Proposed Registration Decision PRD2022-01

Tiafenacil, Tiafenacil 70WG Herbicide, Tiafenacil 339SC Herbicide

(*publié aussi en français*)

6 January 2022

This document is published by the Health Canada Pest Management Regulatory Agency. For further information, please contact:

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ISSN: 1925-0878 (print)
1925-0886 (online)

Catalogue number: H113-9/2022-1E (print version)
H113-9/2022-1E-PDF (PDF version)

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Overview

Proposed registration decision for Tiafenacil

Health Canada's Pest Management Regulatory Agency (PMRA), under the authority of the *Pest Control Products Act*, is proposing registration for the sale and use of Tergeo Technical Herbicide, Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide, containing the technical grade active ingredient tiafenacil, to control weeds in field corn, soybean, spring wheat, grapes, summerfallow and non-crop areas.

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

This Overview describes the key points of the evaluation, while the Science Evaluation provides detailed technical information on the human health, environmental and value assessments of tiafenacil, Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide.

What does Health Canada consider when making a registration decision?

The key objective of the *Pest Control Products Act* is to prevent unacceptable risks to people and the environment from the use of pest control products. Health or environmental risk is considered acceptable[1] if there is reasonable certainty that no harm to human health, future generations or the environment will result from use or exposure to the product under its proposed conditions of registration. The Act also requires that products have value[2] when used according to the label directions. Conditions of registration may include special precautionary measures on the product label to further reduce risk.

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

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

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

Before making a final registration decision on tiafenacil, Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide, Health Canada's PMRA will consider any comments received from the public in response to this consultation document.[3] Health Canada will then publish a Registration Decision[4] on tiafenacil, Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide, which will include the decision, the reasons for it, a summary of comments received on the proposed registration decision and Health Canada's response to these comments.

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

What is Tiafenacil?

Tiafenacil is a non-selective, contact herbicide for weed management early in the season in certain crops, and throughout the season in grapes and non-crop areas.

Health considerations

Can approved uses of tiafenacil affect human health?

Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide, containing tiafenacil, are unlikely to affect your health when used according to label directions.

Potential exposure to tiafenacil may occur through the diet (food and drinking water), when handling and applying the end-use products, or when coming into contact with treated surfaces. When assessing health risks, two key factors are considered: the levels where no health effects occur and the levels to which people may be exposed. The dose levels used to assess risks are established to protect the most sensitive human population (for example, children and nursing mothers). As such, sex and gender are taken into account in the risk assessment. Only uses for which the exposure is well below levels that cause no effects in animal testing are considered acceptable for registration.

Toxicology studies in laboratory animals describe potential health effects from varying levels of exposure to a chemical and identify the dose levels at which no effects are observed. The health effects noted in animals occur at doses more than 100-fold higher (and often much higher) than levels to which humans are normally exposed when pesticide products are used according to label directions.

In laboratory animals, the technical grade active ingredient tiafenacil was of low acute toxicity by the oral, dermal and inhalation routes of exposure. Tiafenacil was minimally irritating to the eyes and non-irritating to the skin, and did not cause an allergic skin reaction.

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

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

The acute toxicity of the end-use product Tiafenacil 70WG Herbicide was low by the oral, dermal and inhalation routes of exposure. Tiafenacil 70WG Herbicide was minimally irritating to the eyes and non-irritating to the skin, and did not cause an allergic skin reaction.

The acute toxicity of the end-use product Tiafenacil 339SC Herbicide was low by the oral, dermal and inhalation routes of exposure. Tiafenacil 339SC Herbicide was non-irritating to the eyes and skin, and did not cause an allergic skin reaction.

Registrant-supplied short- and long-term (lifetime) animal toxicity tests were assessed for the potential of tiafenacil to cause neurotoxicity, immunotoxicity, chronic toxicity, cancer, reproductive and developmental toxicity, and various other effects. The most sensitive endpoints for risk assessment were effects on red blood cell parameters and the liver. The overall evidence suggests low concern for young animals and their sensitivity to tiafenacil when compared to adult animals. The risk assessment protects against the effects noted above and other potential effects by ensuring that the level of exposure to humans is well below the lowest dose level at which these effects occurred in animal tests.

Occupational risks From handling Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide

Occupational risks are not of health concern when Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide are used according to the proposed label directions, which include protective measures.

Workers mixing, loading or applying Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide, and workers entering recently treated areas can come in direct contact with tiafenacil residues on the skin. Therefore, the labels specify that anyone mixing, loading and applying Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide must wear a long-sleeved shirt, long pants, chemical-resistant gloves, socks and shoes. The labels also require that workers do not enter or be allowed entry into treated crops during the restricted-entry interval (REI) of 12 hours for agricultural areas and until sprays have dried in non-crop areas. Taking into consideration the label statements, the number of applications and the duration of exposure for handlers and postapplication workers, the risks to these individuals are not of health concern.

Health risks to bystanders

Bystander risks are not of health concern when Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide are used according to the proposed label directions and spray drift restrictions are observed.

A standard label statement to protect against drift during application is on the label. Therefore, health risks to bystanders are not of concern.

Residues in food and drinking water

Dietary risks from food and drinking water are not of health concern.

Animal studies revealed no acute health effects. Consequently, a single dose of tiafenacil is not likely to cause acute health effects in the general population (including infants and children).

Aggregate dietary intake estimates (food plus drinking water) revealed that the general population and infants less than one-year-old, the subpopulation that would ingest the most tiafenacil relative to body weight, are expected to be exposed to less than 92% of the acceptable daily intake (ADI). When the common metabolite trifluoroacetic acid (TFA) is included for rotational crops, the highest exposure estimate is 102% of the ADI (infants less than one-year old). Based on these estimates, the chronic dietary risk from tiafenacil is not of health concern for all population subgroups due to the level of conservatism inherent in the assessment.

The *Food and Drugs Act* prohibits the sale of adulterated food, that is, food containing a pesticide residue that exceeds the established maximum residue limit (MRL). Pesticide MRLs are established for *Food and Drugs Act* purposes through the evaluation of scientific data under the *Pest Control Products Act.* Given that dietary risks from the consumption of foods are shown to be acceptable when tiafenacil is used according to the supported label directions, MRLs are being proposed as a result of this assessment (refer to PMRL2022-01*, Tiafenacil*).

MRLs for tiafenacil determined from the acceptable residue trials conducted throughout Canada and the United States on grapes, corn, soybeans and wheat can be found in the Science Evaluation of this consultation document.

Environmental considerations

What happens when tiafenacil is introduced into the environment?

When tiafenacil is used according to the label directions, the risks to the environment are acceptable.

When tiafenacil is used in accordance with label directions and the required precautions, the risks associated with tiafenacil are acceptable from the viewpoint of environmental protection.

When tiafenacil is applied as a foliar spray to control grassy and broadleaf weeds, it breaks down very quickly to a number of transformation products in the presence of sunlight in shallow water. Tiafenacil can also break down quickly through the action of microbes in soil and aquatic systems. Many of the transformation products of tiafenacil are formed in significant amounts in the environment. Most of these transformation products can move downward through the soil and reach groundwater. The transformation products can also move off the treatment area to reach surface waters such as ponds, streams, and rivers. However, adverse effects of the transformation products to terrestrial and aquatic life are not expected when the label directions

are followed. Tiafenacil and its transformation products are not likely to accumulate in tissues of organisms.

Tiafenacil can affect non-target plants adjacent to treated fields following application. If it enters bodies of water after it is sprayed, tiafenacil can affect freshwater fish, amphibians and aquatic plants and algae. To minimize exposure to sensitive non-target species, spray buffer zones are required. In addition, precautionary statements and best management practices are required on the label. When tiafenacil is used in accordance with the label and the required precautions, the resulting environmental risk is considered to be acceptable.

Value considerations

What is the value of Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide?

Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide are conventional, non-selective, contact herbicides for the control or suppression of certain annual broadleaf weed species when applied in the early season in field corn, soybean and spring wheat, and throughout the season in grapes, summerfallow and non-crop areas.

Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide will serve as additional options for early season weed management and can be included as a component of integrated weed management programs that include tillage and other preplant, pre-emergent and/or postemergent herbicides for season-long weed management.

