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Proposed Special Review Decision PSRD2022-01

# Special Review of Chlorothalonil and Its Associated End-use Products: Proposed Decision for Consultation

*Consultation Document*

*(publié aussi en français)*

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## 1.0 Introduction

Health Canada's Pest Management Regulatory Agency (PMRA) initiated a special review of chlorothalonil in 2018 under subsection 17(1) of the *Pest Control Products Act* based on the information reported under section 13 of the *Pest Control Products Act*, and information from the 2016 European Food Safety Authority report, with respect to chlorothalonil.

Subsequent to the initiation of the special review, PMRA became aware of the the European Union (EU) decision to prohibit all uses of chlorothalonil as plant protection products due to human health and environmental concerns (European Commission, 2019). Certain aspects of concern identified by the EU have been included in this special review (refer to Section 3.0). The remaining aspects of concern were previously addressed as part of the re-evaluation of chlorothalonil that was completed in 2018 (Re-evaluation Decision RVD2018-11, *Chlorothalonil and Its Associated End-use Products for Agricultural and Turf Uses*).

Pursuant to subsection 18(4) of the *Pest Control Products Act*, Health Canada has evaluated the aspects of concern that prompted the special review of pest control products containing chlorothalonil. The aspects of concern for this special review are relevant to human health and the environment.

## 2.0 Uses of chlorothalonil in Canada

Chlorothalonil is a contact and protectant fungicide with a multi-site mode of action. It controls a broad range of fungal diseases on a large number of field and orchard crops, conifers, greenhouse celery seedbeds, greenhouse ornamentals, outdoor ornamentals, mushroom houses, and turf (golf courses and sod farms). Chlorothalonil is applied by both aerial and ground application equipment. All registered pest control products containing chlorothalonil used in agriculture, horticulture and turf (Appendix I), are considered for the special review (summary of uses in Appendix II).

Chlorothalonil is also used as a dry-film material preservative agent against bacterial and fungi contamination or spoilage of paint and is currently under re-evaluation in Canada. Health Canada published the proposed re-evaluation decision for chlorothalonil in July 2020 (PRVD2020-06, *Chlorothalonil and Its Associated End-use Products, Used as a Preservative in Paints*), and the final decision will be published after considering the comments received during consultation. This use is not part of the scope of this special review.

## 3.0 Aspects of concern that prompted the special review

Based on the review of submitted information under section 13 of the *Pest Control Products Act*, as well as from the European Food Safety Authority report (2016) for chlorothalonil, Health Canada identified the following initial aspects of concern that prompted the special review:

- Environment
  - Potential changes to environmental fate and ecotoxicological endpoints.

Additionally, the European Union prohibited all uses of chlorothalonil based on human health and environmental concerns in 2020 based on the 2019 European Commission (EC) decision on the non-renewal of plant protection products containing chlorothalonil. The 2019 EC decision identified the following aspects of concern:

- Potential exposure to metabolites R417888, R419492, R471811, SYN507900, M3, M11, M2, M7 and M10 from groundwater.
- Potential genotoxicity of chlorothalonil metabolites.
- Potential carcinogenicity of chlorothalonil.
- Potential risk to amphibians and fish.

This special review added certain aspects of concern identified in the 2019 EC decision with the exception of the aspect of concern related to potential carcinogenicity of chlorothalonil (from occupational and residential exposure). The latter was previously assessed as part of the re-evaluation of chlorothalonil (RVD2018-11) and there was no additional information identified in the 2019 EC decision to indicate risks of concern relating to occupational and residential exposure.

Therefore, the aspects of concern considered in this special review of chlorothalonil are:

- Human Health
    - Potential exposure to metabolites R417888, R419492, R471811, SYN507900, M3, M11, M2, M7 and M10 from groundwater.
    - Potential carcinogenicity of chlorothalonil (related to dietary exposure).
    - Potential genotoxicity of chlorothalonil metabolites.

- Environment
    - Potential changes to environmental fate and ecotoxicological endpoints (expanded to include transformation products).
    - Potential risk to amphibians and fish.

## 4.0 Evaluation of the aspects of concern that prompted the special review

Following the initiation of the special review, Health Canada requested information related to the aspects of concern from provinces and other relevant federal government departments and agencies in accordance with the subsection 18(2) of the *Pest Control Products Act*.

In order to evaluate the aspects of concern for chlorothalonil, Health Canada considered currently available relevant scientific information, which includes information considered for the re-evaluation of chlorothalonil (Canada, 2018), water monitoring information, information submitted through the Canadian incident report database, information from the European Food Safety Authority, and the European Union decision.

## 4.1 Assessment of aspects of concern related to human health

### 4.1.1 Potential exposure to metabolites (R417888, R419492, R471811, SYN507900, M3, M11, M2, M7 and M10) from groundwater

As part of the special review, potential exposure from chlorothalonil and various transformation products in ground water was considered. Based on the additional environmental fate data that was not included in the 2018 re-evaluation (studies submitted through Incident Reporting program and EFSA review), the existing residue definition in drinking water was updated as part of this special review (Appendix III).

Based on the review of the available data, including new environmental fate and existing toxicological data, the residue definition in drinking water considered for this special review was determined to be the following: chlorothalonil and 15 of the transformation products – R182281 (also known as SDS-3701), R611965, R471811, SYN507900, SYN546671, R613636, R613801, R613841, PD1, PD2, PD3, PD4, PD5, Polar 1, and I. See Section 4.2.1 for details on transformation products of chlorothalonil.

Note that the transformation products identified as part of the aspects of concerns from the 2019 EC decision are: R417888, R419492, R471811, SYN507900, M3, M11, M2, M7 and M10 (from ground water). Due to the limited data available for identified major transformation products, as well as a large number of unidentified transformation products, not all transformation products are included in the residue definition. Potential dietary risk (acute and chronic) from exposure to relevant metabolites from groundwater is outlined in Section 4.1.4.

### 4.1.2 Potential carcinogenicity of chlorothalonil (related to dietary exposure)

See Section 4.1.4.

### 4.1.3 Potential genotoxicity of chlorothalonil metabolites (related to the health hazard)

Health Canada has considered all currently available relevant scientific information, which includes the available information from the European Union, the United States Environmental Protection Agency, and existing reviews of chlorothalonil (Canada, 2011; Canada, 2016; Canada, 2018) to assess the potential genotoxicity of chlorothalonil metabolites. The weight of evidence review suggests that chlorothalonil metabolites identified as residues of concern are not likely to be genotoxic. Note that since the chlorothalonil cancer assessment is already based on a linear, low dose extrapolation method and these metabolites of concern are included in the residue definition for risk assessment, the existing risk assessment is considered conservative and protective of any residual uncertainties regarding the potential risk from these metabolites. There are no further concerns regarding the potential genotoxicity of these metabolites identified at this time.

### 4.1.4 Dietary exposure and risk assessment

As part of the special review, Health Canada assessed the dietary risk from exposure to chlorothalonil and various metabolites (R182281, R611965, R471811, SYN507900, SYN546671, R613636, R613801, R613841, PD1, PD2, PD3, PD4, PD5, Polar 1 and I) from groundwater.

The residue definition for dietary risk assessment in plant commodities is chlorothalonil and the metabolite SDS-3701 (R182281). The residue definition for dietary risk assessment in animal commodities is the metabolite SDS-3701 (R182281).

The acute and chronic (non-cancer and cancer) dietary (food plus drinking water) exposure assessments were conducted using the Dietary Exposure Evaluation Model - Food Commodity Intake Database™ (DEEM-FCID™; Version 4.02) program which incorporates food consumption data from the National Health and Nutrition Examination Survey/"What We Eat in America" dietary survey for the years 2005- 2010 available through the Centers for Disease Control and Prevention's National Center for Health Statistics.

The acute and chronic (non-cancer and cancer) dietary exposure estimates for chlorothalonil are considered to be highly refined as monitoring data, and domestic/import data were used to the extent possible. The dietary exposure assessment for chlorothalonil was conducted using the Canadian Food Inspection Agency's (CFIA) and the United States Department of Agriculture's (USDA) Pesticide Data Program (PDP) residue monitoring data for many of the commodities; for a few commodities with no monitoring data, anticipated residues from American and Canadian field trials or maximum residue limit (MRL)/American tolerance values were used. Policies from the PMRA and United States Environmental Protection Agency were used for crop translations when necessary. In addition, the following inputs were incorporated: 100% crop treated was assumed for all commodities; DEEM-FCID default processing factors were used. The residue definition in animal commodities only includes the metabolite, SDS-3701 (R182281). Residues of SDS-3701 (R182281) in animal commodities are covered under Part B, Division 15, subsection B.15.002(1) of the Food and Drug Regulations (in other words, ≤0.1 ppm). There is no indication SDS-3701 is carcinogenic (Canada, 2011; Canada, 2018) thus, contribution of SDS-3701 (R182281) residues from animal commodities to human dietary exposure is assumed negligible and was, therefore, not included in the cancer assessment.

Estimated environmental concentrations (EECs) of chlorothalonil and 15 of its transformation products (R182281, R611965, R471811, SYN507900, SYN546671, R613636, R613801, R613841, PD1, PD2, PD3, PD4, PD5, Polar 1, and I) were modelled using the Pesticide in Water Calculator (PWC, version 1.52). EECs in groundwater were calculated by selecting the highest EEC from a set of standard scenarios representing different regions of Canada. Simulations were run for 50 years. The use of a parent-daughter modelling approach was used to refine the groundwater EECs. This approach took into account the different sorption characteristics of the various compounds in the residue definition (where available). The final groundwater EEC (5380 µg/L [5.38 ppm]) was used as the input value to estimate dietary exposure to chlorotholonil and its 15 metabolites in drinking water. Details of estimated EECs are presented in Appendix III, Table 3.

The available ground water monitoring information was also considered (Appendix IV, Table 8); however, it was insufficient to characterize exposure due to limitations in the dataset including the fact that sampling was only for chlorothalonil and none of the transformation products of concern.

The acute reference dose (ARfD) for chlorothalonil is 0.58 mg/kg bw/day, based on the lowest observed adverse effect level (LOAEL) of 175 mg/kg bw/day determined in a 90-day feeding study in rats, and a composite assessment factor (CAF) of 300 (Canada, 2018). The refined acute dietary exposure from food uses alone for the general population and all representative population subgroups (at the 95th percentile) is less than 8% of the ARfD. The refined acute dietary exposures from food and drinking water (95th percentile), are in the range from 42% to 76% of the ARfD for all subpopulations except infants (<1 years old). The refined acute dietary exposure (food and drinking water) for infants (95th percentile) is 170 % of the ARfD, which is of health concern. The major contributor to the dietary exposure and risk estimate for infants is drinking water.

The chronic (non-cancer) reference dose for chlorothalonil is 0.015 mg/kg bw/day, based on a no observed adverse effect level (NOAEL) of 1.5 mg/kg bw/day determined in the 2-year study in rats, and a CAF of 100 (Canada, 2018). The refined chronic (non-cancer) dietary exposures from food uses alone are less than 42% of the acceptable daily intake (ADI) for the general population and all representative population subgroups. The refined chronic (non-cancer) dietary exposures (food and drinking water) for all population subgroups range from 519% to 2719% of the ADI, which are of health concern. The major contributor to the dietary exposure and risk is drinking water.

Based on a 2-year toxicity study in rats, a q1* of $7.66 \times 10^{-3}$ $(mg/kg\ bw/day)^{-1}$ was established to assess cancer risk from chlorothalonil (Canada, 2011; Canada, 2016; Canada, 2018). Based on this information, the dietary risk was assessed. The refined chronic (cancer) exposure estimates from all supported food uses (alone) and food plus drinking water for the general population are $4.98 \times 10^{-6}$ and $8.38 \times 10^{-4}$, respectively, which are of health concern. The major contributor to the dietary risk is exposure from drinking water.

The results of the acute, chronic (non-cancer) and chronic (cancer) dietary exposure and risk assessments for chlorothalonil are presented in Appendix III, Tables 1 and 2.

### 4.1.5 Dietary risk assessment conclusions

Based on the results of the dietary exposure assessments considering the currently available information, Health Canada has concluded that the acute dietary exposure risk from food alone for the general population and all subpopulations has been shown to be acceptable. Aggregate acute exposure risk from food and drinking water has not been shown to be acceptable for infants (<1 years old). The chronic (non-cancer) dietary exposure risk from food alone has been shown to be acceptable based on the currently registered use pattern. Aggregate chronic (non-cancer) exposure from food and drinking water has not been shown to be acceptable for all population subgroups. The lifetime cancer risks for the general population from exposure to food alone and food plus drinking water have not been shown to be acceptable.

Based on this, dietary health risks were not shown to be acceptable for all food uses of chlorothalonil. Therefore, all food uses of chlorothalonil are proposed for cancellation and all maximum residue limits (MRLs) are proposed for revocation.

## 4.2 Assessment of aspects of concern related to the environment

The aspects of concern were related to potential changes to environmental fate and ecotoxicological endpoints, including transformation products, as well as potential risks to amphibians and fish. Additional information indicating potential increased risk to bees (PMRA# 2781997) was provided, however, the risk to aquatic organisms was identified as eclipsing the risk to bees based on the 2016 EFSA draft review. Based on this, the aspects of concern were limited to aquatic organisms. If outdoor uses of chlorothalonil are maintained, further assessment of risk to bees and potential increased mitigation measures may be required.

The potential risks to non-target aquatic organisms resulting from application of chlorothalonil were assessed using information from registrant-submitted data, open literature, water monitoring data, incident reports and reviews from the European Food and Safety Authority (EFSA; 2016 and 2018; PMRA# 2778799, 2778800, 3169502, 3169504, 3169505, 3169506).

The review of two studies (aerobic aquatic biotransformation and amphibian metamorphosis assay) submitted through the Incident Reporting Program (IRP) show more conservative fate parameters and ecotoxicology endpoints than were considered in the existing assessments of chlorothalonil.

Furthermore, Health Canada considered the EFSA review (2016; PMRA# 2778799, 2778800, 3169502, 3169504, 3169505, 3169506), which included a large volume of data that was not previously available to Health Canada. This data set included newer fate studies conducted using new analytical methods that resulted in the detection of numerous new major transformation products.

Based on the above information, the special review focused on risk to aquatic organisms.

### 4.2.1 Potential changes to environmental fate and ecotoxicological endpoints

**Fate and behaviour in the environment**

**Chlorothalonil**

Chlorothalonil may reach soil when it is applied to foliage and through spray drift, with direct application being the primary route of exposure.

Hydrolysis and soil phototransformation are not a major route of transformation under most conditions. In water, photolysis results in the formation of a number of transformation products, including compounds with more complex chemical structures than the parent. Many of the major transformation products from this route of transformation were not identified.

In soil, chlorothalonil is classified as slightly persistent with a dissipation time of $DT_{50}$ of 47 days (90% confidence bound on the mean, n=23; range 0.33 to 246 days). The laboratory studies may not be indicative of the expected dissipation of chlorothalonil in Canadian soils. First, the extraction methods that were used were insufficient to remove all potential bioavailable residues of chlorothalonil. Thus, total residues of chlorothalonil could be higher resulting in longer dissipation times and more persistence. In addition, available scientific information shows that the rate of dissipation of chlorothalonil is affected by the application rate, with higher application rates resulting in longer dissipation times. The dissipation time ($DT_{50}$) of 47 days includes results from studies conducted with application rates below the lowest application rate in the Canadian use pattern. Thus, it is possible that including the laboratory studies that do not reflect the most relevant use rates for Canada could be underestimating the persistence of chlorothalonil in Canadian soils. Submitted soil studies included large numbers of unknown major transformation products which could not be assessed.

Chlorothalonil may enter the aquatic environment through spray drift or runoff, with runoff being the primary route of exposure.

