9.8**	0.6
Reproduction	2.88	Insectivore	**33**	**23**	**1.4**
Medium Sized Bird (0.1 kg)					
Acute	6.6	Insectivore	**11**	**7.7**	0.5
Reproduction	2.88	Insectivore	**25**	**18**	**1.1**
Large Sized Bird (1 kg)					
Acute	6.6	Herbivore (short grass)	**7.2**	**2.5**	0.2
Reproduction	2.88	Herbivore (short grass)	**16**	**5.8**	0.4
Small Mammal (0.015 kg)					
Acute	6	Insectivore	**9**	**6.2**	0.4
Reproduction	1	Insectivore	**54**	**37**	**2.2**
Medium Sized Mammal (0.035 kg)					
Acute	6	Herbivore (short grass)	**17**	**6.2**	0.4
Reproduction	1	Herbivore (short grass)	**105**	**37**	**2.2**
Large Sized Mammal (1 kg)					
Acute	6	Herbivore (short grass)	**9.3**	**3.3**	0.2
Reproduction	1	Herbivore (short grass)	**56**	**20**	**1.2**

Table 8 Refined risk assessment using mean nomogram values risk for birds and mammals at 2304 g a.i./ha for uses on carrots and seedling onions – ground applications at medium spray quality

	Toxicity (mg a.i./kg bw/d)	Feeding Guild (food item)	Aerial and Ground Screening Level RQ	Ground Application	
				On-Field RQ	Off-Field RQ
Small Bird (0.02 kg)					
Acute	6.6	Insectivore	**28**	**20**	**1.2**
Reproduction	2.88	Insectivore	**65**	**45**	**2.7**
Medium Sized Bird (0.1 kg)					
Acute	6.6	Insectivore	**22**	**15**	0.9
Reproduction	2.88	Insectivore	**51**	**35**	**2.1**

	Toxicity (mg a.i./kg bw/d)	Feeding Guild (food item)	Aerial and Ground Screening Level RQ	Ground Application	
				On-Field RQ	Off-Field RQ
Large Sized Bird (1 kg)					
Acute	6.6	Herbivore (short grass)	**14**	**5.1**	0.3
Reproduction	2.88	Herbivore (short grass)	**33**	**12**	0.7
Small Mammal (0.015 kg)					
Acute	6	Insectivore	**18**	**12**	0.8
Reproduction	1	Insectivore	**108**	**75**	**4.5**
Medium Sized Mammal (0.035 kg)					
Acute	6	Herbivore (short grass)	**35**	**12**	0.7
Reproduction	1	Herbivore (short grass)	**209**	**74**	**4.5**
Large Sized Mammal (1 kg)					
Acute	6	Herbivore (short grass)	**19**	**6.6**	0.4
Reproduction	1	Herbivore (short grass)	**112**	**40**	**2.4**

Table 9 Refined risk assessment using mean nomogram values risk for birds and mammals at 3360 g a.i./ha for use on Asian radish–ground applications at medium spray quality

	Toxicity (mg a.i./kg bw/d)	Feeding Guild (food item)	Screening Level RQ	Ground Application	
				On-Field RQ	Off-Field RQ
Small Bird (0.02 kg)					
Acute	6.60	Insectivore	**72**	**49**	**2.9**
Reproduction	2.88	Insectivore	**164**	**113**	**6.8**
Medium Sized Bird (0.1 kg)					
Acute	6.60	Insectivore	**56**	**39**	**2.3**
Reproduction	2.88	Insectivore	**128**	**88**	**5.3**
Large Sized Bird (1 kg)					
Acute	6.60	Herbivore (short grass)	**36**	**13**	0.8
Reproduction	2.88	Herbivore (short grass)	**83**	**29**	**1.8**
Small Mammal (0.015 kg)					
Acute	6.00	Insectivore	**45**	**31**	**1.9**
Reproduction	1.00	Insectivore	**272**	**188**	**11**
Medium Sized Mammal (0.035 kg)					
Acute	6.00	Herbivore (short grass)	**88**	**32**	**1.9**

	Toxicity (mg a.i./kg bw/d)	Feeding Guild (food item)	Screening Level RQ	Ground Application	
				On-Field RQ	Off-Field RQ
Reproduction	1.00	Herbivore (short grass)	**527**	**187**	**11**
Large Sized Mammal (1 kg)					
Acute	6.00	Herbivore (short grass)	**47**	**17**	**1.0**
Reproduction	1.00	Herbivore (short grass)	**282**	**100**	**6.0**

Appendix V Label amendments for products containing chlorpyrifos

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

I. Label Amendments for Technical Grade Active Ingredient Class Products

Under the **Environmental Hazards/Precautions** Section

The following statements are required:

- TOXIC to aquatic organisms.
- DO NOT discharge effluent containing this product into sewer systems, lakes, streams, ponds, estuaries, oceans or other waters.