Measures to minimize risk

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

The key risk-reduction measures being proposed on the label of Tergeo Technical Herbicide, Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide to address the potential risks identified in this assessment are as follows.

Key risk-reduction measures

Human health

To reduce the potential of workers coming into direct contact with tiafenacil on the skin or through inhalation of sprays, workers mixing, loading and applying Tiafenacil 70WG Herbicide or Tiafenacil 339SC Herbicide and performing cleaning and repair activities must wear a long-sleeved shirt, long pants, chemical-resistant gloves, socks and shoes. Additionally, standard label statements to protect against drift during application are on the labels. The labels also require that workers do not enter or be allowed entry into treated agricultural fields during the REI of 12 hours and until sprays have dried in non-crop areas.

Environment

With the following risk reduction measures on the label, the risks are considered acceptable:

- Environmental hazard statements for terrestrial plants and aquatic organisms;
- Precautionary label statements for run-off and leaching; and
- Label statements and spray buffer zones to protect non-target aquatic and terrestrial habitats.

Next steps

Before making a final registration decision on tiafenacil, Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide, Health Canada's PMRA will consider any comments received from the public in response to this consultation document. Health Canada will accept written comments on this proposal up to 45 days from the date of publication of this document. Please note that, to comply with Canada's international trade obligations, consultation on the proposed MRLs will also be conducted internationally via a notification to the World Trade Organization. Please forward all comments to Publications (contact information on the cover page of this document). Health Canada will then publish a Registration Decision, which will include its decision, the reasons for it, a summary of comments received on the proposed decision and Health Canada's response to these comments.

Other information

When Health Canada makes its registration decision, it will publish a Registration Decision on tiafenacil, Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide (based on the Science Evaluation of this consultation document). In addition, the test data referenced in this consultation document will be available for public inspection, upon application, in the PMRA's Reading Room.

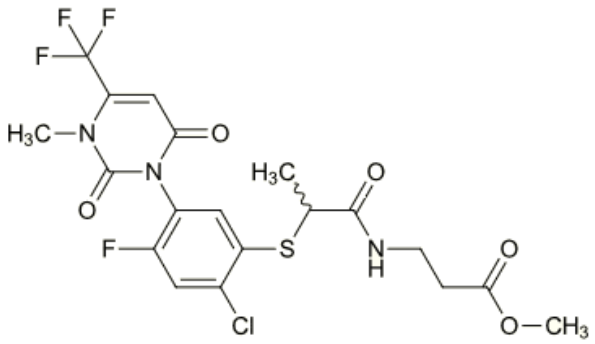
Science Evaluation

Tiafenacil, Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide

1.0 The Active Ingredient, Its Properties and Uses

1.1 Identity of the Active Ingredient

Active substance

Function	Herbicide
Chemical name	
1. International Union of Pure and Applied Chemistry (IUPAC)	methyl 3-{[(2RS)-2-({2-chloro-5-[3-methyl-2,6-dioxo-4-(trifluoromethyl)-3,6-dihydropyrimidin-1(2H)-yl]-4-fluorophenyl}thio)propanoyl]amino}propanoate
2. Chemical Abstracts Service (CAS)	methyl *N*-[2-[[2-chloro-5-[3,6-dihydro-3-methyl-2,6-dioxo-4-(trifluoromethyl)-1(2*H*)-pyrimidinyl]-4-fluorophenyl]thio]-1-oxopropyl]-β-alaninate
CAS number	1220411-29-9
Molecular formula	$C_{19}H_{18}ClF_4N_3O_5S$
Molecular weight	511.88
Structural formula	
Purity of the active ingredient	98.2%

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

Technical product — Tergeo Technical Herbicide

Property	Result
Colour and physical state	Pale yellow solid
Odour	Characteristic
Melting range	120–123 °C
Boiling point or range	The product starts boiling at 342 °C at atmospheric pressure.
Relative density	$D_4^{20} = 1.513$
Vapour pressure at 20 °C	$\leq 1.48 \times 10^{-8}$ Pa
Ultraviolet (UV)-visible spectrum	Media [methanol] / λ (nm) / ε (L*mol^{-1}*cm^{-1}) Neutral 205 29300 270 9300 290 4700 Acidic 204 25500 268 7200 290 3400 Basic 218 15400 254 10000 290 2800 No absorption at λ>290 nm.
Solubility in water at 20 °C	110 mg/L
Solubility in organic solvents at 20 °C	Solvent / Solubility (g/L) n-heptane 0.074 xylene 4.3 dichloroethane 323 acetone 189 methanol 24 *N,N*-dimethyl formamide 227 ethyl acetate 137
n-Octanol-water partition coefficient (K_{ow})	log $K_{ow} = 2.0$
Dissociation constant (pK_a)	Not applicable
Stability (temperature, metal)	Stable to iron, aluminum, iron acetate and aluminum acetate at 54 °C for 14 days. Stable at ambient conditions for at least 2 years.

End-use product — Tiafenacil 70WG Herbicide

Property	Result
Colour	Beige
Odour	Odourless
Physical state	Solid
Formulation type	WD (water dispersible granule)
Label concentration	700 g/kg
Container material and description	Plastic bottle or drum, 0.10 – 60 kg
Density	0.530–0.587 g/mL
pH of 1% dispersion in water	8.1–8.5
Oxidizing or reducing action	The product is not an oxidizing agent.
Storage stability	The product is stable for 14 days when stored at 54 °C in HDPE bottles.
Corrosion characteristics	No corrosion to HDPE bottles was observed after 2 week storage at 54 °C.
Explodability	The product did not display explosive properties.

End-use product — Tiafenacil 339SC Herbicide

Property	Result
Colour	White
Odour	Characteristic
Physical state	Liquid
Formulation type	SU (suspension)
Label concentration	339 g/L
Container material and description	Plastic bottle or drum, 0.50–200 L
Density	1.13 g/mL at 20 °C
pH of 1% dispersion in water	4.5–4.6
Oxidizing or reducing action	Compatible with water, monoammonium phosphate, powdered zinc and kerosene; oxidized by potassium permanganate.
Storage stability	Stable for 14 days when stored at 54 °C in HDPE bottles.
Corrosion characteristics	No corrosion to HDPE bottles was observed after 14-day storage at 54 °C.
Explodability	Not explosive

1.3 Directions for use

Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide are applied as broadcast sprays to field corn, soybean, spring wheat, summerfallow and non-crop areas, and as directed sprays to grape at 25 to 50 g a.i./ha in mixture with methylated seed oil (MSO) adjuvant at 1% v/v (10L/1000L water) using ground application equipment to young emerged weeds. A rate in the upper end of the rate range may be used for more dense weed infestations and/or for larger weeds up to 12.5 cm in height. One application of up to 50 g a.i./ha or two applications of 25 g a.i. ha may be made per year with a minimum reapplication interval of two weeks, except three weeks in grape. In field corn, soybean and spring wheat, application may only be made prior to planting and/or after planting but prior to crop emergence. In the event of a crop failure, field corn, soybean and spring wheat may be replanted immediately. Any crop may be planted after a tiafenacil-treated crop provided that planting is nine or more months after the last application.

1.4 Mode of action

Tiafenacil is a conventional, non-selective, contact herbicide that inhibits protoporphyrinogen oxidase, which in turn inhibits production of important compounds like chlorophyll and ultimately leads to the formation of highly reactive molecules that destroy lipids and proteins in membranes, resulting in tissue death.

The mode of action of tiafenacil is classified as a Group 14 herbicide by the Weed Science Society of America (WSSA) and the Herbicide Resistance Action Committee (HRAC).

2.0 Methods of analysis

2.1 Methods for analysis of the active ingredient

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

2.2 Method for formulation analysis

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

2.3 Methods for residue analysis

Environmental media: High-performance liquid chromatography methods with tandem mass spectrometric detection (HPLC-MS/MS) were developed and proposed for data generation and enforcement purposes. These methods fulfilled the requirements with regards to selectivity, accuracy and precision at the respective method limit of quantitation. Acceptable recoveries (70-120%) were obtained in environmental media.