In aquatic environments, chlorothalonil is classified as non-persistent with a $DT_{50}$ of 5.3 days ($80^{th}$ percentile, n=4; range 0.8 to 6.87 days). A study with only a water phase suggests that the application rate will also influence persistence in water, as is seen in the aerobic soil studies. Therefore, the water/sediment $DT_{50}$ value may be underestimating persistence in aquatic environments as the submitted studies were conducted at rates below the Canadian use pattern and dissipation rates are affected by application rates. Submitted studies reported numerous unknown major transformation products which could not be assessed.

Mobility of chlorothalonil ranges from being immobile to having medium mobility in soil with $K_{oc}$ values ranging from 471.2 to 10 875. Chlorothalonil binds rapidly to soil (in 2-24 hours); therefore, binding to soil is expected to be the dominant route of dissipation in the environment compared to microbial transformation. The bound chlorothalonil can desorb (unbind) from soil under certain conditions. While the new desorption data did not follow the methods required by Health Canada, the data showed that under saturated conditions (for example, soil eroded from fields into water), chlorothalonil can desorb from soil and become bioavailable. Further, the data shows that the higher the concentration of chlorothalonil in the soil, the greater percentage that will desorb under these conditions. Given the high Canadian rates the higher rate of desorption is likely.

**Transformation products of chlorothalonil**

Data available for the previous re-evaluation of chlorothalonil (PRVD2011-14) identified a single major transformation product and three minor transformation products. In the new submitted studies, 38 transformation products were identified (16 major) and a further 61 unidentified transformation products were noted in the studies (19 major). See Appendix V, Table 2 for full details of the transformation products. In the lysimeter studies, a further 14 transformation products were not identified; however, due to poor mass balance in the studies, they cannot be characterized as minor or major. The reference standards used were inconsistent across studies, with subsets used for different groups, in other words, aerobic soil, bringing into question if all major transformation products have been identified.

Of the 38 identified transformation products, 15 had available fate data and were determined to be as or more persistent in soil ($DT_{50}$ range from 15.5 to 582 days) and more mobile in the environment (leaching potential ranges from medium to very high) than the parent (refer to Appendix V, Table 2).

**Environmental toxicity**

Due to the rapid dissipation of chlorothalonil in aquatic environments, only those studies with confirmed concentrations of chlorothalonil were used in the risk assessment. A full list of acceptable studies and toxicity endpoints that were used in the risk assessment can be found in Appendix VI, Tables 1–3.

By limiting the studies to those that have confirmed concentrations, the number of species became too limited to conduct species sensitivity distributions (SSD). Vertebrates, fish and amphibians, were found to be the most sensitive organisms to chlorothalonil, for both acute and chronic exposure.

Mesocosm studies showed that some groups of organisms would recover from exposure to chlorothalonil. However, the duration of these studies was not long enough to determine that all groups would recover, nor were vertebrate organisms included in the study, the most sensitive group. Therefore, the utility of the mesocosm studies for the risk assessment was limited.

Overall, new environmental fate parameters and ecotoxicity end points were established; however, the movement of all possible transformation products to depth could not be assessed due to lack of data.

### 4.2.2 Potential risk to amphibians and fish

**Risks to aquatic organisms**

The environmental risk assessment integrates the environmental exposure and ecotoxicology information to estimate the potential for adverse effects on non-target species. This integration is achieved by comparing exposure concentrations with concentrations at which adverse effects occur. Estimated environmental concentrations (EECs) are concentrations of pesticides in various environmental media, such as food, water, soil and air. The EECs are estimated using standard models which take into consideration the application rate(s), chemical properties and environmental fate properties, including the dissipation of the pesticide between applications. Ecotoxicology information includes acute and chronic toxicity data for various organisms or groups of organisms from both terrestrial and aquatic habitats including invertebrates, vertebrates, and plants. Toxicity endpoints used in risk assessments may be adjusted to account for potential differences in species sensitivity as well as varying protection goals (in other words, protection at the community, population, or individual level).

Initially, a screening level risk assessment is performed to identify pesticides and/or specific uses that do not pose a risk to non-target organisms, and to identify those groups of organisms for which there may be a potential risk. The screening level risk assessment uses simple methods, conservative exposure scenarios (for example, direct application at a maximum cumulative application rate) and sensitive toxicity endpoints. A risk quotient (RQ) is calculated by dividing the exposure estimated by an appropriate toxicity value (RQ = exposure/toxicity), and the risk quotient is then compared to the level of concern (LOC). If the screening level risk quotient is below the level of concern, the risk is considered negligible and no further risk characterization is necessary. If the screening level risk quotient is equal to or greater than the level of concern, then a refined risk assessment is performed to further characterize the risk. A refined assessment takes into consideration more realistic exposure scenarios (such as drift and run-off to non-target habitats) and might consider different toxicity endpoints. Refinements may include further characterization of risk based on exposure modelling, monitoring data, results from field or mesocosm studies, and probabilistic risk assessment methods. Refinements to the risk assessment may continue until the risk is adequately characterized or no further refinements are possible.

The rapid dissipation of chlorothalonil in aquatic habitats, combined with the large number of crops and up to nine applications per season, is expected to result in pulse exposures to aquatic environments. The pulsed nature of exposure will make detection of potentially lethal runoff events through water monitoring programs difficult unless a system of continuous sampling is in place, or sampling is tied to runoff events (precipitation).

All aquatic organism groups were assessed in the risk assessment (freshwater invertebrate, freshwater fish, freshwater aquatic plant, freshwater algae, amphibian, marine invertebrate, marine fish, and marine algae). The most sensitive endpoint from each group, acute and chronic (where available), were used (Appendix VI, Tables 1–3). The most sensitive endpoint overall is from a 21-d freshwater fish study. Effects on fecundity were observed at the lowest concentration tested (NOEC < 0.000078 mg a.i./L), therefore a no-effect-level could not be determined. As this is the most sensitive endpoint, it was used in the risk assessment with risk quotients (RQs) reported as “greater than” values

For the initial screening level risk assessment, all RQs exceeded the LOC. Therefore, refined aquatic risk assessments for cranberry use, runoff and spray drift were conducted (see below).

**Greenhouse and mushroom house uses**

The aquatic risk assessment for greenhouses and mushroom houses is qualitative. Chlorothalonil is highly toxic to aquatic organisms. The highest single application rate is registered for mushroom houses (equivalent to 12.7 kg a.i./ha). Potential exposure of aquatic habitats through the release of effluent containing chlorothalonil must be avoided. A label statement prohibiting the release of effluent from greenhouses and mushroom houses is required to prevent entry into aquatic waterbodies which is already included on relevant labels. Therefore, potential risk to aquatic organisms from mushroom house and greenhouse uses are shown to be acceptable when current label use directions are followed.

Greenhouses using closed recirculation systems (for example, closed chemigation system) the following is proposed: a third-party audit that validates the facility's closed recirculation system and other measures are sufficient to prevent releases, effluent or runoff containing this product from entering lakes, streams, ponds, or other waters.

### Cranberry use

Four scenarios were modelled and the risk from cranberry flood waters exceeded the LOC for all aquatic organisms with the exception of aquatic plants (*Lemna gibba*). The RQ for *Lemna gibba* ranged from 0.09 to 1.41. For all other aquatic organisms, the RQ ranged from 6.43 to 3978 (Appendix IV, Table 1–3). Based on the data explained above, including the behaviour of chlorothalonil in water and the high RQs for aquatic organisms, Health Canada has determined that the risks to aquatic organisms from use of chlorothalonil on cranberries are not shown to be acceptable. The risk to aquatic organisms may be mitigated through holding of flood water. However, the time-frame required to reduce concentrations in the water to acceptable levels to achieve mitigation may not be feasible where waters are released to the environment. Open stored water will still be accessible to amphibians.

### Spray drift

The risk from spray drift was assessed initially using three different crops. The lowest cumulative application rate (wheat) for both ground boom and aerial application; a high rate for airblast application (stone fruit), and the highest ground boom rate (turf). The risk to aquatic organisms from spray drift 1 m downwind from the treated site was assessed taking into consideration the spray drift deposition for an ASAE medium spray quality for groundboom (6%)**,** airblast early season (74%) and late season (59%), and medium spray quality for aerial (23%) application equipment. For marine habitats, only single applications at the maximum rate were assessed as chlorothalonil is expected to dissipate between applications due to twice daily tidal movement of water near shore. Only acute risk was assessed for spray drift based on the non-persistent nature of chlorothalonil in aquatic environments. For details, please refer to Appendix VII.

RQs exceeded the LOC for all methods of application (Appendix IV, Table 4):

- For ground boom application to wheat, the RQs ranged from 0.06 to 80.5. For aerial application to wheat, the RQs ranged from 0.22 to 309.
- For airblast application to stone fruit, application scenarios are separated into early and late season applications. For early season airblast the RQs ranged from 2.4-3415. For late season application they ranged from 1.9-2683.
- For ground boom applied to turf the RQs ranged from 0.41 to 585.
- As all scenarios exceeded the LOC, buffer zones were calculated for all outdoor crops.

Buffer zones are proposed for all crops ranging from 1–120 metres for ground applications and 15–800 metres for aerial applications. To summarize:

- Ground application buffer zones mitigate risks from spray drift to an acceptable level for all but turf applications.
- For turf, the RQ for amphibians with the maximum buffer zone of 120 metres in place is 334.6, and thus the risks have not been shown to be acceptable for this use.
- Aerial and airblast (early and late) buffer zones mitigate risks from spray drift for all crops.

Therefore, exposure from spray drift has been shown to be acceptable with the implementation of proposed buffer zones for all uses except turf.

**Runoff**

Chlorothalonil will be transported in runoff, both as a solute and bound to eroded soil, into adjacent water bodies following a rainfall event. Potential exposure of chlorothalonil to aquatic organisms through runoff was assessed using EECs from water modelling, surface water monitoring results and information from incident reports. Acute and chronic risk were assessed as the frequency of runoff events may be high at times.

EECs in water were calculated using the Pesticide in Water Calculator model (PWC, version 1.52) for a 10-ha field adjacent to a 1-ha water body with a depth of 80 cm to represent a permanent water body, or 15 cm to represent a seasonal water body used by amphibians. An aquatic $DT_{50}$ value of 6.87 days ($80^{th}$ percentile, n=6) was used in the water modelling for runoff. Subsequent to completing the water modelling, the data used to produce the aquatic $DT_{50}$ input parameter was further assessed which resulted in the removal of two data points, changing the $80^{th}$ percentile to 5.3 days. Water modelling was not recalculated using the new endpoint as this would have had a minimal effect on the EEC value or any risk quotients derived from the EEC. While limited, water monitoring of surface water concentrations in two provinces overlap with the ecological surface water EEC values calculated by the model, supporting the decision to not update the modelling with the new aquatic $DT_{50}$. For acute risk the modelled 24-hour or 96-hour water concentrations were used while the 21-day water concentrations were used for chronic risk. Nine separate crops were modelled using crop specific application rates (highbush blueberries, lowbush blueberries, carrots, outdoor conifers, potatoes, stone fruit, processing tomatoes, turf, and wheat). The modelling inputs and resulting EECs are summarized in Appendix IV, Tables 1–3.

Using the EECs from the ecoscenario modelling and the most sensitive ecotoxicity endpoints, risks were determined for aquatic organisms. Amphibian RQs ranged across crops from 25.6 to 621 for acute risk and 7.5 to 226 for chronic risk. Freshwater fish RQs ranged across crops from 31.8 to 484 for acute risk and >46.2 to >1141 for chronic risk. Freshwater invertebrate RQs ranged from 28.9 to 439 for acute risk and 6 to 148 for chronic risk. Freshwater algae RQs ranged from 2.1 to 72 and freshwater plants RQs ranged from 0.04 to 0.79, both considered acute risk.

For marine organisms, using the 80 cm freshwater EEC as a surrogate, the invertebrate RQs ranged across crops from 3.9 to 69.2 for acute risk. Marine fish RQs ranged from 3.5 to 61.8 and for marine algae RQs range from 29.5 to 448 for acute risk.

The risk from transformation products could not be determined due to a lack of data. However, as the risk from parent chlorothalonil alone has not been shown to be acceptable, potential risk from transformation products and the parent is also considered not acceptable.

Incident reports in Canada have shown that chlorothalonil moves to waterbodies via runoff after rainfall causing fish mortality. Those incidents with reported eroded soil have brought to question if other factors, such as reduced dissolved oxygen (due to influx of soil-laden water) or physical damage to the fish from the eroded soils, are the main cause of death and not chlorothalonil. Laboratory studies conducted with sediment found no difference in the toxicity endpoints to fish when compared to studies with water only. However, these studies did not address physical damage to the fish from the sediment. It is expected that the levels of chlorothalonil in runoff are sufficiently toxic to result in death without any physical damage to fish. This is supported by the evidence that fish mortality occurred even when eroded soils were not reported. Laboratory fish toxicity studies conducted at different dissolved oxygen saturation levels found that fish were more sensitive to chlorothalonil when under low oxygen stress (low oxygen data were not used in the quantitative risk assessment). From the available data, while low oxygen levels and high sediment load in the water may increase sensitivity to chlorothalonil, chlorothalonil is still expected to be the source of toxicity.

Due to chlorothalonil's short dissipation time in water bodies, these runoff events result in short pulse inputs to the water body. Addressing the short pulse exposure scenarios for chlorothalonil is difficult and requires collection of robust water monitoring data. For water monitoring programs based on random sampling, the probability of capturing the peak exposure concentrations is extremely low. Only when autosamplers tied to precipitation /snow melt events are employed can there be confidence that the monitoring data captures the peak values.

Water monitoring data were collected across Canada and demonstrated that chlorothalonil can be detected in surface water in areas where this pesticide is used, particularly following rainfall events. A summary of chlorothalonil monitoring data in surface water bodies relevant to the aquatic risk assessment is presented in Appendix IV, Table 8. The available data is limited in scope and surveillance monitoring programs may not capture peak exposures. As an example, the water monitoring data in Prince Edward Island from 2010-2019 found no detections in water bodies. Over the same time period, there were four chlorothalonil related fish mortality events in PEI that had water detections of chlorothalonil at concentrations toxic to fish. All were associated with large rainfall events and water samples were taken within a day or two of the event, showing that sampling must be linked to rainfall events to capture peak concentrations. Even with the low frequency of detection in surface water, the available data shows that surface water concentrations can exceed the effects metrics for aquatic organisms. While there is limited information to make conclusions from the monitoring data, there is evidence to show that levels of chlorothalonil in surface water can reach levels high enough to result in fish mortality in highly intensive agricultural areas, especially following a significant rainfall.

The maximum detected values in monitoring data from two provinces exceeded modelled peak surface water values at 80 cm water depths which indicates that the modelled EECs are not overly conservative.

Vegetative filter strips (VFS) were assessed as a potential mitigative measure for runoff of chlorothalonil into aquatic systems. A VFS reduces the velocity of runoff water over a vegetated strip of land at the down-slope edge of the field. This allows any pesticide residues in water or on transported soil particles to settle out, thus reducing the amount that may enter an adjacent waterbody. In Prince Edward Island, where a minimum 15 m VFS has been required for over 10 years, fish mortalities related to runoff events where chlorothalonil has been detected have been reported. New toxicity data indicate that chlorothalonil is more toxic to fish than reported in PRVD2011-14.

Thus, lower levels of residues reaching water could be enough to cause effects. In addition, information regarding the desorption of chlorothalonil from soil and sediment suggests that chlorothalonil residues may be released from soil particles trapped in the VFS from subsequent contact with runoff water. Based on this information it is unlikely that a VFS will be an effective tool for protecting aquatic habitats from chlorothalonil.