Under the **Disposal** Section

The following statements are required:

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

II. Label Amendments for Commercial and Restricted Class Products Containing Chlorpyrifos

a) Acceptable uses

Only the following chlorpyrifos uses are for continued registration:

- Standing water - temporary pools for larval mosquito control
- Outdoor adult mosquito control
- Structural indoor and outdoor (non-residential)
- Tree trunk applications to control elm bark beetle and mountain pine beetle
- Outdoor ornamentals (container stock root immersion only) for control of Japanese beetle larvae

Any references to other uses except two uses (alfalfa looper on canola and darksided and redbacked cutworm control on garlic) must be removed from all **Commercial and Restricted Class** end-use product labels.

b) Cancelled uses with an extended phase out schedule:

Cancellation of the following uses will be delayed for an additional two years (Note: The extended use of two years is only for the crop and pest combinations below, references to all other pests on canola and garlic must be removed from all labels):

- canola - alfalfa looper control

- garlic - darksided and redbacked cutworm

The following table must be added to the PRINCIPAL DISPLAY PANEL of the label:

Cancellation Date For Cancelled Uses with an Extended Phase Out Period

Crops and Pests	Last Date of Use
canola - alfalfa looper control garlic - darksided and redbacked cutworm	**10 December 2024**

c) Environmental Precautions

The following statements are required under the "Environmental Precautions" section of all product labels:

- Toxic to aquatic and terrestrial organisms.
- Toxic to birds.
- Toxic to 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. 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 insects. Minimize spray drift to reduce harmful effects on beneficial insects in habitats next to the application site such as hedgerows and woodland.
- Toxic to non-target terrestrial plants.

For applications on crops that are highly attractive to pollinators (canola) or when using managed bees for pollination services:

- Do not apply during the crop blooming period.

Outdoor surface spray or fogging application uses:

- Outdoor areas: Toxic to bees. Avoid application around blooming plants. Toxic to beneficial insects. Minimize exposure to non-target areas.

Outdoor adult mosquito control:

- Toxic to bees and beneficial insects. Applications are typically made during the cooler hours of the night or early mornings which will minimize exposure to foraging bees and beneficial insects.

For granular products add the following:

- Toxic to birds. Any spilled or exposed granules must be incorporated into the soil or otherwise cleaned-up from the soil surface.

d) Directions for Use

- To reduce runoff from treated areas into aquatic habitats avoid application to areas with a moderate to steep slope, compacted soil, or clay.
- Avoid application of this product when heavy rain is forecast.
- Contamination of aquatic areas as a result of runoff may be reduced by including a vegetative strip between the treated area and the edge of the water body.
- This product demonstrates the properties and characteristics associated with chemicals detected in groundwater. The use of this product in areas where soils are permeable, particularly where the water table is shallow, may result in groundwater contamination.
- To minimize the release of chlorpyrifos into the environment due to volatilization, chlorpyrifos should only be applied on cool mornings and evenings when air temperatures are 15°C or lower. To further reduce volatilization to the atmosphere, incorporation into the soil should occur concurrently with application.
- To protect pollinators, follow the instructions regarding bees in the Environmental Precautions section
- DO NOT contaminate irrigation or drinking water supplies or aquatic habitats by cleaning of equipment or disposal of wastes.