Plant matrices: A high performance liquid chromatography method with tandem mass spectrometric detection (HPLC-MS/MS; Method IRA15016N) was developed and proposed for data generation and enforcement purposes. A revised version of the method, Method GPL-MTH-113, which includes alternate solid phase extraction (SPE) clean-up procedures recommended by the independent laboratory validation (ILV) as well as discussion of the potential issues pertaining to mass overlap and the choice of the quantitation ions, was subsequently developed and found acceptable. In addition, Method IRA16019N (HPLC-MS/MS) was developed and proposed for data generation in rotational wheat matrices. These method fulfilled the requirements with regards to specificity, accuracy and precision at the respective method limit of quantitation. Acceptable recoveries (70–120%) were obtained in plant matrices. The proposed enforcement method was successfully validated in plant matrices by an independent laboratory. Adequate extraction efficiencies were demonstrated using radiolabelled samples (soybean seed and straw; potato foliage; and wheat grain and straw) analyzed with the enforcement method.

Animal matrices: A high performance liquid chromatography method with tandem mass spectrometric detection (HPLC-MS/MS; Method 035315) was developed and proposed for data generation and enforcement purposes. This method fulfilled the requirements with regards to specificity, accuracy and precision at the respective method limit of quantitation. Acceptable recoveries (70–120%) were obtained in animal matrices. The proposed enforcement method was successfully validated in animal matrices by an independent laboratory. Adequate extraction efficiencies were demonstrated using radiolabelled samples (muscle, fat, liver, kidney, milk and eggs) analyzed with the enforcement method.

Methods for residue analysis are summarized in Appendix I, Tables 1A and 1B.

3.0 Impact on human and animal health

3.1 Hazard assessment

3.1.1 Toxicology summary

Tiafenacil (also known as DCC-3825) is a herbicide belonging to the pyrimidione class of chemicals. The primary pesticidal mode of action (MOA) of tiafenacil is inhibition of protoporphyrinogen IX oxidase (PPO) in plants for nonselective burndown weed control. The PPO inhibitors act by disrupting chlorophyll synthesis and protoporphyrin IX accumulation leading to cell membrane and oxidative damage in plants. The same enzyme is also a component of a similar pathway in animals that is involved in heme biosynthesis. Deficiency of this enzyme is seen in humans as an autosomal dominantly inherited disease known as variegate porphyria.

A detailed review of the toxicology database for tiafenacil was conducted. The database is complete, consisting of the full array of toxicity studies currently required for hazard assessment purposes. The studies were carried out in accordance with currently accepted international testing protocols and Good Laboratory Practices. Supplementary in vitro and in vivo studies included further evaluation of cardiovascular, respiratory toxicity effects and species-specific PPO inhibition studies. In addition, acute oral toxicity and in vitro genotoxicity studies, as well

as a quantitative structure-activity relationship (QSAR) analysis were provided on select metabolites of tiafenacil. The human health risk assessment also considered information found in the published scientific literature. The scientific quality of the data is acceptable and the database is considered adequate to characterize the potential health hazards associated with tiafenacil.

The absorption, distribution, metabolism, and elimination profile of tiafenacil was investigated in rats using either [phenyl-^{14}C]-tiafenacil or [pyrimidinyl-^{14}C]-tiafenacil radiolabels. Bile cannulation experiments were also performed. The toxicokinetic data demonstrated that orally administered tiafenacil was rapidly and extensively absorbed from the gastrointestinal tract, distributed and excreted. Regardless of sex, dose level or radiolabel position, peak concentrations in blood and plasma were reached within one hour of dosing, and declined rapidly in the first 24 hours post-dose. The tissue distribution of radioactivity was consistent with the routes of elimination, being mainly concentrated in the liver and kidneys. By 168 hours post-dosing, excretion was complete with no detectable radioactivity remaining in the carcass or tissues. No radioactivity was present in the expired air of animals in a preliminary study. The major route of excretion was via the feces in both sexes, although a sex difference was noted with urinary excretion representing a greater portion of the administered dose (AD) in females. Following administration to bile duct-cannulated animals, the majority of the radioactivity was excreted via the bile.

The metabolism of tiafenacil was qualitatively similar between the sexes regardless of radiolabel position or dose level. The identification of select metabolites is presented in Appendix I, Table 2. Significant (greater than 5% of the AD) metabolites excreted in urine and feces were M-01, M-05, M-07, M-52, and M-59. The less abundant metabolites in urine and feces were M-10, M-20, M-32, M-33, M-36, M-41, M-53 and M-58, as well as unchanged tiafenacil. The main metabolite in the liver, kidney, plasma, and bile was M-01. The major metabolites were consistent across most matrices with the exception of metabolites in excreta following administration of repeated doses to males. In repeat-dose group males, the main metabolite in feces was M-05.

Tiafenacil was rapidly transformed into metabolite M-01 by cleavage of the methyl ester. M-01 was further metabolized by degradation of the thioalkyl chain (M-12, M-13), oxidation of the sulphur atom (M-36, M-52), and modification of pyrimidine ring through reduction (M-05, M-53), demethylation (M-05, M-58), or ring opening (M-29, M-40, M-41).

Technical tiafenacil was of low acute toxicity via the oral, dermal, and inhalation routes in rats. It was minimally irritating to the rabbit eye and was non-irritating when applied to the rabbit skin. Skin sensitization testing in guinea pigs using the maximization method or in mice using the local lymph node assay (LLNA) did not demonstrate a potential for sensitization.

Both end-use products, Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide, were of low acute toxicity via the oral, dermal and inhalation routes in rats. Tiafenacil 70WG Herbicide was minimally irritating to the rabbit eye, whereas Tiafenacil 339SC Herbicide was non-irritating to the rabbit eye. Both end-use products were non-irritating to the skin of rabbits and neither demonstrated dermal sensitization potential in the LLNA in mice.

Repeat-dose, short- and long-term oral toxicity studies with tiafenacil were available in mice (diet), rats (diet) and dogs (capsule). In these studies, the most sensitive species for toxicity was the mouse, followed by the rat and dog. Male mice were more sensitive than female mice. In vitro PPO inhibition studies confirmed these results for sensitivity by demonstrating that mouse PPO was more sensitive than rat, rabbit, or human PPOs. These studies also showed that rat was more sensitive than rabbit and that human PPO inhibition was the least sensitive.

The primary target of toxicity for all species was the hematopoietic system. Alterations in the erythropoietic system were consistently observed in all of the species, affecting red blood cell parameters such as decreases in erythrocyte, hemoglobin, hematocrit, mean cell volume, mean corpuscular hemoglobin or mean corpuscular hemoglobin concentrations and increases in reticulocyte count. These effects were due to the known MOA of tiafenacil, which, as a PPO inhibiting herbicide, generally induces microcytic hypochromic anaemia resulting from hepatic heme synthesis disruption in experimental animals.

The toxicity studies in mice, rats, and dogs exposed to tiafenacil also had common effects such as decreases in body weight and body weight gain. At higher dose levels, all of the species experienced periods of body weight loss as well as clinical signs of toxicity, such as hunched posture, abnormal respiration, piloerection and vomiting.

The other target organs affected by tiafenacil were the liver (mouse, rat and dog), spleen (rat and dog), and bone marrow (rat and dog). The findings in the liver, spleen, and bone marrow indicative of extramedullary hematopoiesis suggest an adaptive response to the reduced circulating red cells brought about by the MOA of tiafenacil. Increases in liver enzymes and liver weight as well as pathology of the liver were observed in mice and dogs. Histopathology changes in the liver included increased incidence of Kupffer cell pigmentation and necrosis in mice, and hepatocyte vacuolation in mice and dogs. Rats, however, had decreased liver weights, with increased liver enzymes but no corresponding liver histology.

The exposure of rats to tiafenacil via the dermal route for 28 days did not result in any toxicologically significant findings up to the limit dose of testing.

Long-term dietary toxicity studies in mice and rats demonstrated systemic toxicity similar to the findings in shorter-term studies. Increases in pigmented Kupffer cells, liver weight and pathology were seen in mice. Hematology parameters were not measured in the long-term mouse study; however, Kupffer cell changes were considered to be an indicator that hematopoietic processes were adversely affected since Kupffer cell changes were only observed in the shorter-term studies in mice in the presence of adverse effects on hematology parameters. Increases in spleen weight and pathology as well as extramedullary hematopoiesis in the bone marrow were observed in rats. In addition, retinal atrophy was observed at high dose levels in female rats. There was no evidence to indicate that tiafenacil was oncogenic in mice or rats.