Based on the lines of evidence explained above pertaining to parent chlorothalonil alone, including the available scientific information regarding the behaviour of chlorothalonil in water, the high RQs for aquatic organisms, the inability to mitigate these risks via use pattern restrictions or vegetative filter strips, repeated fish mortality events associated with measured levels of chlorothalonil that exceed acute fish effects metric, and modelled EECs supported by water monitoring data, Health Canada has determined that the risks to aquatic organisms, including amphibians and fish, from the outdoor use of chlorothalonil were not shown to be acceptable.

### 4.2.3 Environmental risk assessment conclusions

The environmental assessment shows that, in aquatic environments in Canada, chlorothalonil is expected to be present at concentrations that are toxic to aquatic organisms, with the greatest risks identified for fish and amphibians.

Based on the refined water modelling results, the risks to freshwater invertebrates, freshwater fish, freshwater plants, amphibians, marine invertebrates, marine fish, and marine plants following acute or chronic exposure to chlorothalonil were not shown to be acceptable. While the water monitoring data is insufficient to be used quantitatively for a risk assessment, the range of EECs in surface water predicted from modelling (0.0036–0.197 mg/L) overlaps with the range of concentrations measured in surface water bodies (0–1.851 mg/L). Therefore, the modelling EECs were used in the risk assessment. Based on the risk assessment, potential risk to aquatic organisms from all outdoor uses were not shown to be acceptable.

Indoor uses in mushroom houses and greenhouses were only assessed qualitatively. Waste water from both mushroom houses and greenhouses is expected to contain concentrations that would be toxic to aquatic organisms. Potential exposure of aquatic habitats through the release of effluent containing chlorothalonil must be avoided. A label statement prohibiting the release of effluent from greenhouses and mushroom houses is required to prevent entry into aquatic waterbodies. Note that label statements relating to this are already included on relevant labels. Therefore, potential risk to aquatic organisms from mushroom house and greenhouse uses are shown to be acceptable when current label use directions are followed. Greenhouses using closed recirculation systems (for example, closed chemigation system) the following is proposed: a third-party audit that validates the facility's closed recirculation system and other measures are sufficient to prevent releases, effluent or runoff containing this product from entering lakes, streams, ponds, or other waters.

Overall, Health Canada has concluded that environmental risks relating to the aspects of concern were not shown to be acceptable for all outdoor uses. Therefore, all outdoor uses of chlorothalonil are proposed for cancellation.

# 5.0 Incident reports

## 5.1 Health incident reports

As of 22 November 2021, 16 human incidents involving chlorothalonil were submitted to the Health Canada through the Incident Reporting Program.

There were six serious human incidents. The incidents occurred in Canada (one major report) and the United States (4 major, 1 death). Several active ingredients (including chlorothalonil) were reported in these incidents. Overall, there was insufficient information to assess the role of chlorothalonil in the reported incidents. This was based on the lack of information on the circumstances surrounding the exposure of chlorothalonil. In addition, the reported effects in other words, myelodysplastic syndrome, Parkinson's disease or malignant neoplasm are considered multi-factorial in nature to the extent that the effect(s) are unclassifiable due to the role of other unknown confounding factors (for example, biological/environmental factors or causes).

The remaining human incidents were either minor or moderate in severity. None of these incidents were considered relevant to the outlined aspect of concerns based on either the reported symptom (for example, seizure, hair-loss, diarrhea) or the known route of exposure (for example, drift). Hence, no additional mitigation measures were recommended.

## 5.2 Environment incident reports

As of 22 November 2021, there have been six fish mortality events reported to Health Canada related to chlorothalonil through the Incident Reporting Program. Four of these incidents were previously described in RVD2018-11. As indicated in RVD2018-11, all were attributed to products used on potato on Prince Edward Island (PEI), however, one occurred at a golf course in Ontario. An additional event was reported in 2017 in PEI and was not assessed in time to include in the RVD. All resulted in fish mortalities listed as probable or highly probable with relation to chlorothalonil use. A fish mortality incident resulting from a fire in 2010 is not related to normal use and is outside the aspects of concern for the special review and not included.

Health Canada received information for eight other fish mortality incidents associated with chlorothalonil that occurred prior to 2007 (Since 26 April 2007, registrant are required by law to report pesticide incidents, including adverse effects to the environment, to the PMRA). Two were summarized, in part, in PRVD2011-14. Of those incidents occurring prior to 2007, three reported chlorothalonil concentrations in water which exceeded the acute fish effects metric used for this special review. A fourth reported a water concentration just below the acute fish effects metric; however, the report noted that there was a significant time lapse between the fish mortality incident and the water sampling, which would allow for dissipation of the chlorothalonil. In general, the fish mortality events related to chlorothanil use (pre- and post-2007) consistently show that rain events and runoff can result in fish mortality. In addition, available water samples related to some incidents confirm the presence of chlorothalonil at levels that would be toxic to fish.

In the potato growing regions of Atlantic Canada where most of the incidents have occurred, the mortality events are associated with catastrophic rainfall leading to large erosion events with both soil and runoff water reaching water bodies. It was indicated in RVD2018-11 that the probability of these events occurring with the reduced use pattern (3 applications instead of 12 applications per year for potatoes) was assessed to be much lower and with the implementation of the VFS, that the risk to fish would be mitigated. However, the incident at the Ontario golf course occurred over a grassed area and did not involve either a catastrophic rainfall event or soil erosion.

As outlined in Section 4.2.2, the more sensitive endpoint for fish that is now available (acute fish effect metric is 0.00044 mg a.i./L) indicates that risks to aquatic organisms (fish) is higher (than previously reported in RVD2018-11; Acute fish SSD $HC_5$ 0.013 mg a.i./L) and that fewer chlorothalonil residues are needed to reach aquatic habitats to cause an effect. In addition, soil desorption data (Section 4.2.1) indicated that a VFS may not be as effective for retaining chlorothalonil residues as originally predicted in RVD2018-11. As all outdoor uses are proposed for cancellation, no additional risk mitigation measures are proposed.

A full list of the studies and environmental incidents reported to the PMRA can be found in Appendix IX.

# 6.0 Proposed special review decision for chlorothalonil

Under the authority of the *Pest Control Products Act* and based on an evaluation of available relevant scientific information related to the aspects of concern for human health and the environment, Health Canada is proposing continued registration of greenhouse ornamental uses of chlorothalonil and associated end-use products registered for sale and use in Canada. All other uses of chlorothalonil are proposed for cancellation since potential risks to human health and the environment were not shown to be acceptable when products are used according to the current conditions of registration.

With respect to human health, dietary risks (food alone and food plus water) were not shown to be acceptable for food uses when chlorothalonil is used according to current conditions of registration. Based on this, all food uses of chlorothalonil are proposed for cancellation and all maximum residue limits (MRLs) are proposed for revocation.

Environmental risks to aquatic organisms were not shown to be acceptable for all outdoor uses when chlorothalonil is used according to current conditions of registration. However, environmental risks to aquatic organisms from mushroom houses and greenhouse uses were shown to be acceptable with the following proposed risk mitigation: Greenhouses using closed recirculation systems (for example, closed chemigation system) the following requirement is proposed: a third-party audit that validates the facility's closed recirculation system and other measures are sufficient to prevent releases, effluent or runoff containing this product from entering lakes, streams, ponds, or other waters.

This proposed special review decision is a consultation document.[1] Health Canada will accept written comments on this proposal up to 45 days from the date of publication of this document. Please forward all comments to Publications (please see contact information on the cover page of this document).

## 7.0 Additional information that may help refine risk assessments

The current health and environmental risk assessments for chlorothalonil is based on the data and information available at this time. No additional scientific data are being requested during the consultation period for this Proposed Special Review Decision. However, registrants and stakeholders are encouraged to provide available information that may address uncertainties in the available information database of chlorothalonil before the end of the consultation period for consideration in the final special review decision.

The evaluation of any additional data would be based on the scientific merit and relevance to the risk assessment. While additional data may reduce uncertainty in the risk assessment, continued registration of any uses would be based on the acceptability of risk assessed using a science-based approach.

**Dietary**

Although, no additional scientific data have been identified at this time that may help refine the dietary risk assessment, proposed changes to the use pattern, such as the removal of uses, could potentially be considered to address the identified risks.

**Environment**

No additional scientific data are required at this time.

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

## 8.0 Next steps

Before making a special review decision on the agricultural, horticultural and turf uses of chlorothalonil, Health Canada will consider all comments received from the public in response to this consultation document. A science-based approach will be applied in making a final decision on chlorothalonil. Health Canada will then publish a special review decision document, which will include the decision, the reasons for it, a summary of the comments received on the proposed decision, and Health Canada's response to these comments.

## 9.0 Other information

The relevant confidential test data on which the proposed decision is based (see References section of this document) are available for public inspection, upon application, in Health Canada's Reading Room. For more information, please contact Health Canada's Pest Management Information Service.

# List of abbreviations

| | |
|---|---|
| µg | microgram(s) |
| AB | Alberta |
| ABN | Alberta north |
| ABS | Alberta south |
| ADI | acceptable daily intake |
| a.i. | active ingredient |
| ARfD | acute reference dose |
| BC | British Columbia |
| BCO | British Columbia Okanogan |
| BCV | British Columbia Vancouver |
| BCF | bioconcentration factor |
| bw | body weight |
| C | celcius |
| CAF | composite assessment factor |
| CAS | Chemical Abstracts Service |
| CFIA | Canadian Food Inspection Agency |
| cm | centimetres |
| d | day |
| DEEM-FCID | Dietary Exposure Evaluation Model - Food Commodity Intake Database |
| DFOP | double first order in parallel |
| $DT_{50}$ | dissipation time 50% (the dose required to observe a 50% decline in concentration) |
| $EbC_{50}$ | effective concentration for a 50% reduction in biomass |
| $EC_{50}$ | effective concentration on 50% of the population |
| EEC | Estimated environmental concentration |
| EFSA | European Food Safety Authority |
| $ErC_{50}$ | effective concentration for a 50% reduction in growth rate |
| EU | European Union |
| g | gram |
| ha | hectare(s) |
| HCB | hexachlorobenzene |
| IORE | indeterminate order rate equation model |
| IRP | Incident Reporting Program |
| IUPAC | International Union of Pure and Applied Chemistry |
| kg | kilogram(s) |
| $K_d$ | soil-water partition coefficient |
| $K_{oc}$ | organic-carbon partition coefficient |
| $K_{ow}$ | n-octanoal-water partition coefficient |
| L | litre(s) |
| $LC_{50}$ | lethal concentration 50% of the population |
| LOAEL | lowest observed adverse effect level |
| LOC | level of concern |
| m | metre |

| | |
|---|---|
| MB | Manitoba |
| mg | milligram |
| MRL | Maximum Residue Limit |
| mg | milligram(s) |
| n | number |
| n/c | not calculated |
| NHANES | National Health and Nutrition Examination Survey |
| NOAEL | no observed adverse effect level |
| NOEC | no observed effect concentration |
| OC | organic carbon content |
| OM | organic matter content |
| ON | Ontario |
| ONE | Ontario east |
| ONW | Ontario west |
| PDP | Pesticide Data Program |
| p*K*a | dissociation constant |
| ppm | part per million |
| PRVD | proposed re-evaluation decision |
| $q_1$* | cancer potency factor |
| QC | Quebec |
| RQ | risk quotient |
| SFO | single first order |
| SK | Saskatchewan |
| SSD | species sensitivity distribution |
| TSMP | Toxic Substance Management Policy |
| USDA | United States Department of Agriculture's |
| USEPA | United States Environmental Protection Agency |
| VFS | vegetative filter strips |

# Appendix I Registered products containing chlorothalonil as of 19 November 2021

| Registration Number | Marketing Class | Registrant | Product Name | Guarantee |
|---|---|---|---|---|
| 25574 | T | GB BioscienceS LLC. | Technical Chlorothalonil Fungicide | 98.5% |
| 27059 | T | Sipcam Agro USA, Inc. | Chlorothalonil Technical Fungicide | 98% |
| 29354 | T | Sipcam Agro USA, Inc. | Chlorothalonil Technical AG | 99.3% |
| 31763 | T | Adama Agricultural Solutions Canada LTD. | Adama chlorothalonil technical | 98.6% |
| 24915 | M | Bayer CropScience Inc. | Tattoo Manufacturing Use Product | 375 g/L |
| 15724 | C | Syngenta Canada Inc. | Daconil 2787 Flowable Fungicide | 500 g/L |
| 28861 | C | Syngenta Canada Inc. | Instrata Fungicide | 362 g/L |
| 28900 | C | Syngenta Canada Inc. | Bravo ZN Agricultural Fungicide | 500 g/L |
| 29225 | C | Syngenta Canada Inc. | Bravo 720 Agricultural Fungicide | 720 g/L |
| 29355 | C | Sipcam Agro USA, Inc. | Echo 720 Agricultural Fungicide | 720 g/L |
| 30333 | C | Production Agriscience Canada Company | Treoris Fungicide | 250 g/L |
| 31537 | C | Syngenta Canada Inc. | Bravo Top Fungicide | 500 g/L |
| 32030 | C | Adama Agricultural Solutions Canada LTD. | Chlorothalonil 720F | 720 g/L |
| 32363 | C | Gowan Company, LLC | Zing Fungicide | 500 g/L |
| 33479 | C | sipcam agro USA, Inc. | Echo NP Fungicide | 720 g/L |
| 33489 | C | Syngenta Canada Inc. | Bravo Top 550 Fungicide | 500 g/L |
| 33515 | C | Syngenta Canada Inc. | Bravo ZNC Agricultural Fungicide | 500 g/L |
| 33516 | C | Syngenta Canada Inc. | Bravo Weatherstik Fungicide | 720 g/L |
| 33519 | C | Sipcam Agro USA, Inc. | Echo 90WSP Agricultural Fungicide | 90% |
| 33565 | C | UPL NA Inc. | Elixir WSB Fungicide | 12.5% |
| 33605 | C | Adama Agricultural Solutions Canada LTD. | Equus 82.5 WSP | 82.5% |

C – Commercial, T – Technical, M – Manufacturing.