For all products not registered for aerial application, add the following:

- Do not apply using aerial application equipment

For all products that are not registered to control larval mosquitoes, add the following:

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

For garlic (darksided and redbacked cutworm), the “Directions for Use” must be revised as per the following requirement:

- a single application per season at a rate of 576 g a.i./ha

For the two cancelled uses, in other words, alfalfa looper on canola and darksided and redbacked cutworm control on garlic, the following statements are required:

Field sprayer application: **DO NOT** apply during periods of dead calm. Avoid application of this product when winds are gusty. **DO NOT** apply when wind speed is greater than 8 km/h at the site of application. **DO NOT** apply with spray droplets smaller than the American Society of Agricultural Engineers (ASAE S572.1) medium classification for foliage treatment and coarse classification for soil treatment. Boom height must be 60 cm or less above the crop or ground.

Aerial application: **DO NOT** apply during periods of dead calm. Avoid application of this product when winds are gusty. **DO NOT** apply when wind speed is greater than 8 km/h at flying height at the site of application. **DO NOT** apply with spray droplets smaller than the American Society of Agricultural Engineers (ASAE S572.1) medium-coarse classification. DO NOT apply under weather conditions of less than 50% relative humidity and temperatures greater than 20°C. Reduce drift caused by turbulent wingtip vortices. Nozzle distribution along the spray boom length **MUST NOT** exceed 65% of the wing- or rotorspan.

Buffer zones:

Spot treatments using hand-held equipment **DO NOT** require a buffer zone. Use of low-clearance hooded or shielded sprayers that prevent spray contact with crop, fruit or foliage, and soil drench or soil incorporation **DO NOT** require a buffer zone.

The buffer zones specified in the table below are required between the point of direct application and the closest downwind edge of sensitive terrestrial habitats (such as grasslands, forested areas, shelter belts, woodlots, hedgerows, riparian areas and shrub lands), sensitive freshwater habitats (such as lakes, rivers, sloughs, ponds, prairie potholes, creeks, marshes, streams, reservoirs and wetlands) and estuarine/marine habitats.

Method of Application	Crop		Buffer Zones (metres) Required for the Protection of:			
			Freshwater Habitat of Depths:		Estuarine/Marine Habitat of Depths:	
			Less than 1 m	Greater than 1 m	Less than 1 m	Greater than 1 m
Field sprayer (foliage treatment) **Medium Spray and 8 km/h wind**	Canola		50	25	10	5
Field sprayer (soil treatment) **Coarse spray and 8 km/h wind**	Garlic		75	35	10	4
Aerial **Medium-Coarse spray and 8 km/h wind**	Canola	Fixed wing	800	575	275	175
		Rotary wing	800	575	200	125

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

Buffer zones for field sprayer or aerial application CANNOT be modified using the Buffer Zone Calculator.

e) Storage

The following statement is required under the STORAGE heading:

- To prevent contamination, store this product away from food and feed.

f) Disposal

The following relevant statements are required under the "Disposal" Section on all product labels, where necessary:

The following statements should be used for commercial and restricted class products other than agriculture and non-crop land (for example, forestry), where non-recyclable, non-returnable or non-refillable containers are used:

- Triple- or pressure-rinse the empty container. Add the rinsings to the spray mixture in the tank.
- Follow provincial instruction for any required additional cleaning of the container prior to its disposal.
- Make the empty container unsuitable for further use.
- Dispose of the container in accordance with provincial requirements.
- For information on disposal of unused, unwanted product, contact the manufacturer or the provincial regulatory agency. Contact the manufacturer and the provincial regulatory agency in case of a spill, and for clean-up of spills.

For recyclable containers:

The following statement would apply to plastic or metal containers that contain agricultural and non-crop land uses (for example, forestry) pesticide products, and that are designed to contain 23 L or less of product.

- Disposal of Container*:*
    - DO NOT reuse this container for any purpose. This is a recyclable container, and is to be disposed of at a container collection site. Contact your local distributor/dealer or municipality for the location of the nearest collection site. Before taking the container to the collection site:
        - Triple- or pressure-rinse the empty container. Add the rinsings to the spray mixture in the tank.
        - Make the empty, rinsed container unsuitable for further use.
    - If there is no container collection site in your area, dispose of the container in accordance with provincial requirements.

For returnable containers:

- Disposal of Container:
    - DO NOT reuse this container for any purpose. For disposal, this empty container may be returned to the point of purchase (distributor/dealer).

For containers that can be refilled for the user by the distributor/dealer:

- Disposal of Container:
    - For disposal, this container may be returned to the point of purchase (distributor/dealer). It must be refilled by the distributor/dealer with the same product. Do not reuse this container for any other purpose.