Tiafenacil was negative in a battery of in vitro and in vivo genotoxicity assays.

There was no evidence of reproductive toxicity in either the range-finding 1-generation or 2-generation reproductive dietary toxicity rat studies. Parental and offspring toxicity was evidenced by the increased levels of porphyrin observed in the liver. This effect is consistent with the hematotoxicity observed throughout the database, and the effect was more pronounced in males than females. Additional effects in the offspring included an increase in kidney cysts in the 2-generation reproductive dietary toxicity study and decreased body weight and increased spleen weight in the 1-generation reproductive toxicity study. These effects in the 1-generation reproductive toxicity occurred in absence of parental toxicity, however the findings were not replicated in offspring of the more robust 2-generation reproductive toxicity study. Therefore there was no evidence of sensitivity of the young.

There was evidence of increased sensitivity of the young in rats but not rabbits in the gavage developmental toxicity studies. In rats, no maternal effects were observed up to the highest dose level tested, while there was a decrease in fetal weights and increased ossification of the phalanges at the high-dose level in fetuses. The toxicological significance of an increase in ossification is uncertain, however it is not considered to be a serious effect. Decreases in body weight are also not considered a serious effect. No adverse effects were observed in rabbits in the maternal or the fetal animals. Range-finding developmental studies conducted in rats and rabbits demonstrated serious effects which occurred only at doses that were much higher than those in the main studies. Increased post-implantation loss was observed in rats, and decreased live fetuses was observed in rabbits in the absence of maternal toxicity in both cases. The effects in the range-finding studies were not considered relevant to reference value selection as they only occurred at very high doses and were not observed at lower doses in the more robust guideline studies. Overall, there is low concern for effects in the young.

Tiafenacil showed no evidence of selective neurotoxicity in oral acute and 90-day dietary neurotoxicity studies in rats or immune dysregulation in a 28-day dietary immunotoxicity study in mice.

A 30-day oral telemetric evaluation of cardiovascular effects in dogs and a whole-body bias flow plethysmography study measuring respiratory parameters in rats did not reveal any treatment-related effects. An in vitro hERG tail current amplitude assay showed that tiafenacil produced a partial block of the hERG current although an IC_{50} could not be derived.

Thirteen metabolites of tiafenacil were screened for acute toxicity endpoints using QSAR software TOPKAT 4.5. The majority of metabolites had predicted acute oral toxicities of low to slight acute toxicity. Only metabolite M-69 had a predicted acute oral toxicity of highly acutely toxic. In addition, metabolites M-36 and M-53 were assessed in acute oral toxicity studies in rats, and in both cases, acute oral toxicity was low. Although there was limited information available, for the purposes of risk assessment the metabolites were considered to be of equivalent toxicity to tiafenacil.

Eighteen tiafenacil metabolites were screened for possible genotoxicity or mutagenicity in bacteria and mammals using the DEREK NEXUS system. There were no alerts identified for any of the metabolites. In addition, metabolites M-36 and M-53 were screened for evidence of genotoxicity and mutagenicity using the bacterial reverse mutation assay and both assays were negative.

The identification of select metabolites is presented in Appendix I, Table 2. Results of the toxicology studies conducted on laboratory animals with tiafenacil and its associated end-use products, Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide, are summarized in Appendix I, Tables 3, 4 and 5. The toxicology reference values for use in the human health risk assessment are summarized in Appendix I, Table 6.

3.1.2 *Pest Control Products Act* Hazard Characterization

For assessing risks from potential residues in food or from products used in or around homes or schools, the *Pest Control Products Act* requires the application of an additional 10-fold factor to threshold effects to take into account completeness of the data with respect to the exposure of, and toxicity to, infants and children, and potential prenatal and postnatal toxicity. A different factor may be determined to be appropriate on the basis of reliable scientific data.

With respect to the completeness of the toxicity database as it pertains to the toxicity to infants and children, the database contains the full complement of required studies including oral gavage developmental toxicity studies in rats and rabbits and a 2-generation reproductive dietary toxicity study in rats.

With respect to potential prenatal and postnatal toxicity, there was no indication of increased sensitivity of fetuses or offspring compared to parental animals in the gavage rabbit prenatal developmental or dietary reproductive toxicity studies. An increased incidence of ossification of phalanges and decreased fetal weight were observed in the rat developmental toxicity study in the absence of maternal toxicity, however, the toxicological significance of the increased ossification is uncertain. The serious effect of post-implantation loss, observed in the rat range-finding study, occurred at a much higher dose level than the dose levels used in the main study. Overall, the database is adequate for determining sensitivity of the young. There is a low level of concern for sensitivity of the young as the effects in the young were well-characterized and the effects in main studies at dose levels relevant for risk assessment are not considered to be serious in nature. On the basis of this information, the *Pest Control Products Act* (PCPA) factor was reduced to onefold.

3.2 Toxicology reference values

3.2.1 Route and duration of exposure

For mixers, loaders and applicators, occupational exposure to Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide is characterized as short- to intermediate-term in duration and is predominantly by the dermal and inhalation routes. For postapplication workers, occupational exposure to Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide is characterized as short-term in duration and is predominantly by the dermal route.

3.2.2 Occupational and residential toxicology reference values

Short- and intermediate-term dermal

For the short- and intermediate-term dermal occupational risk assessment, the NOAEL of 1000 mg/kg bw/day from the 28-day dermal toxicity study in rats was selected, which was the highest dose level tested in this study. This study was conducted via the relevant route and was of an appropriate duration of exposure. For occupational and residential scenarios, the target margin of exposure (MOE) is 100, which includes standard uncertainty factors of 10-fold for interspecies extrapolation and 10-fold for intraspecies variability. For residential scenarios, the PCPA factor was reduced to onefold as discussed in the *Pest Control Products Act* Hazard Characterization section. The selection of this study and target MOE is considered to be protective of all populations, including nursing infants and unborn children of exposed women.

Short-, intermediate-term inhalation

For short- and intermediate-term inhalation risk assessment, a NOAEL of 1.7 mg/kg bw/day from the 90-day dietary toxicity study in mice was selected. A repeat-dose inhalation toxicity study was not available and thus, use of a NOAEL from an oral study was appropriate. At the LOAEL of 13 mg/kg bw/day, liver toxicity was observed.

For occupational scenarios, the target MOE for this endpoint is 100, which includes standard uncertainty factors of 10-fold for interspecies extrapolation and 10-fold for intraspecies variability. The selection of this study and target MOE is considered to be protective of all populations, including nursing infants and the unborn children of exposed female workers.

3.2.3 Acute reference dose (ARfD)

General population (including females 13-49 years of age)

Establishment of an acute reference dose is not required, as an endpoint of concern attributable to a single exposure was not identified in the oral toxicity studies.

3.2.4 Acceptable daily intake (ADI)

General population (including females 13-49 years of age)

To estimate risk following repeated dietary exposure, the NOAEL of 0.35 mg/kg bw/day from the 78-week dietary carcinogenicity study in the male mouse was selected. At the LOAEL of 1.1 mg/kg bw/day, liver effects including increases in pigmented Kupffer cells (as a marker for hematological changes) and hepatocellular hypertrophy were observed. This study provides the lowest NOAEL in the database. Standard uncertainty factors of 10-fold for interspecies extrapolation and 10-fold for intraspecies variability were applied. As discussed in the *Pest Control Products Act* Hazard Characterization section, the PCPA factor was reduced to onefold. **The composite assessment factor (CAF) is thus 100.**

The ADI is calculated according to the following formula:

$$\text{ADI} = \frac{\text{NOAEL}}{\text{CAF}} = \frac{0.35 \text{ mg/kg bw/day}}{100} = 0.004 \text{ mg/kg bw/day of tiafenacil}$$

3.2.5 Cancer assessment

There was no evidence of carcinogenicity and therefore, a cancer risk assessment was not necessary.