# Appendix II Use pattern considered in the special review of chlorothalonil

| Crop | Maximum Application Rate (kg a.i./ha) | Maximum Number of Applications per year for chlorothalonil | Retreatment Interval (days) |
|---|---|---|---|
| Asparagus | 1.7 (SN)<br>1.2 (DF) | 3 | 14 |
| Highbush Blueberries | 3.6 | 2 | 7 |
| Lowbush Blueberries | 3.6 (SN)<br>2.5 (DF) | 2 | 42 |
| Carrot | 1.6 | 7 | 7 |
| Celery, field | 2.0 | 2 | 3 |
| Celery seedbeds (greenhouse) | 1.4 | 1 | N/A |
| Cherry (sweet and sour) | 4.5 | 2 (spring) +<br>1 (post-harvest) | 10 |
| Chickpeas | 2.0 (1st)<br>1.5 (2nd) | 2 | 10 |
| Cole crops:<br>Broccoli, Brussels sprouts, cauliflower | 2.4 | 1 | N/A |
| Cabbage | 2.4 | 2 | 7 |
| Conifers - outdoor<br>(for example, cedar, Douglas-fir, cypresses, fir, junipers, pine, spruce); including Christmas trees | 4.8 | 2 | 7 |
| Conifer nursery beds (greenhouse) | 1.2 | 1 | N/A |
| Corn, sweet | 1.6 | 2 | 10 |
| Cranberry | 5.8 | 1 | N/A |
| Cucurbit vegetables (Cantaloupe, muskmelon, honeydew, squash, pumpkin, watermelon, cucumber) | 2.4 | 2 | 7 |
| Evening Primrose | 1.2 | 2 | 14 |
| Ginseng | 2.4 | 2 + 1 (fall) | 7 |
| Hazelnut | 3.4 | 3 | 20 |
| Lentils | 2.0 | 2 | 10 |
| Mushroom houses | 12.7 | 1 | N/A |
| Onion (dry bulb) | 2.4 | 2 | 7 |
| Onion (green bunching) | 2.4 | 2 | 7 |
| Greenhouse ornamentals other than roses (not grown for cut flowers) | 1.25 | 1 | N/A |
| Greenhouse roses (not grown for cut flowers) | 0.94 | 1 | N/A |
| Outdoor ornamentals (not grown for cut flowers) except roses and *pachysandra* | 2.5 | 2 | 7 |

| Crop | Maximum Application Rate (kg a.i./ha) | Maximum Number of Applications per year for chlorothalonil | Retreatment Interval (days) |
|---|---|---|---|
| Outdoor ornamentals (cut flowers except roses) | 2.5 | 1 | N/A |
| Outdoor roses (not grown for cut flowers) | 1.9 | 2 | 7 |
| Outdoor pachysandra | 5.0 | 1 | N/A |
| Parsnip | 1.4 | 7 | 7 |
| Pea, dry | 1.5 | 2 | 10 |
| Peach and nectarine | 4.5 | 2 (spring) + 1 (dormant) | 10 |
| Potato (seed) | 1.2 | 3 | 7 |
| Potato (table) | 1.2 | 3 | 7 |
| Strawberry | 1.8 | 2 (spring) + 1 (post-harvest) | 10 |
| Tomato (not for processing) | 2.4 and 1.2 | 2 (total) | 14 (2.4 kg a.i./ha); 8 (1.2 kg a.i./ha) |
| Tomato (for processing) | 2.4 and 1.2 | 2 at 2.4 and 7 at 1.2 | 14 (2.4 kg a.i./ha); 8 (1.2 kg a.i./ha) |
| Turf (snow mould) | 12.0 | 1 | N/A |
| Turf – golf courses and sod farms | 9.5 and 4.8 | 2 (total) | 14 (9.5 kg a.i./ha) 7 (4.8 kg a.i./ha) |
| Wheat | 1.3 | 2 | 10 |

# Appendix III Dietary exposure assessments

## Table 1 Acute and chronic (non-cancer) dietary exposure assessments

| Population Subgroup | Refined | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Acute Dietary (95th Percentile)[1] | | | | Chronic (Non-Cancer) Dietary[2] | | | |
| | Food Only | | Food + Drinking Water | | Food Only | | Food + Drinking Water | |
| | Exposure (mg/kg/day) | % ARfD | Exposure (mg/kg/day) | % ARfD | Exposure (mg/kg/day) | % ADI | Exposure (mg/kg/day) | % ADI |
| General Population | 0.019756 | 3.41 | 0.294681 | 50.81 | 0.001511 | 10.1 | **0.110210** | **734.7** |
| All Infants <1 year old | 0.022498 | 3.88 | **0.983359** | **169.54** | 0.001758 | 11.7 | **0.407797** | **2718.6** |
| Children 1-2 years old | 0.045642 | 7.87 | 0.439433 | 75.76 | 0.006229 | 41.5 | **0.155720** | **1,038.1** |
| Children 3-5 years old | 0.039672 | 6.84 | 0.343104 | 59.16 | 0.003764 | 25.1 | **0.125404** | **836.0** |
| Children 6-12 years old | 0.024972 | 4.31 | 0.264339 | 45.58 | 0.002257 | 15.0 | **0.092702** | **618.0** |
| Youth 13-19 years old | 0.016637 | 2.87 | 0.245723 | 42.37 | 0.001283 | 8.6 | **0.077912** | **519.4** |
| Adults 20-49 years old | 0.016596 | 2.86 | 0.287288 | 49.53 | 0.001192 | 7.9 | **0.109186** | **727.9** |
| Adults 50+ years old | 0.014570 | 2.51 | 0.250588 | 43.20 | 0.001044 | 7.0 | **0.106073** | **707.2** |
| Females 13-49 years old | 0.016255 | 2.80 | 0.288729 | 49.78 | 0.001166 | 7.8 | **0.107332** | **715.5** |

[1] Acute Reference Dose (ARfD) of 0.58 mg/kg bw/day applies to the general population and all population subgroups (Canada, 2018).
[2] Acceptable Daily Intake (ADI) of 0.015 mg/kg bw/day applies to the general population and all population subgroups (Canada, 2018).
Bolded cells indicated unacceptable risk.

## Table 2 Chronic (cancer) dietary exposure assessments

| Population Subgroup | Refined | | | |
|---|---|---|---|---|
| | Chronic (Cancer) Dietary[1] | | | |
| | Food Only | | Food + Drinking Water | |
| | Exposure (mg/kg/day) | Lifetime Risk | Exposure (mg/kg/day) | Lifetime Risk |
| General Population | **0.000651** | **$4.98 \times 10^{-6}$** | **0.109350** | **$8.38 \times 10^{-4}$** |

[1] $q_1$* of $7.66 \times 10^{-3}$ (mg/kg bw/day)$^{-1}$ applies to the general population (Canada, 2018).
Bolded cells indicate unacceptable risk.

### Table 3 Refined level 1 estimated environmental concentrations (EECs) in potential sources of drinking water for the combined residues of chlorothalonil and 15 transformation products

| Crop And Annual Application Rate | Active Ingredient (RD in water) | Groundwater (µg a.i./L) | |
|---|---|---|---|
| | | Acute[1] | Chronic[2] |
| 2 applications of 9.5 kg a.i./ha + 1 application of 12 kg a.i./ha[3] | chlorothalonil and 15 of its transformation products: R182281, R611965, R471811, SYN507900, SYN546671, R613636, R613801, R613841, PD1, PD2, PD3, PD4, PD5, Polar 1, I. | **5380** | **5380** |

1 $90^{th}$ percentile of daily concentrations.
2 $90^{th}$ percentile of 365-day moving average concentrations.
3 Modelled using the turf use pattern, which covers the rates for all other assessed crops.

### Table 4 Comparison of dietary exposure assessments (DEAs) (current vs previous)

| | | DEA (PRVD2011-14 and RVD2018-11) | DEA in 2021 |
|---|---|---|---|
| **Residue Definition** | **Plant** | Chlorothalonil + SDS-3701 | Chlorothalonil + SDS-3701 |
| | **Livestock** | SDS-3701 | SDS-3701 |
| | **Drinking water** | Chlorothalonil | Chlorothalonil and 15 of its transformation products: R182281, R611965, R471811, SYN507900, SYN546671, R613636, R613801, R613841, PD1, PD2, PD3, PD4, PD5, Polar 1, I. |
| **Reference values** | **ADI** | 0.015 mg/kg bw/day | |
| | **ARfD** | General population: 0.58 mg/kg bw/day | |
| | **Cancer** | $q_1^* = 7.66 \times 10^{-3}$ (mg/kg bw/day)$^{-1}$ | |
| **DEA (Chronic)** | Food+Water | 69.9% ADI, highest for Children 1-2 yrs | 2719% ADI, highest for All infants |
| **DEA (Acute)** | Food+Water | 27.3% ARfD, highest for Children 1-2 yrs | 170% ARfD, highest for All infants |
| **DEA (Cancer)** | Food+Water | $1.57 \times 10^{-6}$ | $8.38 \times 10^{-4}$ |

# Appendix IV Water modelling and water monitoring reports

## 1.0 Water modelling

### Table 1 Major fate inputs for the modelling

| Fate Parameter | Drinking Water Value (chlorothalonil + 15 transformation products)[1] | Ecological Value (chlorothalonil) | Comment |
|---|---|---|---|
| $K_d$ | - | 15 L/kg | 20th percentile of 16 values |
| $K_{oc}$ | 1.2 L/kg | - | 20th percentile of 5 values |
| Water half-life | 49.1 days at 20°C | 6.87 days at 20°C | 80th percentile of 6 values, aerobic aquatic whole systems |
| Sediment half-life | 61.7 days at 20°C | 5.67 days at 20°C[3] | Single study, anaerobic soil |
| Photolysis half-life | 25.8 days at 35° latitude | 18 days at 35° latitude | 80th percentile of 4 values |
| Hydrolysis | Stable | Stable | Stable to hydrolysis at ambient temperatures |
| Soil half-life | 227 days at 20°C | 37 days at 20°C[2] | 90% upper confidence bound on the mean of 18 values |

[1] The residue definition for drinking water modelling included chlorothalonil and 15 transformation products: R182281 (also known as SDS-3701), R611965, R471811, SYN507900, SYN546671, R613636, R613801, R613841, PD1, PD2, PD3, PD4, PD5, Polar 1, and I.
[2] Post modelling errors were corrected in the soil fate data that resulted in a new 90% upper confidence bound on the mean of 18 values of 47 days. The change would not improve the risk assessment, therefore, water modelling was not updated.
[3] Post modelling errors were corrected in the aquatic fate data that resulted in a removal of two endpoints from the data set.

### Table 2 Groundwater model input parameters for parent-daughter refinement

| Parameter | Chlorothalonil | Combined daughter |
|---|---|---|
| Molecular weight (g/mole) | 265.9 | 265.9 |
| Vapour pressure (mm Hg) at 20°C | 7.65E-5 | 7.65E-5 |
| Solubility (mg/L) in water at pH 7 | 0.81 | 0.81 |
| Henry's law constant (unitless) | 1.35E-3 | 1.35E-3 |
| Hydrolysis at pH 7 | Stable | Stable[1] |
| Aerobic soil half-life (day) at 20°C* | 0.32-81.3[2] | 46.4-2367[3] |
| Transformation fraction in soil* | NA | 0.178-1.0[4] |
| $K_{oc}$ (L/kg) | 1290 | 1.2 |
| Vapour phase diffusion coefficient ($cm^2$/day) | 4520 | 4520 |
| Heat of Henry (Joule/mole) | 50000 | 50000 |

[1] assumed stable
[2] the range of half-lives for chlorothalonil for all 17 soils that curve fits could be achieved
[3] the range of half-lives for the combined daughter for all 17 soils that curve fits could be achieved
[4] the range of transformation fractions from chlorothalonil to the combined daughter for all 17 soils that curve fits could be achieved
* aerobic soil half-lives and fractions used are soil dependent

**Table 3 Estimated environmental concentrations (EECs) (µg a.i./L) of chlorothalonil for the ecological risk assessment**

| Use | Region | Water Depth | Water column | | | | Pore water | |
|---|---|---|---|---|---|---|---|---|
| | | | Peak | 24-h | 96-h | 21-d | Peak | 21-d |
| Blueberry, highbush | BC | 80 cm | 15 | 14 | 12 | 6.6 | 1.5 | 1.4 |
| | | 15 cm | 63 | 52 | 36 | 12 | - | - |
| Blueberries, lowbush | Atlantic | 80 cm | 68 | 57 | 42 | 22 | 5.9 | 5.4 |
| | | 15 cm | 334 | 195 | 94 | 36 | - | - |
| Carrots | Prairie | 80 cm | 44 | 39 | 29 | 11 | 2.6 | 1.9 |
| | | 15 cm | 221 | 147 | 63 | 15 | - | - |
| Cherries | BC | 80 cm | 4.0 | 3.8 | 3.2 | 1.3 | 0.21 | 0.16 |
| | | 15 cm | 21 | 17 | 9.4 | 2.1 | - | - |
| Peaches | ON | 80 cm | 39 | 36 | 28 | 17 | 5.0 | 4.8 |
| | | 15 cm | 200 | 137 | 79 | 42 | - | - |
| | QC | 80 cm | 31 | 28 | 23 | 10 | 2.6 | 2.2 |
| | | 15 cm | 149 | 108 | 70 | 19 | - | - |
| Conifers, nursery bed | Atlantic | 80 cm | 7.2 | 6.3 | 4.6 | 1.6 | 0.28 | 0.19 |
| | | 15 cm | 38 | 25 | 13 | 3.5 | - | - |
| Conifers, outdoor | Atlantic | 80 cm | 63 | 57 | 41 | 20 | 4.4 | 4.3 |
| | | 15 cm | 335 | 240 | 108 | 35 | - | - |
| Potatoes | Atlantic | 80 cm | 44 | 38 | 30 | 16 | 4.2 | 3.5 |
| | | 15 cm | 221 | 133 | 61 | 25 | - | - |
| Tomatoes, fresh | ON | 80 cm | 45 | 40 | 31 | 12 | 2.8 | 1.8 |
| | | 15 cm | 211 | 142 | 83 | 19 | - | - |
| | QC | 80 cm | 52 | 47 | 40 | 20 | 5.5 | 4.8 |
| | | 15 cm | 275 | 197 | 107 | 39 | - | - |
| Tomatoes, processing | ON | 80 cm | 87 | 76 | 58 | 22 | 4.3 | 3.1 |
| | | 15 cm | 426 | 295 | 139 | 37 | - | - |
| | QC | 80 cm | 108 | 101 | 78 | 34 | 9.1 | 8.4 |
| | | 15 cm | 480 | 393 | 197 | 66 | - | - |
| Wheat | SK | 80 cm | 16 | 14 | 9.8 | 3.6 | 0.81 | 0.58 |
| | | 15 cm | 79 | 49 | 20 | 4.6 | - | - |
| | MB | 80 cm | 14 | 13 | 9.0 | 3.6 | 0.73 | 0.50 |
| | | 15 cm | 76 | 51 | 21 | 4.4 | - | - |
| Turf | BCO | 80 cm | 8.7 | 8.2 | 6.9 | 4.7 | 1.1 | 1.0 |
| | | 15 cm | 43 | 36 | 29 | 12 | - | - |
| | BCV | 80 cm | 230 | 213 | 173 | 89 | 22 | 24 |
| | | 15 cm | 1170 | 896 | 509 | 138 | - | - |
| | ABS | 80 cm | 145 | 131 | 102 | 38 | 7.0 | 5.2 |
| | | 15 cm | 644 | 454 | 231 | 51 | - | - |
| | ABN | 80 cm | 62 | 57 | 46 | 20 | 3.4 | 2.7 |
| | | 15 cm | 330 | 251 | 130 | 29 | - | - |
| | SK | 80 cm | 101 | 89 | 64 | 27 | 5.0 | 3.4 |
| | | 15 cm | 530 | 334 | 131 | 32 | - | - |

| Use | Region | Water Depth | Water column | | | | Pore water | |
|---|---|---|---|---|---|---|---|---|
| | | | Peak | 24-h | 96-h | 21-d | Peak | 21-d |
| | MB | 80 cm | 84 | 74 | 53 | 20 | 4.5 | 3.6 |
| | | 15 cm | 448 | 281 | 125 | 32 | - | - |
| | ONE | 80 cm | 89 | 81 | 64 | 32 | 6.2 | 6.0 |
| | | 15 cm | 471 | 350 | 185 | 48 | - | - |
| | ONW | 80 cm | 102 | 92 | 78 | 38 | 6.7 | 6.1 |
| | | 15 cm | 517 | 385 | 177 | 52 | - | - |
| | QC | 80 cm | 139 | 135 | 121 | 59 | 16 | 16 |
| | | 15 cm | 719 | 581 | 307 | 134 | - | - |

## 2.0 Cranberry flood water modelling

### Summary

Foliar use of chlorothalonil in cranberry fields was assessed by modelling estimated concentrations in receiving waters following the release of treated cranberry flood water. A range of chlorothalonil concentrations in cranberry tailwater were estimated with a simple risk assessment cranberry model internally developed by the PMRA, V.3.0. For this purpose, it was assumed that 5 or 10 fields can be flooded with the same water, and that 25% or 50% of chlorothalonil residues can transfer from soil to floodwater; yielding a total of 4 scenarios. The modelled RQs, based on a rainbow trout $LC_{50}$/10 of 0.00044 mg a.i./L ranged between 4.3 and 70 in receiving waters following immediate release of floodwaters from fields treated at the maximum allowable seasonal rate of 5800 g a.i./ha (Table 6). Based on the modelling results, chlorothalonil application on cranberries poses a risk to aquatic organisms and requires mitigation.

Mitigating measures could include a lower application rate, or the retention of water prior to release after the last application.