Disposal of unused, unwanted product

- For information on disposal of unused, unwanted product, contact the manufacturer or the provincial regulatory agency. Contact the manufacturer and the provincial regulatory agency in case of a spill, and for clean-up of spills.

III. **General Label Amendments for All End-use Products**

- For products with structural label claims
    - Labels should be consistent with the PMRA Guidance document, Structural Pest Control Products: label updates https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/cps-spc/alt_formats/pdf/pubs/pest/pol-guide/structural-pest-control-products-label-updates/structural-pest-control-products-label-updates-eng.pdf

- For Tank Mixing
    - Tank mix partners must be clearly indicated, by product name, on the product labels. Specific directions regarding use of the tank mix, or a reference to the tank mix partner label, must be included. A general reference that "this product can be tank mixed with other products" is not acceptable. Therefore, remove any vague or non-specific claims that the product can be tank mixed with another pesticide.
    - For Product labels with existing tank mix partners, verification is required to ensure the product is still registered for that use and that the product name has not changed.

IV General Label Improvements For All End-Use Products:

- On the PRINCIPAL DISPLAY PANEL
    - add "GROUP 1B INSECTICIDE" (note "GROUP 1B[1] INSECTICIDE" is incorrect)

- For Resistance Management Recommendations
    - As per Regulatory Directive DIR2013-04, Pesticide Resistance Management Labelling Based on Target Site/Mode of Action, product label should be updated to reflect the wording in Section 5.3 Insecticides and Acaricides. Resistance management statements should be modified to reflect the use site.

- Under "NOTICE TO USER"
    - remove the following statement from the labels: "The user assumes the risk to

persons or property that arises from any use of this product."

- Under use directions for Minor Uses
  - remove **the following text** "The DIRECTIONS FOR USE for this product for the use(s) described below were developed by persons other than <*Company Name*> and accepted for registration by Health Canada under the User Requested Minor Use Label Expansion program. <*Company Name*> itself makes no representation or warranty with respect to performance (efficacy) and/or crop tolerance (phytotoxicity) claims for this product when used on the crop(s) listed below.

    Accordingly, the Buyer and User assume all risks related to performance and crop tolerance arising, and agree to hold <*Company Name*> harmless from any claims based on efficacy and/or phytotoxicity in connection with the use(s) described below."

    and replace with "The DIRECTIONS FOR USE for the uses described in this section of the label were developed by persons other than [registrant name] under the User Requested Minor Use Label Expansion program. For these uses, [Registrant name] has not fully assessed performance (efficacy) and/or crop tolerance (phytotoxicity) under all environmental conditions or for all crop varieties when used in accordance with the label. The user should test the product on a small area first, under local conditions and using standard practices, to confirm the product is suitable for widespread application."

Appendix VI References considered following publication of PRVD2019-05

Additional information Considered

a) Published Information

PMRA Number	Reference
2745506	2016, PEI Pesticide Monitoring Program Stream Water Pesticide Analysis, 2009-2015, DACO: 8.6
2879350	Challis, J.K., L.D. Cuscito, S. Joudan, K.H. Luong, C.W. Knapp, M.L. Hanson and C.S. Wong, 2018, Inputs, source apportionment, and transboundary transport of pesticides and other polar organic contaminants along the lower Red River, Manitoba, Canada, DACO: 8.6
2895037	Giroux, I., 2018, État de situation sur la présence de pesticides au lac Saint-Pierre, DACO: 12.5,8.6
2965069	Giroux, I., 2019, Présence de pesticides dans l'eau au Québec: Portrait et tendances dans les zones de maïs et de soya - 2015 à 2017, Québec, ministère de l'Environnement et de la Lutte contre les changements climatiques, Direction générale du suivi de l'état de l'environnement., DACO: 8.6

b) Unpublished Information

PMRA Number	Reference
2834289	2017, Unpublished water monitoring data for pesticides in the Atlantic region from 2013 to 2016, DACO: 8.6
3013275	2018, Unpublished water monitoring data 2003-2018, DACO: 8.6
3027986	2019, Unpublished water monitoring data. Saskatchewan Water Security Agency. DACO 8.6