3.2.6 Aggregate risk assessment

Aggregate exposure is the total exposure to a single pesticide that may occur from dietary (food and drinking water), residential and other non-occupational sources, and from all known or plausible exposure routes (oral, dermal and inhalation). For tiafenacil, the aggregate assessment consisted of combining food and drinking water exposure only, since residential exposure is not expected. The most relevant toxicology endpoints and assessment factors for acute and chronic oral aggregate exposure are the same as those selected for the ARfD (see section 3.2.3) and ADI (see section 3.2.4), respectively.

3.3 Dermal absorption

A dermal absorption value is not required in the risk assessment since the dermal toxicology reference value for tiafenacil is based on a dermal toxicity study.

3.4 Occupational and residential exposure assessment

3.4.1 Acute hazards of end-use products and mitigation measures

Tiafenacil 70WG Herbicide

Tiafenacil 70WG Herbicide is of low acute toxicity in the rats via oral, dermal and inhalation routes of exposure. In rabbits, it is minimally irritating to the eyes and non-irritating to the skin. It is not a skin sensitizer in mice. Based on these acute hazards, a long-sleeved shirt, long pants, chemical-resistant gloves, socks and shoes are required for workers during mixing, loading, application, clean-up and repair.

Tiafenacil 339SC Herbicide

Tiafenacil 339SC Herbicide is of low acute oral, dermal and inhalation toxicity in rats. It is considered non-irritating to the eyes and skin of rabbits and is not a dermal sensitizer. Based on these acute hazards, a long-sleeved shirt, long pants, chemical-resistant gloves, socks and shoes are required for workers during mixing, loading, application, clean-up and repair.

3.4.2 Occupational exposure and risk assessment

3.4.2.1 Mixer, loader and applicator exposure and risk assessment

Individuals have potential for exposure to tiafenacil during mixing, loading, application, clean-up and repair. Dermal and inhalation exposure estimates were generated from the Agricultural Handlers Exposure Task Force (AHETF) database and the Pesticide Handlers Exposure Database (PHED) for mixers, loaders and applicators applying Tiafenacil 70WG Herbicide or Tiafenacil 339SC Herbicide as a preplant or pre-emergent burndown treatment to field corn, soybeans and spring wheat; as a directed postemergent burndown treatment to grape canes; and as a postemergent burndown treatment to fallow and bare ground non-crop areas using ground and handheld equipment. The applicant is a member of AHETF and has full access to the data that were used to estimate worker exposure. The unit exposure values in the risk assessment are based on handlers wearing a single layer of clothing and chemical-resistant gloves (Appendix I, Table 7).

Dermal exposure was estimated using the unit exposure values with the amount of product handled per day. Inhalation exposure was estimated by coupling the unit exposure values with the amount of product handled per day with 100% inhalation absorption. Exposure was normalized to mg/kg bw/day by using 80 kg adult body weight.

Calculated MOEs are greater than the target margin of exposure (MOE) of 100 for all chemical handler scenarios in agricultural crops and non-cropland areas, and are therefore not of health concern (Appendix I, Tables 8 and 9).

Taking into account both the acute toxicity of the end-use products and the risk assessment for tiafenacil, workers are required to wear a long-sleeved shirt, long pants, chemical-resistant gloves, socks and shoes. Chemical-resistant gloves are not required during application within a closed cab.

3.4.2.2 Exposure and risk assessment for workers entering treated areas

Postapplication dermal exposure is expected to be negligible for farmers and workers when tiafenacil is applied as a preplant or pre-emergent burndown treatment to field corn, soybeans and spring wheat as well as a postemergent burndown treatment to fallow and bare ground non-crop areas. It is expected that the main postapplication activity, if any, would be scouting for remaining weeds, and this visual inspection does not require the workers to be in close contact to the plants. Consequently, the dermal exposure to workers scouting for weeds would be minimal, and therefore, for these uses, a qualitative postapplication dermal risk assessment was performed for tiafenacil. No health risks of concern are expected at the restricted-entry interval (REI) of 12 hours for agricultural areas and of until sprays have dried for non-cropland areas to protect workers conducting postapplication activities.

There is potential for exposure to workers entering vineyards treated with Tiafenacil 70WG Herbicide or Tiafenacil 339SC Herbicide when applied as a postemergent burndown treatment directed to weeds at the base of grape canes. Given the nature of activities performed (hand-set irrigation, scouting and pruning), exposure should be primarily via the dermal route based on contact with treated foliage. Inhalation exposure is not expected as tiafenacil is considered non-volatile with a vapour pressure $\leq 1.48 \times 10^{-8}$ Pa (at 20 °C), which is less than the North American Free Trade Agreement (NAFTA) criterion for a non-volatile product for outdoor scenarios of 1×10^{-4} kPa (7.5×10^{-4} mm Hg) at 20–30 °C. As such, a quantitative postapplication inhalation risk assessment is not required. Inhalation risk is not of health concern for postapplication workers as tiafenacil is considered to be non-volatile and the restricted-entry interval of 12 hours will allow residues to dry, suspended particles to settle and vapours to dissipate.

Dermal exposure to workers entering treated vineyards is estimated using dislodgeable foliar residue (DFR) values with activity-specific transfer coefficients (TCs). Activity TCs are based on data from the Agricultural Re-entry Task Force (ARTF), of which the applicant is a member and has full access to the data used to estimate the worker exposure. As chemical-specific DFR data were not submitted, a default DFR value of 25% of the application rate coupled with 10% daily dissipation of residues were used in the exposure assessment.

Exposure estimates were compared to the toxicology reference value to obtain the margin of exposure (MOE); the target MOE is 100. Only exposures and risks to the activities with the highest TCs are presented as MOEs for these activities exceed the target MOE of 100 (Appendix I, Tables 10 and 11). As such, there are no health risks of concern and the REI of 12 hours is adequate to protect workers entering treated vineyards to conduct postapplication activities.

3.4.3 Residential exposure and risk assessment

3.4.3.1 Handler exposure and risk assessment

Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide are not domestic class products; therefore, a residential handler exposure assessment is not required.

3.4.3.2 Postapplication exposure and risk assessment

Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide are not domestic class products and are not for use in residential settings; therefore, a residential postapplication exposure assessment is not required.

3.4.4 Bystander exposure and risk assessment

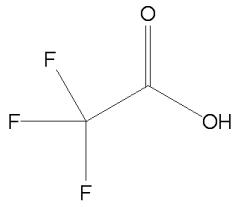
Bystander exposure is considered negligible as application is limited when there is low risk of drift beyond the area to be treated, taking into consideration wind speed, wind direction, temperature inversions, application equipment, and sprayer settings. Therefore, bystander exposure and risk are not of health concern since the potential for drift is expected to be minimal.

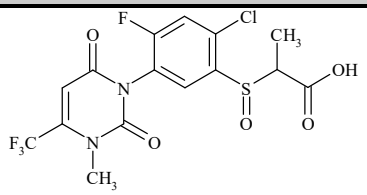
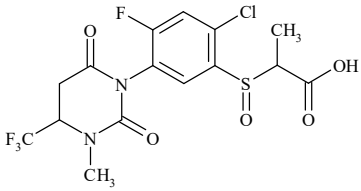
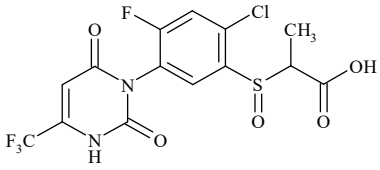
3.5 Dietary exposure and risk assessment

3.5.1 Exposure from residues in foods of plant and animal origin

Commodities of plant origin

The residue definition for enforcement in plants is tiafenacil. In primary crops, the residue definition for risk assessment is tiafenacil for human food commodities; and tiafenacil and the metabolites M-36, M-53 and M-56 for livestock feed commodities. In rotational crops, the residue definition for risk assessment is tiafenacil and the metabolite M-32 (TFA) in human food commodities, and in livestock feed commodities is tiafenacil and the metabolites M-32, M-36, M-53 and M-56. All residue definitions are expressed in parent equivalents.