**Table 4 Variable input parameters tested to estimate EECs of chlorothalonil in cranberry field floodwater.**

| Parameter | High value | Low value |
|---|---|---|
| Number of fields successively flooded | 10 fields | 5 fields |
| Estimate of residue transferred from soil to water | 50% | 25% |

**Table 5 Non-variable model input parameters**

| Parameter | Value |
|---|---|
| Rate (currently only one labeled rate) and number of applications | 5800 g a.i./ha × 1 |
| Soil half-life | 46-d[1] |
| Aquatic half-life | 5.3-d[2] |
| Aquatic toxicity endpoint (chronic/acute) | Rainbow trout $LC_{50}$/10 = 0.00044 mg a.i./L |
| $Q_{10}$ | 2 |

| Parameter | Value |
|---|---|
| City | Vancouver |
| First treatment date (same date for all fields) | 2 August |
| First harvest date | 21 September |
| Flood water depth | 0.6 m |
| Dilution factor by the water body receiving the tail water | 10 × |

[1] Cranberry water modelling was completed with an updated soil half-life value that included a rounding error. This error is not expected to affect the resulting EECs. The error was corrected in Table 1
[2] Cranberry water modelling was completed with the updated aquatic half-life (see Table 1 for details)

The scenario results are summarised in Table 6. EECs and RQs are presented for water assuming two weeks retention time.

**Table 6 Scenarios conducted with acute chlorothalonil endpoint ($LC_{50}$ /10= 0.0044 mg a.i./L)**

| No | Scenario short description | Rate (g/ha) | N app | interval (d) | N fields | soil to water (%) | Chlorothalonil $DT_{50}$ | | Floodwater EEC (ug/L) | Floodwater RQ | Receiving water EEC (ug/L) | Receiving water RQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | soil | water | | | | |
| 1 | 10 fields; 50% transfer from water to soil | 5800 | 1 | NA | 10 | 50% | 46 | 5.3 | 310.2756 | 705.2 | 31.0276 | 70.5 |
| 2 | 10 fields; 25% transfer from water to soil | 5800 | 1 | NA | 10 | **25%** | 46 | 5.3 | 155.1378 | 352.6 | 15.5138 | 35.3 |
| 3 | 5 fields; 50% transfer from water to soil | 5800 | 1 | NA | **5** | 50% | 46 | 5.3 | 37.9481 | 86.2 | 3.7948 | 8.6 |
| 4 | 5 fields; 25% transfer from water to soil | 5800 | 1 | NA | **5** | **25%** | 46 | 5.3 | 18.9740 | 43.1 | 1.8974 | 4.3 |

*The representative half-lives at 20°C were adjusted daily to Vancouver mean temperatures, ranging between 4.1°C and 18°C. The beginning of wet-harvest (flooding) was set to 21 September, with an interval of 5 days between fields. Treatment date was set 50 days prior to harvest, as per current label requirements. The floodwater depth was modelled at 0.6 m. The reported EECs and RQs are calculated two weeks after the beginning of the last harvest. Bolded cells are changes from the base (first) scenario listed.

# 3.0 Monitoring

## Table 7 Summary of chlorothalonil detections in Canadian groundwater (2005-2019) available for consideration in the dietary risk assessment

| Location/ Province | Year of Sampling | # Samples | # Detections | % Detection | Maximum Concentration (µg/L)[1] | Minimum Concentration (µg/L) | Limit of detection (µg/L) |
|---|---|---|---|---|---|---|---|
| **Sampling between 2005-2019** | | | | | | | |
| BC | 2005-2010 | 33 | 14 | 42.42 | 0.000061 | ND | 0.00001-1 |
| MB | 2009 | 5 | 0 | 0 | ND | ND | 0.005 |
| QC | 2005-2019 | 792 | 2 | 0.27 | 0.19 | ND | 0.01 – 0.06 |
| PEI | 2005-2012 | 819 | 9 | 1.09 | 0.0008 | ND | 0.00002-0.02 |
| NS | 2005-2011 | 174 | 1 | 0.57 | 0.09 | ND | 0.02-1 |
| NB | 2007 | 44 | 2 | 4.54 | 0.14 | ND | 0.025-0.05 |
| **Total** | **2005-2019** | **1933** | **28** | **1.44** | **0.19** | **ND** | |
| **Sampling between 2010-2018** | | | | | | | |
| BC | 2010 | 18 | 0 | 0 | ND | ND | |
| QC | 2010-2018 | 478 | 0 | 0 | ND | ND | 0.01-0.05 |
| PEI | 2010-2012 | 111 | 1 | 0.90 | 0.00003 | ND | 0.00002 |
| NS | 2011 | 5 | 0 | 0 | ND | ND | 1 |
| AB | 2010-2017 | 66 | 0 | 0 | ND | ND | 0.005 |
| **Total** | **2010-2018** | **686** | **1** | **0.14** | 0.00003 | **ND** | |

ND: No detection

[1] Only parent chlorothalonil is measured in monitoring, therefore, these values cannot be compared with the EECs determined through modelling

## Table 8 Summary of chlorothalonil detections in Canadian surface water (2010-2019) available for consideration in the aquatic risk assessment

| Location/ Province | Year of Sampling | # Samples | # Detections | % Detection | Maximum Concentration (µg/L) | Minimum Concentration (µg/L) | Limit of detection (µg/L) |
|---|---|---|---|---|---|---|---|
| BC | 2010-2014 | 99 | 14 | 14.14 | 0.00132 | 0.000123 | 0.0000012-0.0001 |
| AB | 2010-2019 | 1566 | 2 | 0.13 | 0.018 | 0.009 | 0.005-0.025 |
| MB | 2010-2018 | 876 | 22 | 2.51 | 0.729 | 0.077 | 0.05-0.5 |
| QC | 2010-2018 | 2773 | 34 | 1.2 | 82 | 0.01 | 0.04-0.32 |
| NB | 2013-2015 | 43 | 3 | 6.9 | 0.81 | 0.23 | 0.05-0.06 |
| PEI | 2010-2018 | 298 | 0 | 0.56 | ND | ND | 0.02-0.05 |
| | Incident reports 2011 - 2017 | 29 | 19 | 65.5 | 150.8 | ND | 0.01 – 0.06 |
| NS | 2013-2015 | 45 | 0 | 0 | ND | ND | 0.05-0.06 |
| NFL | 2013 | 1 | 0 | 0 | ND | ND | 0.05 |
| **Total** | **2010-2019** | **5701** | **75** | **1.31** | **82** | **ND** | - |

ND: No detection

# Appendix V Environmental fate data

## Table 1 Chlorothalonil fate studies used for the special review

| Study | Details | DT50* (d) | Tr (d) | DT90 (d) | Kinetics | Study PMRA# |
|---|---|---|---|---|---|---|
| Hydrolysis | pH 9, 25°C | 17.0 | - | 56.5 | SFO | 1340587 |
| | pH 9, 20°C | 9.53 | - | 31.6 | SFO | 2918264 |
| | pH 9, 20°C | 11.44 | - | 37.99 | SFO | 2918265 |
| | pH 9, 20°C | 50.62 | - | 168.1 | SFO | 1219851 |
| Hydrolysis surogate [Aquatic photolysis Natural water dark control] | pH 8.1, 25°C | 229 | - | 762 | SFO | 2918269 |
| Aquatic Photolysis | pH 7, corrected for dark control | 0.5816 | - | 1.911 | SFO | 2918267 |
| | pH 6.3, natural water | 0.1892 | 0.3221 | 1.135 | DFOP | 2918268 |
| | pH 8.1, natural water | 0.1437 | - | 0.4773 | SFO | 2918269 |
| Soil Photolysis | Corrected for dark control 28.8 d pH 7 | 8.74 | 14.4 | 47.7 | IORE | 2918266 |
| Aerobic soil | Perry loamy sand pH 5.1 1 mg a.i./kg | 2.5 | 16.9 | 56.1 | IORE | 1166165 |
| | Perry loamy sand pH 5.1 10 mg a.i/kg | 15.41 | 35.16 | 97.76 | IORE | 1166165 |
| | Macomb silt clay loam pH 5.1 39 mg a..i./kg | 45.9 | 127 | 335 | DFOP | 1180935 |
| | Iowa peat pH 7 39 mg a.i./kg | 12.3 | 23 | 76.5 | IORE | 1180935 |
| | Tulia sandy loam pH 8 39 mg a.i./kg | 10.3 | 21.4 | 71.1 | IORE | 1180935 |
| | Painesville sandy loam pH 6 3.9 mg a.i./kg | 7.15 | 16.4 | 54.5 | IORE | 1180935 |
| | Marsillargues silty clay loam pH 7.8 1.29 mg a.i./kg | 3.96 | 6.57 | 21.8 | IORE | 2548555 |
| | 18 Acres sandy clay loam pH 7.8 1.29 mg a.i./kg | 4.67 | - | 15.5 | SFO | 2548555 |
| | Gartenacker loam pH 7 1.29 mg a.i./kg | 1.39 | 2.09 | 6.93 | IORE | 2548555 |
| | White Swan loam/silt loam pH 5.9 | 3.4 | 9.9 | 32.9 | IORE | 2548555 |

| Study | Details | DT50* (d) | Tr (d) | DT90 (d) | Kinetics | Study PMRA# |
|---|---|---|---|---|---|---|
| | 1.29 mg a.i./kg | | | | | |
| | Speyer 2.2<br>pH 6.1<br>2.5 mg a.i./kg | 9.59 | 20.2 | 67.3 | IORE | 2918270 |
| | Evesham 3 clay loam<br>pH 7.7<br>2.5 mg a.i./kg | 1.98 | 4.31 | 14.3 | IORE | 2918271 |
| | Malham silt loam<br>pH 6.2<br>2.5 mg a.i./kg | 3.15 | - | 10.5 | SFO | 2918271 |
| | Wick sandy loam<br>pH 5.1<br>2.5 mg a.i./kg | 19.6 | - | 66.2 | SFO | 2918271 |
| | Wick sandy loam (10°C)<br>pH 5.1<br>2.5 mg a.i./kg | 48.5 | - | 161 | SFO | 2918271 |
| | 18 Acres loam<br>pH 6<br>0.1 mg a.i./kg | 0.039 | 0.336 | 1.12 | IORE | 1500647<br>2918273 |
| | 18 Acres loam<br>pH 6<br>1.0 mg a.i./kg | 1.03 | 1.46 | 4.84 | IORE | 1500647<br>2918273 |
| | 18 Acres loam<br>pH 6<br>10 mg a.i./kg | 9.45 | - | 31.4 | SFO | 1500647<br>2918273 |
| | 18 Acres loam<br>pH 6<br>25 mg a.i./kg | 13.4 | 246 | 817 | IORE | 1500647<br>2918273 |
| | 18 Acres loam<br>pH 6<br>1.0 mg a.i./kg | 0.85 | 1.53 | 5.07 | SFO | 1500648<br>2918274 |
| | Chamberlain's Farm loamy sand<br>pH 7.5<br>1.0 mg a.i./kg | 0.274 | 0.453 | 1.51 | IORE | 1500648<br>2918274 |
| | ERTC sandy loam<br>pH 6.7<br>1.0 mg a.i./kg | 1.2 | 1.67 | 5.56 | IORE | 1500648<br>2918274 |
| | Munster loamy sand<br>pH 5.6<br>1.0 mg a.i./kg | 1.63 | 2.36 | 7.84 | IORE | 1500648<br>2918274 |
| Aerobic soil | 90% upper confidence bound on the mean | 47.0 | - | - | - | - |
| Anaerobic soil | Anaerobic conditions were not confirmed in either of the studies submitted. Aquatic anaerobic studies will be used. | | | | | |
| Aerobic Aquatic | Emperor Lake<br>Water pH 6.55<br>Sediment sandy loam<br>pH 5.6<br>Whole system | 2.47 | - | 8.22 | SFO | 1500651 |
| | Water only | 2.47 | - | 8.21 | SFO | 1500651 |
| | Bury Pond<br>Water pH 7.2<br>Sediment sandy clay | 0.826 | - | 2.75 | SFO | 1500651 |

| Study | Details | DT50* (d) | Tr (d) | DT90 (d) | Kinetics | Study PMRA# |
|---|---|---|---|---|---|---|
| | loam<br>pH 7.9<br>Whole system | | | | | |
| | Water only | 0.83 | - | 2.75 | SFO | 1500651 |
| | Swiss Lake<br>Water pH 7.0<br>Sediment sandy loam<br>pH 5.3<br>Whole system | 6.87 | - | 22.8 | SFO | 2737552 |
| | Water only | 7.55 | - | 25.1 | SFO | |
| | Sediment only | 0.9 | - | 3.0 | SFO | |
| | Calwich Abbey<br>Water pH 7.75<br>Sediment silt loam<br>pH 7.4<br>Whole system | 3.25 | 4.31 | 13.25 | DFOP | 2737552 |
| | Water only | 3.6 | - | 12 | SFO | |
| Aerobic Aquatic | Whole system 80th percentile | 5.33 | - | - | - | - |
| | Water only 80th percentile | 3.6 | - | - | - | - |
| Anaerobic aquatic | Swiss lake<br>Water pH 6.9<br>Sediment pH 5.3<br>Whole system | 3.08 | 5.67 | 16.2 | DFOP | 2737552 |
| - | Water only | 4.59 | - | 15.3 | SFO | 2737552 |

## Table 2 Transformation products of chlorothalonil found in acceptable fate studies and identification of ecotoxicity studies, if available

| Compound[1] (alternative names) | Study Type (hydrolysis, aerobic soil, etc) Reference standard (Y/N) | Geomean days from normalized data (n=number of studies) | Formation fraction in soil (transformed from)[2] |
|---|---|---|---|
| **IDENTIFIED (some incomplete)** | | | |
| R182281 (SDS 3701) | Hydrolysis (Y) | Increasing with time | n/a |
| | Phototransformation (Y) | Increasing with time | n/a |
| | Aerobic soil (Y) | 143.9 (n=13)* | 0.186 (parent) |
| | Aerobic aquatic (Y) | 265 (n=4)* | n/c |
| | Anaerobic aquatic (Y) | Could not calculate | n/c |
| R417888 (VIS01) | Hydrolysis (N) | - | - |
| | Phototransformation (Y) | None detected | n/a |
| | Aerobic soil (Y) | 332 (n=14)* | 0.106 (parent) |
| | Aerobic aquatic (Y) | Increasing with time | n/c |
| | Anaerobic aquatic (N) | - | - |
| R417888/Na | Hydrolysis (N) | - | - |
| | Phototransformation (N) | - | - |
| | Aerobic soil (Y) | None detected | n/a |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |

| Compound[1] (alternative names) | Study Type (hydrolysis, aerobic soil, etc) Reference standard (Y/N) | Geomean days from normalized data (n=number of studies) | Formation fraction in soil (transformed from)[2] |
|---|---|---|---|
| R418503 | Hydrolysis (N) | - | - |
| | Phototransformation (Y) | - | - |
| | Aerobic soil (Y) | 30.8 (n=7)* | 0.042 (parent) |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| R419492 | Hydrolysis (N) | - | - |
| | Phototransformation (N) | - | - |
| | Aerobic soil (Y) | 377 (n=7)* | 0.049 (parent)<br>1.0 (R418503)<br>0.451 (R417888) |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| R471811 | Hydrolysis (N) | - | - |
| | Phototransformation (N) | - | - |
| | Aerobic soil (Y) | 582 (n=8)* | 0.022 (parent)<br>0.755 (R417888) |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| R611553 | Hydrolysis (N) | - | - |
| | Phototransformation (N) | - | - |
| | Aerobic soil (Y) | None detected | n/c |
| | Aerobic aquatic (Y) | Could not calculate | - |
| | Anaerobic aquatic (N) | - | - |
| R611965 (SDS 46851) | Hydrolysis (N) | - | - |
| | Phototransformation (Y) | None detected | n/c |
| | Aerobic soil (Y) | 381 (n=10)* | 0.062 (parent)<br>0.946 (R611965) |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| R611966 (SDS 47523) | Hydrolysis (N) | - | - |
| | Phototransformation (Y) | None detected | n/c |
| | Aerobic soil (Y) | 75.2 (n=4)* | 0.079 (parent) |
| | Aerobic aquatic (Y) | Could not calculate | n/c |
| | Anaerobic aquatic (N) | - | - |
| R611967 (SDS 47524) | Hydrolysis (N) | - | - |
| | Phototransformation (Y) | None detected | n/c |
| | Aerobic soil (Y) | 26.5 (n=2)* | 0.150 (parent) |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| R611968 (SDS 47525) | Hydrolysis (N) | - | - |
| | Phototransformation (Y) | None detected | n/c |
| | Aerobic soil (Y) | 55.1 (n=1)* | 0.067 (parent) |
| | Aerobic aquatic (Y) | Could not calculate | n/c |
| | Anaerobic aquatic (N) | - | - |
| R613636 (SDS 19221) | Hydrolysis (Y) | 220 (n=1) | n/c |
| | Phototransformation (Y) | Increasing with time | n/c |
| | Aerobic soil (Y) | 33.0 (n=6)* | 0.091 (parent) |
| | Aerobic aquatic (Y) | Could not calculate | n/c |
| | Anaerobic aquatic (Y) | Could not calculate | n/c |

| Compound[1] (alternative names) | Study Type (hydrolysis, aerobic soil, etc) Reference standard (Y/N) | Geomean days from normalized data (n=number of studies) | Formation fraction in soil (transformed from)[2] |
|---|---|---|---|
| R613801 | Hydrolysis (N) | - | - |
| | Phototransformation (Y) | Could not calculate | n/c |
| | Aerobic soil (N) | - | - |
| | Aerobic aquatic (Y) | 15.5 (n=3)* | 0.223 (parent) |
| | Anaerobic aquatic (Y) | Could not calculate | n/c |
| R613841 (SDS 67042) | Hydrolysis (N) | - | - |
| | Phototransformation (N) | - | - |
| | Aerobic soil (Y) | None detected | n/c |
| | Aerobic aquatic (Y) | 47.0 (n=3)* | 0.245 (parent) |
| | Anaerobic aquatic (Y) | 36.4 (n=1) | n/c |
| R613842 | Hydrolysis (N) | - | - |
| | Phototransformation (N) | - | - |
| | Aerobic soil (N) | - | - |
| | Aerobic aquatic (Y) | 34.7 (n=1) | n/c |
| | Anaerobic aquatic (Y) | Can not calculate | n/c |
| SYN507900 (SDS 66882) (monomide of chlorothalonil) | Hydrolysis (N) | - | - |
| | Phototransformation (N) | - | - |
| | Aerobic soil (Y) | Could not calculate | n/c |
| | Aerobic aquatic (Y) | 180 (n=3) | n/c |
| | Anaerobic aquatic (N) | - | - |
| SYN546671[1] (R613803) | Hydrolysis (N) | - | - |
| | Phototransformation (N) | - | - |
| | Aerobic soil (N) | - | - |
| | Aerobic aquatic (N) | 160 (n=2) | n/c |
| | Anaerobic aquatic (N) | - | - |
| SYN546934 | Hydrolysis (N) | - | - |
| | Phototransformation (Y) | Could not calculate | n/c |
| | Aerobic soil (N) | - | - |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| SYN564872 | Hydrolysis (Y) | Increasing with time | n/c |
| | Phototransformation (N) | - | - |
| | Aerobic soil (Y) | Increasing with time | n/c |
| | Aerobic aquatic (Y) | Could not calculate | n/c |
| | Anaerobic aquatic (N) | - | - |
| SYN546677 | Hydrolysis (N) | - | - |
| | Phototransformation (N) | - | - |
| | Aerobic soil (N) | - | - |
| | Anaerobic soil (Y) | None detected | n/a |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| SYN546673 | Hydrolysis (N) | - | - |
| | Phototransformation (N) | - | - |
| | Aerobic soil (N) | - | - |
| | Anaerobic soil (Y) | None detected | n/a |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| PD1 (incomplete structure) | Hydrolysis (N) | - | - |
| | Phototransformation (Y) | Increasing with time | n/c |
| | Aerobic soil (N) | - | - |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |

| Compound[1] (alternative names) | Study Type (hydrolysis, aerobic soil, etc) Reference standard (Y/N) | Geomean days from normalized data (n=number of studies) | Formation fraction in soil (transformed from)[2] |
|---|---|---|---|
| PD2 (incomplete structure) | Hydrolysis (N) | - | - |
| | Phototransformation (Y) | Could not calculate | n/c |
| | Aerobic soil (N) | - | - |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| PD3 (incomplete structure) | Hydrolysis (N) | - | - |
| | Phototransformation (Y) | Increasing with time | n/c |
| | Aerobic soil (N) | - | - |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| PD4 (incomplete structure) | Hydrolysis (N) | - | - |
| | Phototransformation (Y) | 222.8 (n=1) | n/c |
| | Aerobic soil (N) | - | - |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| PD5 (incomplete structure) | Hydrolysis (N) | - | - |
| | Phototransformation (Y) | 16.5 (n=1) | n/c |
| | Aerobic soil (N) | - | - |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| CTL-7 | Hydrolysis (N) | - | - |
| | Phototransformation (Y) | None detected | - |
| | Aerobic soil (N) | - | - |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| CTL-8 | Hydrolysis (N) | - | - |
| | Phototransformation (Y) | Could not calculate | n/c |
| | Aerobic soil (N) | - | - |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| CTL-9 | Hydrolysis (N) | - | - |
| | Phototransformation (Y) | Could not calculate | n/c |
| | Aerobic soil (N) | - | - |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| CTL-10 | Hydrolysis (N) | - | - |
| | Phototransformation (Y) | None detected | - |
| | Aerobic soil (N) | - | - |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| SDS 3113 | Hydrolysis (Y) | Increasing with time | n/c |
| | Phototransformation (N) | - | - |
| | Aerobic soil (N) | - | - |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| SDS 66382 | Hydrolysis (N) | - | - |
| | Phototransformation (N) | - | - |
| | Aerobic soil (Y) | None detected | n/c |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |

| Compound[1] (alternative names) | Study Type (hydrolysis, aerobic soil, etc) Reference standard (Y/N) | Geomean days from normalized data (n=number of studies) | Formation fraction in soil (transformed from)[2] |
|---|---|---|---|
| SDS 66432 | Hydrolysis (N) | - | - |
| | Phototransformation (N) | - | - |
| | Aerobic soil (Y) | None detected | n/c |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| Pentachlorobenzonitrile | Hydrolysis (N) | - | - |
| | Phototransformation (Y) | None detected | n/c |
| | Aerobic soil (N) | - | - |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| 4-methoxy-2,5,6-trichlorlsophthalonitile | Hydrolysis (N) | - | - |
| | Phototransformation (N) | - | - |
| | Aerobic soil (Y) | None detected | n/c |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| MM162 | Hydrolysis (N) | - | - |
| | Phototransformation (Y) | Trace amounts, no data provided | n/c |
| | Aerobic soil (N) | - | - |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| MM196 | Hydrolysis (N) | - | - |
| | Phototransformation (Y) | None detected | n/c |
| | Aerobic soil (N) | - | - |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| I (N-oxide of chlorothalonil) | Hydrolysis (N) | - | - |
| | Phototransformation (Y) | Could not claculate | n/c |
| | Aerobic soil (N) | - | - |
| | Aerobic aquatic (N) | - | - |
| | Anaerobic aquatic (N) | - | - |
| **UNKNOWNS** | | | |
| PI | Hydrolysis | Increasing with time | - |
| PII | **Hydrolysis** | Increasing with time | - |
| A | Photolysis | Could not calculate | - |
| UN A | **Aerobic aquatic** | 58.11 (n=1) | - |
| A (expected to be different compounds) | Photolysis | Could not calculate | - |
| | **Aerobic aquatic** | Could not calculate | - |
| B (expected to be different compounds) | **Photolysis** | Could not calculate | - |
| | Aerobic aquatic | Could not calculate | - |
| C (expected to be different compounds) | Photolysis | Could not calculate | - |
| | Aerobic aquatic | Could not calculate | - |
| D (expected to be different compounds) | Photolysis | Could not calculate | - |
| | Aerobic aquatic | Could not calculate | - |
| E (expected to be different compounds) | Photolysis | Could not calculate | - |
| | Aerobic aquatic | Could not calculate | - |
| F | Photolysis | Could not calculate | - |
| G (expected to be different compounds) | Photolysis | Could not calculate | - |
| | Aerobic aquatic | Could not calculate | - |
| H (expected to be different compounds) | Photolysis | Could not calculate | - |
| | Aerobic aquatic | Could not calculate | - |
| I (expected to be | **Photolysis** | Increasing with time | - |

| **Compound[1] (alternative names)** | **Study Type (hydrolysis, aerobic soil, etc) Reference standard (Y/N)** | **Geomean days from normalized data (n=number of studies)** | **Formation fraction in soil (transformed from)[2]** |
|---|---|---|---|
| different compounds) | Aerobic aquatic | Could not calculate | - |
| J | **Photolysis** | Could not calculate | - |
| K | **Photolysis** | Increasing with time | - |
| L | **Photolysis** | Increasing with time | - |
| Unk 3 | **Aerobic soil** | Increasing with time | - |
| Unk 5 | **Aerobic soil** | Increasing with time | - |
| Water soluble non-ether extraction | Aerobic soil | Increasing with time | - |
| UN1 | **Aerobic soil** | Increasing with time | - |
| UN2 | **Aerobic soil** | Increasing with time | - |
| UN5 | **Aerobic soil** | Increasing with time | - |
| UN6 | Aerobic soil | 34.45 (n=2) | n/c |
| UK38 | Aerobic aquatic | Could not calculate | - |
| | Anaerobic aquatic | Could not calculate | - |
| UK40 | **Aerobic aquatic** | Increasing with time | - |
| | Anaerobic aquatic | Incerasing with time | - |
| UK44 | Aerobic aquatic | Could not calculate | - |
| | **Anaerobic aquatic** | Increasing with time | - |
| PI | **Aerobic aquatic** | Could not calculate | - |
| P2 | Aerobic aquatic | Increasing with time | - |
| P3 | Aerobic aquatic | Increasing with time | - |
| P4 | Aerobic aquatic | Could not calculate | - |
| C1 | **Aerobic aquatic** | Could not calculate | - |
| C2 | Aerobic aquatic | Could not calculate | - |
| C3 | Aerobic aquatic | Could not calculate | - |
| C4 | Aerobic aquatic | Could not calculate | - |
| C5 | **Aerobic aquatic** | Could not calculate | - |
| C6 | **Aerobic aquatic** | Could not calculate | - |
| C7 | Aerobic aquatic | Could not calculate | - |
| UK 21.1 | Aerobic water | Could not calculate | - |
| UK 23.1 | Aerobic water | Could not calculate | - |
| UK 25.6 | Aerobic water | Could not calculate | - |
| UK 31.1 | Aerobic water | Could not calculate | - |
| M2 | Lysimeter | Could not calculate | - |
| M6 | Lysimeter | Could not calculate | - |
| M7 | Lysimeter | Could not calculate | - |
| M10 | Lysimeter | Could not calculate | - |
| M15 | Lysimeter | Could not calculate | - |
| M16 | Lysimeter | Could not calculate | - |
| M17 | Lysimeter | Could not calculate | - |
| M18 | Lysimeter | Could not calculate | - |
| M19 | Lysimeter | Could not calculate | - |
| M20 | Lysimeter | Could not calculate | - |
| M21 | Lysimeter | Could not calculate | - |
| M22 | Lysimeter | Could not calculate | - |
| M23 | Lysimeter | Could not calculate | - |
| M24 | Lysimeter | Could not calculate | - |
| Polar (assumed not the same between studies but lumped together to make the table smaller) | Hydrolysis | Could not calculate | - |
| | **Phototransformation** | Could not calculate | - |
| | **Aerobic soil** | Could not calculate | - |
| | **Aerobic aquatic** | Could not calculate | - |

| **Compound[1] (alternative names)** | **Study Type (hydrolysis, aerobic soil, etc) Reference standard (Y/N)** | **Geomean days from normalized data (n=number of studies)** | **Formation fraction in soil (transformed from)[2]** |
|---|---|---|---|
| Others (assumed not the same between studies) | Hydrolysis | Could not calculate | - |
| | Phototransformation | Could not calculate | - |
| | Aerobic soil | Could not calculate | - |
| | Aerobic aquatic | Could not calculate | - |
| Unidentified (assumed not the same between studies) | Hydrolysis | Could not calculate | - |
| | Phototransformation | Could not calculate | - |
| | Aerobic soil | Could not calculate | - |
| | Aerobic aquatic | Could not calculate | - |
| Unknowns (assumed not the same between studies) | Hydrolysis | Could not calculate | - |
| | Phototransformation | Could not calculate | - |
| | Aerobic soil | Could not calculate | - |
| | Aerobic aquatic | Could not calculate | - |
| Minor unknowns (assumed not the same between studies) | Hydrolysis | Could not calculate | - |
| | Phototransformation | Could not calculate | - |
| | Aerobic soil | Could not calculate | - |
| | Aerobic aquatic | Could not calculate | - |
| Remainder (assumed not the same between studies) | Aerobic soil | Could not calculate | - |
| | Aerobic aquatic | Could not calculate | - |
| Baseline (assumed not the same between studies) | Aerobic soil | Could not calculate | - |
| | Aerobic aquatic | Could not calculate | - |
| Origin (thin layer chromatography) | Aerobic soil | Could not calculate | - |
| Zone 1 | Aerobic soil | Could not calculate | - |
| Vessel wash | Aerobic aquatic | Could not calculate | - |

*As reported in EFSA 2016 (PMRA# 2778799)

[1]Transformation product naming and identificiation is inconsistent between studies. The lack of chemical structures for the identified transformation products does not allow for all cases to be correctly cross referenced. Example is SYN546671 which EFSA identified as a major transformation product in an aerobic aquatic study, but this could not be confirmed. Due to the inconsistancies, this transformation product is included and assumed a major transformation product.

[2]Arithmetic average of all relevant formation fractions in the report (taken directly from EFSA, 2016 (PMRA# 2778799)). Formation fraction is the maximum amount of a transformation product formed during a study as expressed as a percentage of applied radioactivity.