Metabolite	Chemical Name	Structure
M-32 (TFA)	Trifluoroacetic acid	
M-36	2-(2-chloro-4-fluoro-5-(3-methyl-2,6-dioxo-4-(trifluoromethyl)-2,3-dihydropyrimidin-1(6*H*)-yl)-	

Metabolite	Chemical Name	Structure
	phenylsulfinyl)propanoic acid	
M-53	2-(2-chloro-4-fluoro-5-(3-methyl-2,6-dioxo-4-(trifluoromethyl)tetrahydropyrimidin-1(2*H*)-yl)phenylsulfinyl)propanoic acid	
M-56	2-(2-chloro-5-(2,6-dioxo-4-(trifluoromethyl)-2,3-dihydropyrimidin-1(6*H*)-yl)-4-fluorophenylsulfinyl)propanoic acid	

The data gathering/enforcement analytical method, Method IRA15016N (revised version, GPL-MTH-113), is valid for the quantitation of tiafenacil and metabolites M-36, M-53 and M-56 residues in crop matrices. In addition, the data gathering method, Method IRA16019N, is valid for the quantitation of tiafenacil and the metabolites M-36, M-53, M-56, in rotational wheat matrices.

The demonstrated freezer storage stabilities of tiafenacil and the metabolites are as follows:

- Grapes: Tiafenacil, M-36, M-53 and M-56 are stable for 24 months;
- Grape Juice and Raisins: Tiafenacil, M-36, M-53 and M-56 are stable for 12 months;
- Soybean Seed: Tiafenacil is stable for 6 months; M-36 and M-56 are stable for 18 months; and M-53 is stable for 24 months;
- Wheat Forage and straw: Tiafenacil, M-36, M-53 and M-56 are stable for 24 months;
- Wheat grain: Tiafenacil, M-36, M-53 and M-56 are stable for 22 months.

During the grape, corn, wheat and soybean field trials, additional plots were allocated for treatment rates corresponding to 1.50 kg a.i./ha (30-fold of maximum seasonal rate). As residues of tiafenacil were non-quantifiable in/on wheat grain, corn grain and soybean seed, samples were not processed. Tiafenacil residues were non-quantifiable in grapes and processed commodities (in other words, juice and raisins). As such, processing factors could not be calculated for tiafenacil in any processed fractions.

Crop field trials conducted throughout Canada and the United States using end-use products containing tiafenacil at exaggerated rates in or on grapes, corn, wheat and soybean are sufficient to support the proposed MRLs.

Field rotational crop studies were conducted in/on wheat. These data together with the data from the confined crop rotation study are adequate to demonstrate that labeled crops can be planted immediately after application, a 30-day plant-back interval is appropriate for non-labeled roots crops and leafy vegetables, and 90 days for all other non-labeled crops.

Commodities of animal origin

The residue definition for risk assessment and enforcement in animal commodities is tiafenacil. The data gathering/enforcement analytical method, Method 035315, is valid for the quantitation of tiafenacil residues in livestock matrices. Quantifiable residues are not expected to occur in livestock matrices with the current use pattern. As such, MRLs are proposed at the limit of quantitation (LOQ) of the enforcement method for animal matrices.

3.5.2 Concentrations in drinking water

3.5.2.1 Surface water

Level 1 Estimated Environmental Concentrations (EECs) were calculated using the Pesticide in Water Calculator model (PWC, version 1.52). Modelling for surface water used a standard Level 1 scenario, a small reservoir adjacent to agricultural fields. All scenarios were run for 50 years.

The following use patterns were considered in the modelling for surface water:

- A single application of 50 g a.i./ha, as would be used on crops and fallow
- Two applications of 25 g a.i./ha with a 21-d interval, corresponding to a maximum annual rate of 50 g a.i./ha, as would be used on grapes
- Two applications of 25 g a.i./ha with a 14-d interval, corresponding to a maximum annual rate of 50 g a.i./ha, as would be used on fallow and crops other than grapes

The modelling used a combined residue approach for initial application dates ranging from early April to late October (for fallow) and from early April to late June (for crops). The modelling was conducted with and without trifluoroacetic acid (TFA, identified as M-32 in the fate studies), in the form of two separate combined residue groupings. Residue Definition 1 consisted of tiafenacil plus 24 transformation products (without M-32) and Residue Definition 2 consisted of tiafenacil plus 25 transformation products (with M-32). Transformation products included in the residue definition were as follows: M-01, M-06, M-07, M-12, M-13, M-16, M-20, M-26, M-28, M-29, M-30, M-35, M-36, M-39, M-40, M-49, M-53, M-63, M-69, M-71, M-72, M-73, M-85, M-86 (and M-32).

Fate input parameters for modelling of the combined residue approach are listed in Table 3.5.2.1-1.

Table 3.5.2.1-1 Fate input parameters for the drinking water modelling for surface water

Fate Parameter	Value
Residues modelled	Residue Definition 1: Combined residue of Parent + 24TPs Residue Definition 2: Combined residue of Parent + 24TPs + M-32
K_d	0.063 L/kg
Water half-life	Residue Definition 1: 462 d at 20 °C Residue Definition 2: 485 d at 20 °C
Sediment half-life	Stable at 20 °C
Photolysis half-life	151 d
Hydrolysis	Stable at 20 °C
Soil half-life	Residue Definition 1: 2004 d at 20 °C Residue Definition 2: 2319 d at 20 °C

Table 3.5.2.1-2 reports the surface water EECs obtained with the standard Level 1 scenario, covering all regions of Canada.

Table 3.5.2.1-2 Level 1 Estimated Environmental Concentrations of tiafenacil combined residues in surface water, reported as parent equivalent

Use pattern	Residues Modelled	Surface Water (µg a.i./L)		
		Daily[1]	Yearly[2]	Overall[3]
Fallow				
1 × 50 g a.i./ha	P + 24 TPs	3.6	0.54	0.28
	P + 24 TPs + M-32	3.6	0.54	0.28
2 × 25 g a.i./ha	P + 24 TPs	2.6	0.48	0.26
	P + 24 TPs + M-32	2.6	0.48	0.27
Crops				
1 × 50 g a.i./ha	P + 24 TPs	3.5	0.56	0.23
	P + 24 TPs + M-32	3.5	0.56	0.23
2 × 25 g a.i./ha	P + 24 TPs	2.3	0.49	0.23
	P + 24 TPs + M-32	2.3	0.49	0.23

[1] 90th percentile of the highest 1-day average concentration from each year
[2] 90th percentile of yearly average concentrations
[3] Average of all yearly average concentrations

3.5.2.2 Groundwater

Level 1 EECs were calculated using the Pesticide in Water Calculator model (PWC, version 1.52). The model was run for 50 years using all possible combinations of scenarios, degradation parameters, and application dates for a single application of 50 g a.i./ha, as would be used on crops and fallow. The following was used:

- A set of standard scenarios representing the soil and climate in different regions of Canada,
- A set of soil degradation parameters taken from all four soils in which degradation of tiafenacil was studied, and
- A set of six initial application dates between 1 April and 28 October.

The groundwater modelling used a parent-daughter-granddaughter modelling approach. Residues relevant for the groundwater modelling were tiafenacil, M-01, M-12, M-13, M-16, M-29, M-30, M-35, M-36, M-53, M-63, M-69, M-72, M-73, and optionally M-32 (trifluoroacetic acid). Other compounds in the residue definition were not observed during the soil degradation of tiafenacil and are therefore not expected in groundwater.

Fate input parameters for groundwater modelling of the parent-daughter-granddaughter approach are listed in Table 3.5.2.2-1.

Table 3.5.2.2-1 Fate input parameters for the drinking water modelling for groundwater

	Combined Parent	Combined Daughter	Granddaughter	Granddaughter
Residues Modelled	Tiafenacil, M-01, M-12, M-13, and M-16	M-29, M-30, M-35, M-36, M-53, M-63, M-72, and M-73	M-32	M-69
K_{oc} (L/kg)				
CA	15	10	1	10
LAD	15	2.1	1	2.1
MCL	14	1.8	1	N/A
MSL	17	3.5	1	N/A
Hydrolysis (at 20 °C)	Stable			
Soil half-life (days, at 20 °C)				
CA	5.5	3.62e+03	1.6e+06	3.62e+03
LAD	4.8	2.88	1.7e+11	288
MCL	0.74	5.22e+03	730	N/A
MSL	1.7	1.20e+07	7.5	N/A

CA = loamy sand from California; LAD = clay from Wyoming; MCL = clay loam from North Dakota; MSL = sandy clay loam from North Dakota.