# Appendix VI Ecotoxicity data

## Table 1 Chlorothalonil ecotoxicity studies used in the special review

| Species | Study PMRA# | Study Type/ Endpoint Type | Comments | Endpoint (mg a.i./L) |
|---|---|---|---|---|
| **Freshwater** | | | | |
| *Daphnia magna* | 1274228 (1500668) | 48-h EC50 | - | 0.056 |
| | 1310980 | 48-h EC50 | - | 0.059 |
| | 1310981 | 21-d NOEC | - | 0.0006 |
| *Lampsilis siliquioidea* glochidia | 3231061 | 48-h EC50 | - | 0.04 |
| *Lampsilis siliquioidea* juvenile | 3231061 | 96-h EC50 | - | 0.25 |
| *Unio elongatulus* glochidia | 3231062 | 48-h EC50 | Not used by EFSA | 0.047 |
| *Dreissena polymorpha* embryos | 3231062 | 48-h EC50 | Not used by EFSA | 0.00097 |
| *Chironomus riparius* | Study not submitted | 48-h EC50 | Overlying water | 0.015 |
| | | 28-d NOEC | Overlying water | 0.04 |
| *Chironomus dilutus* | Study not submitted | 10-d NOEC | Sediment (mg/kg)<br>Pore water | 10<br>0.0788 |
| *Hyalella azteca* | Study not submitted | 10-d NOEC | Sediment (mg/kg)<br>Pore water | 7.5<br>0.096 |
| *Paratya australiensis* | 3231076 | 7-d LC50 | - | 0.0109 |
| *Astacopsis gouldi* | 3231076 | 7-d LC50 | - | 0.0036 |
| *Colubotelson chiltoni* | 3231076 | 7-d LC50 | - | >0.04 |
| *Neoniphargus* sp | 3231076 | 7-d LC50 | - | >0.04 |
| Rainbow trout *Oncorhynchus mykiss* | 1274396 (1500664) | 48-h LC50<br>96-h LC50 | EFSA used the 48-h endpoint | 0.0044<br>0.03 |
| | 1310982 | 96-h LC50 | | 0.017 |
| | 3248240 | 96-h LC50 | Analytically verified nominal | 0.076 |
| | - | 96-h LC50 | >9 mg O2/L, static renewal | 0.057 |
| | Study not submitted | 96-h LC50 | - | 0.033 |
| | 3231082 | 96-h LC50 | Flow-through endpoint only. Same endpoint reported in Davies 1987 | 0.0171 |
| | 1310985 | 21-d NOEC | - | 0.0069 |
| | | 28-d LC50 | Static renewal | 0.054 |
| Carp *Cyprinus carpio* | 1310984 | 96-h LC50 | - | 0.060 |

| Species | Study PMRA# | Study Type/ Endpoint Type | Comments | Endpoint (mg a.i./L) |
|---|---|---|---|---|
| *Galaxias maculates* | 3231082 | 96-h LC50 | Flow-through | 0.0163 |
| *Galaxias truttaceus* | 3231082 | 96-h LC50 | Flow-through | 0.0189 |
| *Galaxias auratus* | 3231082 | 96-h LC50 | Flow-through | 0.0292 |
| Fathead minnow *Pimephales promelas* | 1236946 | 45-w NOEC | Flow-through | 0.003 |
| Fathead minnow *Pimephales promelas* Fish Short Term Reproduction Assay (FSTRA) | 2918311 | 21-d NOEC | Flow-through, repro endpoint | <0.000078 |
| *Xenopus laevis* embryo | 3231100 | 96-h LC50 | - | 0.0229 |
| *Xenopus laevis* larvae | 3231100 | 96-h LC50 | - | 0.0082 |
| *Xenopus laevis* Amphibian Metamorphosis Assay (AMA) | 2298718 | 21-d NOEC | - | 0.00061 |
| *Spea multiplicata* larvae | 3231100 | 96-h LC50 | - | 0.0107 |
| **Marine** | | | | |
| *Scenedesmus subspicatus* | 1310991 | 96-h EbC50 | - | 0.45 |
| *Navicula pelliculosa* | 1500676 | 120-h EbC50<br>72-h EbC50 | - | 0.0088<br>0.0051 |
| | Study not submitted | 120-h EbC50 | sediment | 0.069 |
| | Study not submitted | 72-h EbC50 | - | 0.0069 |
| *Lemna gibba* | 1500673 | 72-h EbC50 | - | 0.51 |
| | Study not submitted | 7-d EbC50 | - | 0.134 |
| Marine | | | | |
| *Amphiascus tenuiremis* | 3231101 | 96-h LC50 | male | 0.02672 |
| *Marsupenaeus japonicas* | 3231172 | 96-h LC50 | - | 0.28 |
| *Tigriopus japonicus* | 3231172 | 24-h EC50 | - | 0.016 |
| Oyster *Crassostrea virginica* | 1237165 | 96-h EC50 | - | 0.005 |
| Mysid Mysidopsis bahia | No study submitted | 28-d NOEC | - | 0.0004 |

| Species | Study PMRA# | Study Type/ Endpoint Type | Comments | Endpoint (mg a.i./L) |
|---|---|---|---|---|
| Sheepshead minnow *Cyprinodon variegatus* | No study submitted | 96-h LC50 | - | 0.028 |
| Threespine stickelback *Gasterosteus aculeatus* | - | 96-h LC50 | Only three analytical measures used to verify nominal | 0.035 |
| *Fungulus heterolitus* embryo | 3231172 | 8-w NOEC | - | 0.011 |
| *Skeletoma costatum* | 3231172 | 72-h ErC50 | - | 0.00095 |

## Table 2 End-use product ecotoxicity studies

| Species | Study PMRA# | Study Type/Endpoint Type | Comments | Endpoint (mg a.i./L) |
|---|---|---|---|---|
| *Daphnia magna* | 1181047 | 48-h EC50 | Bravo 720 | 0.097 |
| | 1237159 | 22-d NOEC | Chlorothalonil 40.4% | <0.0023 |
| | 1838902 | 48-h EC50 | Treoris | 0.045 |
| Rainbow Trout *Oncorhynchus mykiss* | 1236945 | 21-d NOEC | Daconil 2787 | 0.00087 |
| | **1181045** | **96-h LC50** | **Bravo 720** | **0.061** |
| | **No study submitted** | **96-h LC50** | **Bravo 720** | **0.0332** |
| | **Geomean** | | | **0.045** |
| | 1838901 | 96-h LC50 | Treoris | 0.0254 |
| Bluegill *Lepomis macrochirus* | 1181046 | 96-h LC50 | Bravo 720 | 0.064 |
| *Pseudokirchneriella subcapitata* | 1838903 | 72-h EC50 (cell density) | Treoris | 0.17 |

Boldedcells refer to endpoints that are the data source for the geomean.

## Table 3 Transformation product ecotoxicity studies

| Chemical | Species | Study PMRA# | Study Type/Endpoint Type | Endpoint (mg a.i./L) |
|---|---|---|---|---|
| R182281 | *Daphnia magna* | No data submitted | - | - |
| | Rainbow trout *Oncorhynchus mykiss* | Not submitted | 96-h LC50 | 9.1 |
| | | - | 28-d LC50 | 3.4 |
| | Threespine stickleback *Gasterosteus aculeatus* | - | 96-h LC50 | 21.2 |
| | Freshwater algae | No data submitted | - | - |
| R417888 | *Daphnia magna* | Not submitted | 48-h EC50 | >110 |
| | Rainbow trout *Oncorhynchus mykiss* | Not submitted | 96-h LC50 | >100 |
| | *Selenastrum capricornutum* | Not submitted | 72-h EbC50 | >100 |

| Chemical | Species | Study PMRA# | Study Type/Endpoint Type | Endpoint (mg a.i./L) |
|---|---|---|---|---|
| | *Pseudokirchneriella subcapitata* | Not submitted | 72-h EbC50 | >100 |
| R417888-Na | No data submitted | - | | |
| R418503 | No data submitted | - | | |
| R419492 | No data submitted | - | | |
| R471811 | No data submitted | - | | |
| R611553 | No data submitted | - | | |
| R611965 | *Daphnia magna* | Not submitted | 48-h EC50 | >123.6 |
| | Rainbow trout *Oncorhynchus mykiss* | Not submitted | 96-h LC50 | >120 |
| | *Selenastrum capricornutum* | Not submitted | 72-h EbC50 | 0.045 |
| | *Pseudokirchneriella subcapitata* | Not submitted | 72-h EbC50 | >45 |
| R611966 | No data submitted | - | | |
| R611967 | No data submitted | - | | |
| R611968 | No data submitted | - | | |
| R613636 | *Daphnia magna* | Not submitted | 48-h EC50 | 12.4 |
| | Rainbow trout *Oncorhynchus mykiss* | Not submitted | 96-h LC50 | 18 |
| | *Selenastrum capricornutum* | Not submitted | 72-h EbC50 | 5 |
| R613801 | *Daphnia magna* | No data submitted | | |
| | Rainbow trout *Oncorhynchus mykiss* | No data submitted | | |
| | *Pseudokirchneriella subcapitata* | Not submitted | 72-h EyC50 | 0.11 |
| | | Not submitted | 96-h EyC50 | 0.086 |
| R613841 | *Daphnia magna* | Not submitted | 48-h EC50 | >0.94 |
| | Rainbow trout *Oncorhynchus mykiss* | Not submitted | 96-h LC50 | >0.83 |
| | *Selenastrum capricornutum* | Not submitted | 72-h EbC50 | 0.00086 |
| | *Pseudokirchneriella subcapitata* | Not submitted | 72-h EbC50 | 0.12 |
| | *Navicula pelliculosa* | Not submitted | 72-h EbC50 | 0.06 |
| R613842 | *Daphnia magna* | No data submitted | | |
| | Rainbow trout *Oncorhynchus mykiss* | Not submitted | 96-h LC50 | >0.99 |
| | *Selenastrum capricornutum* | Not submitted | 72-h EbC50 | <0.88 |
| SYN507900 | No data submitted | - | - | - |
| SYN546671 | No data submitted | - | - | - |
| SYN546934 | No data submitted | - | - | - |
| SYN564872 | No data submitted | - | - | - |
| SYN546677 | No data submitted | - | - | - |
| SYN546673 | No data submitted | - | - | - |
| PD1 | No data submitted | - | - | - |
| PD2 | No data submitted | - | - | - |
| PD3 | No data submitted | - | - | - |
| PD4 | No data submitted | - | - | - |
| PD5 | No data submitted | - | - | - |

| Chemical | Species | Study PMRA# | Study Type/Endpoint Type | Endpoint (mg a.i./L) |
|---|---|---|---|---|
| CTL-7 | No data submitted | - | - | - |
| CTL-8 | No data submitted | - | - | - |
| CTL-9 | No data submitted | - | - | - |
| CTL-10 | No data submitted | - | - | - |
| MM162 | No data submitted | - | - | - |
| MM196 | No data submitted | - | - | - |
| SDS 3113 | No data submitted | - | - | - |
| SDS 66382 | No data submitted | - | - | - |
| SDS 66432 | No data submitted | - | - | - |
| I (N-oxide of chlorothalonil) | No data submitted | - | - | - |

# Appendix VII Spray drift risk assessment

## Table 1 Off-field refined risk assessment for aquatic organisms for wheat with spray drift deposition of 6% for ground boom and 23% for aerial applications

| Organism | Exposure | Species | Endpoint for RA (mg a.i./L) | Application Method (% Spray Deposition) | EEC (mg a.i./L) | RQ | LOC Exceeded |
|---|---|---|---|---|---|---|---|
| Freshwater Invertebrates | Acute 48-h $EC_{50}$ | *Dreissena polymorpha* embryo | 0.000485 | Ground boom (6%) | 0.0132 | **26.8** | **Yes** |
| | | | | Aerial (23%) | 0.051 | **105.15** | **Yes** |
| Freshwater Fish | Acute 48-h $LC_{50}$ | Rainbow trout *Oncorhynchus mykiss* | 0.00044 | Ground boom (6%) | 0.0132 | **29.55** | **Yes** |
| | | | | Aerial (23%) | 0.051 | **115.91** | **Yes** |
| Amphibians | Acute 96-h $LC_{50}$ | *Xenopus laevis* embryo | 0.00082 | Ground boom (6%) | 0.071 | **86.59** | **Yes** |
| | | | | Aerial (23%) | 0.27 | **329.27** | **Yes** |
| Aquatic Vascular Plants | Acute 7-d $EbC_{50}$ | *Lemna gibba* | 0.22 | Ground boom (6%) | 0.0132 | 0.06 | No |
| | | | | Aerial (23%) | 0.051 | 0.23 | No |
| Algae | Acute Geomean 72-h $EbC_{50}$ | *Navicula pelliculosa* | 0.00295 | Ground boom (6%) | 0.0132 | **4.4** | **Yes** |
| | | | | Aerial (23%) | 0.051 | **17.3** | **Yes** |
| Marine Invertebrates | Acute 96-h $LC_{50}$ | Oyster *Crassostrea virginica* | 0.0025 | Ground boom (6%) | 0.012 | **4.8** | **Yes** |
| | | | | Aerial (23%) | 0.046 | **18.4** | **Yes** |
| Marine Fish | Acute 96-h $LC_{50}$ | Sheepshead minnow *Cyprinodon variegates* | 0.0014 | Ground boom (6%) | 0.012 | **8.57** | **Yes** |
| | | | | Aerial (23%) | 0.046 | **32.86** | **Yes** |
| Marine Algae | Acute 72-h $ErC_{50}$ | *Skeletoma costatum* | 0.00048 | Ground boom (6%) | 0.012 | **25.3** | **Yes** |
| | | | | Aerial (23%) | 0.046 | **96.8** | **Yes** |

**Table 2 Off-field refined risk assessment for aquatic organisms for stone fruit with spray drift deposition of 74% for early application and 59% for late application air blast**

| Organism | Exposure | Species | Endpoint for RA (mg a.i./L) | Application Method (% Spray Deposition) | EEC (mg a.i./L) | RQ | LOC Exceeded |
|---|---|---|---|---|---|---|---|
| Freshwater Invertebrates | Acute 48-h $EC_{50}$ | *Dreissenapolymorpha* embryo | 0.000485 | Early Airblast (74%) | 0.57 | **1175.26** | **Yes** |
| | | | | Late Airblast (59%) | 0.45 | **927.84** | **Yes** |
| Freshwater Fish | Acute 48-h $LC_{50}$ | Rainbow trout *Oncorhynchus mykiss* | 0.00044 | Early Airblast (74%) | 0.57 | **1295.45** | **Yes** |
| | | | | Late Airblast (59%) | 0.45 | **1022.73** | **Yes** |
| Amphibians | Acute 96-h $LC_{50}$ | *Xenopus laevis* embryo | 0.00082 | Early Airblast (74%) | 3.03 | **3695.12** | **Yes** |
| | | | | Late Airblast (59%) | 2.42 | **2951.22** | **Yes** |
| Aquatic Vascular Plants | Acute 7-d $EbC_{50}$ | *Lemna gibba* | 0.22 | Early Airblast (74%) | 0.57 | **2.59** | **Yes** |
| | | | | Late Airblast (59%) | 0.45 | **2.05** | **Yes** |
| Algae | Acute Geomean 72-h $EbC_{50}$ | *Navicula pelliculosa* | 0.00295 | Early Airblast (74%) | 0.57 | **193.2** | **Yes** |
| | | | | Late Airblast (59%) | 0.45 | **152.5** | **Yes** |
| Marine Invertebrates | Acute 96-h $LC_{50}$ | Oyster *Crassostrea virginica* | 0.0025 | Early Airblast (74%) | 0.44 | **177.6** | **Yes** |
| | | | | Late Airblast (59%) | 0.35 | **141.6** | **Yes** |
| Marine Fish | Acute 96-h $LC_{50}$ | Sheepshead minnow *Cyprinodon variegates* | 0.0014 | Early Airblast (74%) | 0.44 | **317.14** | **Yes** |
| | | | | Late Airblast (59%) | 0.35 | **252.86** | **Yes** |
| Marine Algae | Acute 72-h $ErC_{50}$ | *Skeletoma costatum* | 0.00048 | Early Airblast (74%) | 0.44 | **934.7** | **Yes** |
| | | | | Late Airblast (59%) | 0.35 | **745.3** | **Yes** |