The highest groundwater EECs obtained across all modelling combinations are provided in Table 3.5.2.2-2, covering all regions of Canada. The highest groundwater EECs obtained across all modelling combinations are the same with and without M-32.

Table 3.5.2.2-2 Level 1 Estimated environmental concentrations of tiafenacil combined residues in groundwater, reported as parent equivalent

Use pattern	Groundwater (µg a.i./L)	
	Daily[1]	Yearly[2]
Single application of 50 g a.i./ha	46	

[1] 90th percentile of daily concentrations
[2] 90th percentile of 365-day moving average concentrations

3.5.3 Dietary risk assessment

A chronic dietary risk assessment was conducted using the Dietary Exposure Evaluation Model (DEEM-FCID™, Version 4.02, 05-10-c), which incorporates consumption data from the National Health and Nutrition Examination Survey/What We Eat in America (NHANES/WWEIA) for the year 2005-2010.

3.5.3.1 Acute dietary exposure results and characterization

No appropriate toxicological reference value attributable to a single dose for the general population (including children and infants) was identified.

3.5.3.2 Chronic dietary exposure results and characterization

The following criteria were applied to the basic chronic analysis for tiafenacil: proposed MRLs and American tolerances, including imported commodities, 100% crop treated, default processing factors, and inclusion of the common metabolite trifluoroacetic acid (TFA) for rotational crops. Aggregate exposure from food and drinking water is considered acceptable. The PMRA estimates that chronic dietary exposure to tiafenacil from food and drinking water is 26.7% (0.001 mg/kg bw/day) of the ADI for the total population. The highest exposure and risk estimate is for all infants (< 1 year) at 92.0% (0.004 mg/kg bw/day) of the ADI. When TFA in rotational crops is added, the exposure estimate is 31.7% (0.001 mg/kg bw/day) of the ADI for the total population and the highest exposure and risk estimate is at 101.5% (0.004 mg/kg bw/day) for all infants (< 1 year).

3.6 Aggregate exposure and risk assessment

For tiafenacil, the aggregate assessment consisted of combining food and drinking water exposure only, since residential exposure is not expected.

3.7 Cumulative assessment

The *Pest Control Products Act* requires Health Canada's PMRA to consider the cumulative effects of pest control products that have a common mechanism of toxicity. Tiafenacil belongs to a class of herbicides known as protoporphyrinogen IX oxidase (PPO) inhibitors. Within this class, there are several herbicides registered in Canada and internationally that all have the same MOA, namely the inhibition of a key enzyme in the chlorophyll synthesis pathway, protoporphyrinogen oxidase (also referred to as Protox). The same enzyme and pathway are also involved in heme biosynthesis in mammals resulting in changes in hematopoietic parameters. Overall, based on the similar MOA of these compounds, further consideration for potential cumulative health effects is warranted. A cumulative health risk assessment will be conducted separately.

Trifluoroacetic acid (TFA), a metabolite of tiafenacil (metabolite M-32), is a common environmental degradate from both pesticide sources such as tiafenacil, flufenacet, or saflufenacil, and non-pesticide sources, such as industrial chemicals (for example chlorofluorocarbons). Levels of TFA released into the environment from current agricultural uses of tiafenacil in Canada are generally minor compared to other sources, therefore a cumulative assessment for TFA is not required at this time. Health Canada will continue to monitor the status of pesticide-related contributions of TFA to the environment.

3.8 Maximum Residue Limits

Table 3.8-1 Recommended Maximum Residue Limits

MRL (ppm)	Food Commodity
0.01	Dry soybeans; eggs; fat, meat and meat byproducts of cattle, goats, hogs, horses, poultry and sheep; field corn; grapes; milk; popcorn grain; wheat

For additional information on Maximum Residue Limits (MRLs) in terms of the international situation and trade implications, refer to Appendix II.

The nature of the residues in animal and plant matrices, analytical methodologies, field trial data, and chronic dietary risk estimates are summarized in Appendix I, Tables 1B, 12 and 13.

3.9 Health Incident Reports

Tiafenacil is a new active ingredient pending registration for use in Canada, and as of 30 April 2021, no incident reports had been submitted to the PMRA.

4.0 Impact on the environment

4.1 Fate and behaviour in the environment

Environmental fate properties of tiafenacil and its transformation products are summarized in Appendix I, Tables 14 and 15.

Tiafenacil has low vapour pressure (≤1.48×10^{-8} Pa at 20 °C), low Henry's law constant (H ≤ 6.89×10^{-8} Pa-m^3/mol), and it is soluble in water (110 mg/L at 20 °C). These intrinsic physico-chemical properties suggest that tiafenacil is unlikely to volatilize from moist soil or water surfaces under field conditions.

Laboratory studies of abiotic processes indicate that hydrolysis is temperature- and pH-dependant, and not an important route of transformation under neutral and acidic conditions. However, under alkaline conditions (for example, a marine environment), tiafenacil is expected to undergo rapid hydrolysis (DT_{50} of less than 1 to 4 days). Eight major transformation products are formed from hydrolysis (M-01, M-06, M-07, M-33, M-39, M-40, M-49, and M-50).

Phototransformation on soil is not a major route of transformation of tiafenacil (half-life of 405 days adjusted to equivalent summer sunlight). However, phototransformation in water is considered to be an important route of transformation for tiafenacil, with a half-life of 5.9 days adjusted to equivalent summer sunlight, and three major transformation products were formed (M-71, M-72 and M-85).

Laboratory studies of biotic transformation processes indicate that tiafenacil is not persistent in aerobic soil (DT_{50}s of ≤0.116 days) or anaerobic soil (DT_{50}s of ≤1.37 days). The thirteen major transformation products formed in soil under aerobic conditions include M-01, M-12, M-13, M-29, M-30, M-32, M-35, M-36, M-53, M-63, M-69, M-72, and M-73. Under anaerobic conditions, the ten major transformation products formed include M-01, M-07, M-12, M-16, M-20, M-26, M-33, M-34, M-39, and M-86. Observations from terrestrial field dissipation studies complement the interpretation of the laboratory results. Two studies on bare soil in Canadian-relevant ecoregions resulted in DT_{50}s of ≤ 0.61 days, suggesting that tiafenacil rapidly dissipates under field conditions. In aquatic systems under both aerobic and anaerobic conditions, tiafenacil is not expected to be persistent (DT_{50} ranging from 2.5 to 7.8 days). Nine major transformation products were formed under aerobic aquatic conditions, including M-01, M-06, M-07, M-12, M-13, M-16, M-20, M-32, and M-40. Under anaerobic aquatic conditions, nine major transformation products were also formed, however some differed from the aerobic study: M-01, M-06, M-07, M-20, M-26, M-33, M-34, M-39 and M-49.

Overall, 25 major transformation products were identified that may be present in the terrestrial environment (for details, see Appendix I, Table 15). The amounts of several of these transformation products were observed to be increasing at the end of hydrolysis, phototransformation, and aerobic and anaerobic biotransformation studies in at least one sample measured. In terrestrial field dissipation studies, however, transformation of tiafenacil occurred rapidly and resulted in the formation of several identified transformation products. Under field

conditions, transformation products of tiafenacil were last detected at day 10 of 60 in Washington (M-36 and M-72), and day 310 of 366 in North Dakota (M-36 and M-53). Tiafenacil is not considered persistent in the terrestrial environment, and while the total amount of applied residue may remain high in laboratory studies, under field conditions nearly all transformation products of tiafenacil are shown to dissipate over the course of a growing season. Overall, it is not expected that the residue of tiafenacil will carry-over to the next season under field conditions, and as such a label statement pertaining to carry-over is not required.

Tiafenacil is not considered persistent in the aquatic environment. A large number of transformation products were also identified in aquatic systems, which include 15 of the major transformation products identified in the terrestrial environment, as well as M-71 and M-85. As in the terrestrial environment, the amounts of several of these transformation products were observed to be increasing during the various laboratory studies.