**Table 3 Off-field refined risk assessment for aquatic organisms for turf with spray drift deposition of 6% for ground boom application**

| Organism | Exposure | Species | Endpoint for RA (mg a.i./L) | Application Method (% Spray Deposition) | EEC (mg a.i./L) | RQ | LOC Exceeded |
|---|---|---|---|---|---|---|---|
| Freshwater Invertebrates | Acute 48-h $EC_{50}$ | *Dreissena polymorpha* embryo | 0.000485 | Ground boom (6%) | 0.09 | **185.57** | **Yes** |
| Freshwater Fish | Acute 48-h $LC_{50}$ | Rainbow trout *Oncorhynchus mykiss* | 0.00044 | Ground boom (6%) | 0.09 | **204.55** | **Yes** |
| Amphibians | Acute 96-h $LC_{50}$ | *Xenopus laevis* embryo | 0.00082 | Ground boom (6%) | 0.49 | **597.56** | **Yes** |
| Aquatic Vascular Plants | Acute 7-d $EbC_{50}$ | *Lemna gibba* | 0.22 | Ground boom (6%) | 0.09 | 0.41 | No |

| Organism | Exposure | Species | Endpoint for RA (mg a.i./L) | Application Method (% Spray Deposition) | EEC (mg a.i./L) | RQ | LOC Exceeded |
|---|---|---|---|---|---|---|---|
| Algae | Acute Geomean 72-h $EbC_{50}$ | *Navicula pelliculosa* | 0.00295 | Ground boom (6%) | 0.09 | **30.5** | **Yes** |
| Marine Invertebrates | Acute 96-h LC50 | Oyster *Crassostrea virginica* | 0.0025 | Ground boom (6%) | 0.09 | **4.8** | **Yes** |
| Marine Fish | Acute 96-h $LC_{50}$ | Sheepshead minnow *Cyprinodon variegates* | 0.0014 | Ground boom (6%) | 0.09 | **8.57** | **Yes** |
| Marine Algae | Acute 72-h $ErC_{50}$ | *Skeletonema costatum* | 0.00048 | Ground boom (6%) | 0.09 | **25.3** | **Yes** |

## Table 4 Comparison of environmental risk assessments (current vs previous) for chlorothalonil

| Parent Chlorothalonil Only | | Previous Risk Assessment (PRVD2011-14) | Current Risk Assessment |
|---|---|---|---|
| Fate endpoints | Hydrolysis | pH 5 stable<br>pH 7 stable<br>pH 9 38 days | pH 5 stable<br>pH 7 stable<br>pH 9 50.62 days |
| | Phototransformation – soil | Stable | 14.4 days |
| | Phototransformation – water | 65 days | 18 days |
| | Aerobic soil | 52 days (terrestrial field dissipation study used as it was longer than the laboratory studies) | 47 days |
| | Anaerobic soil | 5 – 15 days | n/a |
| | Mobility - adsorption | $K_d$ 16.6 L/kg<br>$K_{oc}$ 1300-14000 | $K_d$ 1.2 L/kg<br>$K_{oc}$ 471.2-10875 |
| | Mobility – desorption | n/a | Percent desorbed increases with increasing initial concentration, up to 30% desorption under saturated conditions |
| | Aerobic aquatic | 0.5 days | 5.33 days |
| | Anaerobic aquatic | n/a | 3.08 days |

| **Parent Chlorothalonil Only** | | **Previous Risk Assessment (PRVD2011-14)** | **Current Risk Assessment** |
|---|---|---|---|
| Water EECs (Turf use pattern) | Ecoscenario | Peak values (Prairie)<br>15 cm – 0.8 mg a.i./L<br>80 cm – 0.2 mg a.i./L<br>Chronic 21-d (Atlantic)<br>15 cm – 0.07 mg a.i./L<br>80 cm – 0.07 mg a.i./L | 96-h values (BC – Vancouver)<br>15 cm – 0.509 mg a.i./L<br>80 cm – 0.173 mg a.i./L<br>Chronic values (BC – Vancouver)<br>15 cm – 0.138 mg a.i./L<br>80 cm – 0.089 mg a.i./L |
| Ecotoxicity effects metric | Acute freshwater fish | SSD $HC_5$ 0.013 mg a.i./L | *Oncorhynchus mykiss*<br>48-h $LC_{50}$ 0.00044 mg a.i./L |
| | Chronic freshwater fish | *Oncorhynchus mykiss*<br>21-d NOEC 0.003 mg a.i./L | *Pimephales promelas*<br>21-d NOEC <0.00007 mg a.i./ha |
| | Acute amphibians | *Bufo bufo japonicas*<br>48-h $LC_{50}$ 0.016 mg a.i./L | *Xenopus laevis*<br>96-h $LC_{50}$ 0.00082 mg a.i./L |
| | Chronic amphibians | *Oncorhynchus mykiss* surrogate<br>21-d NOEC 0.003 mg a.i./L | *Xenopus laevis*<br>21-d NOEC 0.00061 mg a.i./L |
| Runoff risk quotients (Turf use pattern ecoscenario EECs) | Freshwater fish | Acute RQ – 15.4<br>Chronic RQ – 6.7 | Acute RQ – 484<br>Chronic RQ – >1141 |
| | Amphibians | Acute RQ – 50<br>Chronic RQ – 23.3 | Acute RQ – 621<br>Chronic RQ – 226 |

n/a – not available

# Appendix VIII Runoff risk assessment

## Table 1 Ecoscenario off-field refined risk assessment for freshwater aquatic organisms for 24 and 96-hours at 15 and 80 cm water depths

| **Organism** | **Effect matrix (mg a.i./L)** | **Risk Quotients** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **Highbush Blueberries** | **Lowbush blueberries** | **Carrots** | **Outdoor conifers** | **Potatoes** | **Peaches** | **Processing tomatoes** | **Turf** | **Wheat** |
| **Freshwater Acute** | | | | | | | | | | |
| 24-hour 80 cm EEC (mg a.i./L) | | 0.014 | 0.057 | 0.039 | 0.0063 | 0.038 | 0.036 | 0.101 | 0.213 | 0.014 |
| *D. polymorpha* embryo | Acute 48-h $EC_{50}$ 0.000485 mg a.i./L | 29 | 118 | 80 | 13 | 78 | 74 | 208 | 439 | 29 |
| Rainbow trout *Oncorhynchus mykiss* | Acute 48-h $LC_{50}$ 0.00044 mg a.i./L | 32 | 130 | 89 | 14 | 86 | 82 | 230 | 484 | 32 |
| *Navicula pelliculosa* | Acute Geomean 72-h $EbC_{50}$ 0.00295 mg a.i./L | 4.7 | 19 | 13.2 | 2.1 | 13 | 12 | 34.2 | 72.2 | 4.7 |
| 96-hour 80 cm EEC (mg a.i./L) | | 0.012 | 0.042 | 0.029 | 0.041 | 0.03 | 0.028 | 0.078 | 0.173 | 0.0098 |
| *Lemna gibba* | Acute 7-d $EbC_{50}$ 0.22 mg a.i./L | 0.05 | 0.19 | 0.13 | 0.19 | 0.14 | 0.13 | 0.35 | 0.79 | 0.04 |
| Amphibian Acute | | | | | | | | | | |
| 96-hour 15 cm EEC (mg a.i./L) | | 0.036 | 0.094 | 0.063 | 0.108 | 0.061 | 0.079 | 0.197 | 0.509 | 0.021 |
| *Xenopus laevis* embryo | Acute 96-h $LC_{50}$ 0.00082 mg a.i./L | 44 | 115 | 77 | 132 | 74 | 96 | 240 | 621 | 26 |

## Table 2 Ecoscenario off-field refined risk assessment for freshwater aquatic organisms for 21-day values at 15 and 80 cm water depths

| Organism | Effect Matrix (mg a.i./L) | Risk Quotients | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Highbush Blueberries | Lowbush blueberries | Carrots | Outdoor conifers | Potatoes | Peaches | Processing tomatoes | Turf | Wheat |
| **Freshwater Chronic** | | | | | | | | | | |
| 21-day 80 cm EEC (mg a.i./L) | | 0.0066 | 0.022 | 0.011 | 0.02 | 0.016 | 0.017 | 0.034 | 0.089 | 0.0036 |
| *Daphnia magna* | Chronic 21-d NOEC 0.0006 mg a.i./L | 11 | 37 | 18 | 33 | 27 | 28 | 57 | 148 | 6 |
| Fathead minnow *Pimephales promelas* FSTRA | Chronic 21-d NOEC <0.000078 mg a.i./L (reproduction) | >85 | >282 | >141 | >256 | >205 | >218 | >436 | >1141 | >46 |
| **Amphibian Chronic** | | | | | | | | | | |
| 21-day 15 cm EEC (mg a.i./L) | | 0.012 | 0.036 | 0.015 | 0.035 | 0.025 | 0.042 | 0.066 | 0.138 | 0.0046 |
| *Xenopus laevis* AMA | Chronic 21-d NOEC 0.00061 mg a.i./L (development) | 20 | 59 | 25 | 57 | 41 | 69 | 108 | 226 | 7.5 |

## Table 3 Ecoscenario off-field refined risk assessment for marine aquatic organisms for 24 and 96-hour values at 80 cm water depths (based on freshwater 80 cm depth modelled values)

| Organism | Effect Matrix (mg a.i./L) | Risk Quotients | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Highbush Blueberries | Lowbush blueberries | Carrots | Outdoor conifers | Potatoes | Peaches | Processing tomatoes | Turf | Wheat |
| Marine Acute | | | | | | | | | | |
| 24-hour 80 cm EEC (mg a.i./L) | | 0.014 | 0.057 | 0.039 | 0.0063 | 0.038 | 0.036 | 0.101 | 0.213 | 0.014 |
| *Skeletonema costatum* | Acute 72-h $ErC_{50}$ 0.000475 mg a.i./L | 29.5 | 120.0 | 82.1 | 13.3 | 80.0 | 75.8 | 212.6 | 448.4 | 29.5 |
| 96-hour 80 cm EEC (mg a.i./L) | | 0.012 | 0.042 | 0.029 | 0.041 | 0.03 | 0.028 | 0.078 | 0.173 | 0.0098 |
| Oyster *Crassostrea virginica* | Acute 96-h $LC_{50}$ 0.0025 mg a.i./L | 4.8 | 16.8 | 11.6 | 16.4 | 12.0 | 11.2 | 31.2 | 69.2 | 3.9 |
| Sheepshead minnow *Cyprinodon variegates* | Acute 96-h $LC_{50}$ 0.0028 mg a.i./L | 4.3 | 15.0 | 10.4 | 14.6 | 10.7 | 10.0 | 27.9 | 61.8 | 3.5 |

# Appendix IX Environment incident report summary

## Table 1 Incident reporting program submissions for chlorothalonil

| Submission Number | Type | Details | Outcome |
|---|---|---|---|
| 2011-4359 | Study<br>Acute daphnia | Study was conducted with a co-formulated (chlorothalonil and boscalid) end-use product | This study was found not relevant to the Canadian use pattern as there are no end-use products registered that co-formulate chlorothalonil and boscalid. No further action was required. |
| 2013-2376 | Study<br>Amphibian metamorphosis assay (AMA) | At the time of the IR submission, the AMA was a newer study to the PMRA and was not a data requirement. The PMRA was in the process of determining how these studies would be used in the environmental risk assessment. Thus, the review was delayed until 2017. | The review of this study was completed in 2017 and the data provided a development endpoint for the new risk assessment. The results of this study indicated that the current risk assessment was under-predicting risk to amphibians. A Special Review was recommended. |
| 2015-0257 | Study<br>Aerobic soil | This study was reviewed. This was the first fate study submitted that detailed the new analytical methods that allowed for the detection of a number of new, major transformation products.The $DT_{50}$ values calculated were longer than previous laboratory studies but in-line with the Terrestrial Field Dissipation (TFD) endpoint used quantitatively in the re-evaluation risk assessment. While laboratory studies are typically used quantitatively to calculate EECs in the environmental risk assessment, the TFD study endpoints were used for the chlorothalonil re-evaluation, likely because they were longer than the laboratory aerobic soil endpoints. | A risk assessment conducted with the new endpoints did not result in higher risk to the environment. There was insufficient information on the new major transformation products to determine if a Special Review was required. No further action was required. |
| 2016-7425 | Study<br>Chronic adult honeybee | The first of the new pollinator studies required by the PMRA. The EFSA risk assessment resulted in acceptable risk to bees (PMRA# 2778798, page 163). | The endpoint was found to result in higher risk to bees than the original risk assessment. There are no mitigation statements currently on chlorothalonil labels for bees. It was decided that the Special Review would focus on the aquatic risk as the area of concern was based on the EU decision of 2019. |
| 2017-1175 | Study<br>Anaerobic soil | A second fate study using the new analytical methods. The endpoint calculated was not significantly different from previous endpoints. | The new study did not change the characterisation of risk to the environment and no further action was required. |

| Submission Number | Type | Details | Outcome |
|---|---|---|---|
| 2017-1176 | Study<br>Aerobic water/sediment | A third fate study with the new analytical methods. This study resulted in much longer aquatic $DT_{50}$ values which significantly altered the aquatic exposure estimates and the risk assessment. | The endpoint from the new study suggested an increased risk to aquatic organsims, increase in buffer zones required, and was expected to affect drinking water modelling. A Special Review was recommended. |
| 2018-6413 | Fish mortality 2017 | Campbelton, PEI<br>Sampling detections as high as 0.015 mg a.i./L | Draft – Highly Probable<br>Chlorothalonil was the cause of the fish kill |
| 2016-6334 | Fish mortality 2011 | | Draft – Highly Probable<br>Chlorothalonil was the cause of the fish kill |
| 2016-5482 | Fish mortality 2011 | Barclay Brook and Trout River, PEI | Highly Probable<br>Chlorothalonil was the cause of the fish kill |
| 2016-5481 | Fish mortality 2011 | | Highly Probable<br>Chlorothalonil was the cause of the fish kill |
| 2013-5390 | Fish mortality 2013 | Ontario | Draft - Highly Probable<br>Chlorothalonil was the cause of the fish kill |

# References

## A. Studies/Information submitted by the registrant

### Dietary

| PMRA Number | Reference |
|---|---|
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| 2423099 | 2013, Chlorothalonil: Magnitude of the Residue on Cranberry, DACO: 7.4.1 |

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| PMRA Number | Reference |
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| 1180935 | Effect of microorganisms upon the soil metabolism of daconil and 4-hydroxy-2,5,6-trichloroisophthalonitirle. Date 2-5-1976. Document # 1000-3EF-76-2087-001, DACO: 8.2.3.4.2 |
| 1181045 | Acute toxicity to rainbow trout (Oncorhynchus mykiss) under flow-through conditions with Bravo 720. Document # 5727-93-0120-TX-002. Date - 29 December 1994. DACO: 9.5.2.1 |
| 1181046 | Bravo 720 - Acute toxicity to bluegill sunfish (Lepomis macrochirus) under flow-through conditions. Document # 5088-91-0428-TX-002. Date - 29 December 1994. DACO: 9.5.2.2 |
| 1181047 | Bravo 720-acute toxicity to daphnids (Daphnia magna) under flow-through conditions. Document # 5087-91-0427-TX-002. Date 29 December 1994, DACO: 9.3.2 |
| 1219851 | HYDROLYSIS OF DACONIL & METABOLITE 4-HYDROXY-2,5,6-TRICHLOROISOPTHALONITRILE IN ABSCENSE OF LIGHT AT PH LEVELS 5, 7 & 9, DACO: 8.2.1 |
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| 1236946 | A chronic study in the fathead minnow with technical chlorothalonil. Document # 090-5TX-79-0049-003. 1980. DACO: 9.5.5 |
| 1237159 | Daphnia magna, reproduction test with Daconil Extra. Date 1989. Project 025751. DACO 9.3.1 |
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| 1274228 | 1998, CHLOROTHALONIL - ASSESSMENT OF ACUTE TOXICITY TO DAPHNIA MAGNA IN THE PRESENCE OF SEDIMENT, DACO: 9.3.2 |
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|---|---|
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| 1310991 | 1992, The algistatic activity of chlorothalonil, DACO: 9.8.2 |
| 1340587 | 1996, 14C-Chlorothalonil - Hydrolysis Under Laboratory Conditions, DACO: 8.2.3.2 |
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| 2918269 | 2006, CHLOROTHALONIL - PHOTODEGRADATION IN NATURAL WATER, DACO: 8.2.3.3.2 |
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| 2918273 | 2000, Aerobic Soil Degradation at Four Treatment Rates., DACO: 8.2.3.4.2 |
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## Published information

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