Tiafenacil has low mobility in soil due to its strong adsorption onto soil particles (K_{oc} = 1965). Although tiafenacil is not classified as a leaching compound, most of the 14 major (and 1 minor) transformation products evaluated for adsorption/desorption in soil demonstrate high mobility, with low K_{oc} values ranging from 1.76 to 60.8, and may therefore leach to groundwater.

The log octanol/water partitioning coefficient for tiafenacil (log $K_{ow} \leq 2$) suggests that it is not expected to bioaccumulate in aquatic organisms or animal tissue.

4.2 Environmental risk characterization

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. EECs are concentrations of pesticide 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 estimate 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 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.

4.2.1 Risks to terrestrial organisms

Terrestrial organisms, such as earthworms, honeybees, beneficial arthropods, birds, mammals, and terrestrial non-target vascular plants can be exposed to tiafenacil through direct contact with spray, spray drift, run-off, contact with sprayed surfaces, or from ingestion of contaminated food. A risk assessment of tiafenacil, its transformation products, and the associated end-use products, Tiafenacil 70WG and Tiafenacil 339SC, was undertaken based on available toxicity data for these organisms. A summary of the effects metrics for terrestrial organisms considered in the selection of toxicity endpoints is provided in Appendix I, Table 16. The most sensitive terrestrial endpoints used in the risk assessment are provided in Appendix I, Table 18.

When used according to the proposed label directions, risks associated with the use of tiafenacil are acceptable for the following terrestrial organisms:

- Pollinators
- Non-target arthropods
- Earthworms and soil-dwelling invertebrates
- Wild birds and mammals

The LOC is exceeded for the following organisms potentially exposed to tiafenacil:

- Terrestrial vascular plants

With the observance of preventative measures and use-restrictions to reduce exposure, including a buffer zone of 4 metres, the risks towards terrestrial vascular plants associated with the use of tiafenacil are acceptable.

4.2.1.1 Terrestrial invertebrates

At the screening level, the LOC was not exceeded for pollinators (adult and larval honeybees) or soil-dwelling invertebrates (earthworms, springtails, and predatory mites). The LOC was exceeded for foliar-dwelling invertebrates (predatory mites and parasitic wasps) based on chronic exposure (RQs of 3.80 and 3.04, respectively). The screening-level risk results are presented in Appendix I, Table 19. The potential risk to non-target terrestrial invertebrates was further characterized.

Based on off-field exposure from spray drift, the LOC was not exceeded for foliar-dwelling invertebrates (predatory mites and parasitic wasps) for any of the endpoints considered. The results from the further characterization of risk are presented in Appendix I, Table 20. Overall, the risks associated with the application of tiafenacil are considered acceptable for terrestrial invertebrates when label guidance is followed.

4.2.1.2 Terrestrial vertebrates

At the screening level, the LOCs were not exceeded for wild birds or mammals for any feeding guild or size. The screening-level risk results are presented in Appendix I, Tables 21 and 22. Overall, the risks to birds and mammals associated with application of tiafenacil are considered acceptable when label guidance is followed.

4.2.1.3 Non-target terrestrial plants

At the screening level, the LOC was exceeded for effects of the formulated product Tiafenacil 70WG Herbicide on non-target vascular plants. Based on the HR5 (hazardous rate for 5% of species) for vegetative vigor, the resulting RQ was found to be 114. The screening-level results are presented in Appendix I, Table 19. The potential risk to non-target plants was further characterized.

Based on off-field exposure from spray drift, the LOC was exceeded for vegetative vigor effects to terrestrial vascular plants (based on the HR5), with an RQ of 7.00. The results from the further characterization of risk are presented in Appendix I, Table 20. As such, hazard statements and buffer zones of 4 m will be required to mitigate the risk from tiafenacil to non-target plants adjacent to the application site. When label directions are followed the risk to non-target terrestrial plants associated with the use of tiafenacil is considered acceptable.

4.2.2 Risks to aquatic organisms

Aquatic organisms, such as invertebrates, fish, amphibians, and aquatic plants can be exposed to tiafenacil via spray drift or through runoff entering aquatic habitats. The aquatic risk assessment was conducted following a tiered approach, with a conservative screening assessment based on direct overspray, followed by refinements for spray drift and runoff if concerns were identified at the screening level. A summary of the effects on aquatic organisms considered in the selection of toxicity endpoints is provided in Appendix I, Table 17. The most sensitive aquatic endpoints used in the risk assessment are provided in Appendix I, Table 18.

When used according to approved label directions, the risks are acceptable to the following aquatic organisms from the use of tiafenacil:

- Freshwater and marine invertebrates
- Marine fish

The LOC was exceeded for the following aquatic organisms:

- Freshwater fish and amphibians
- Freshwater and marine algae
- Aquatic vascular plants

With the observance of preventative measures and use restrictions to reduce exposure, which include a buffer zone of 1 metre, the risks to these organisms are acceptable.

4.2.2.1 Aquatic invertebrates

At the screening level, RQs for freshwater and marine invertebrates did not exceed the LOC. Therefore, the risks to aquatic invertebrates from the use of tiafenacil are acceptable and no further refinement was necessary. The screening-level risk results are presented in Appendix I, Table 23.

4.2.2.2 Aquatic vertebrates

Tiafenacil is a light-dependent peroxidizing herbicide (LDPH). There is potential for increased sensitivity of fish to LDPHs under enhanced lighting conditions (in other words, clear, shallow waterbodies in direct sunlight) due to the mechanism of action of these chemicals. The use of the molar equivalency-adjusted chronic NOEC provides an additional safety factor to the chronic fish assessment, and is based on the United States Environmental Protection Agency (USEPA) guidance memo for LDPH chemicals (USEPA, 2016). The guidance suggests conducting the risk assessment using the laboratory-derived NOEC endpoint under standard lighting conditions as well as using the molar equivalency adjusted NOEC. The latter accounts for the potential enhanced toxicity of LDPH chemicals under natural sunlight. The molar threshold approach is based on the observation that regardless of the NOEC value determined under standard laboratory lighting for a test suite of three representative LDPH chemicals, the effect level under high intensity UV lighting conditions was relatively consistent (in other words, 0.002 to 0.02 µmol/L). Thus, 0.002 µmol/L is considered the molar threshold, regardless of the chemical. It is noted that the data supporting the molar threshold are limited to a single species (in other words, fathead minnows; *Pimephales promelas*) and three representative LDPH chemicals and may not reflect the extent of variability in UV-enhanced toxicity across species and chemicals. For tiafenacil, the molar equivalency NOEC was calculated as the molecular weight of tiafenacil multiplied by the molar threshold (511.9 g/mol × 0.002 µmol/L = 1.02 µg a.i./L).

At the screening level, for freshwater fish, the LOC was not exceeded for acute exposure, however the chronic LOC was exceeded (RQ of 6.10). For marine fish, the LOC was not exceeded for acute or chronic exposures. For amphibians, freshwater fish endpoints were used as surrogates and the LOC was exceeded on a chronic exposure basis (RQ of 2.08). The screening-level risk results are presented in Appendix I, Table 23. The potential risk to non-target freshwater fish and amphibians was further characterized.

Based on exposure from spray drift, the chronic LOCs were not exceeded for freshwater fish or amphibians. However, RQs were slightly above the LOC for run-off (1.19 and 3.82 for amphibians and fish, respectively). The risk results from further characterization on spray drift and runoff are presented in Appendix I, Tables 24 and 25, respectively. Spray drift buffer zones of 1 m are required to mitigate the potential risk of tiafenacil to freshwater environments.

4.2.2.3 Algae and aquatic plants

At the screening level, the LOC was exceeded for aquatic plants. The RQs for freshwater vascular plants, freshwater algae and marine algae range from 2.15 to 4.31 (see Appendix I, Table 23). The potential risk to non-target aquatic plants and algae was further characterized.

Based on exposure from spray drift, no LOCs were exceeded for freshwater vascular plants, freshwater algae, or marine algae. However, the LOCs were slightly exceeded for runoff (RQs ranged from 1.38 to 2.11). The risk results from further characterization on spray drift and runoff are presented in Appendix I, Tables 24 and 25, respectively. Spray drift buffer zones of 1 m are required to mitigate the potential risk of tiafenacil to freshwater environments.

4.2.3 Environmental incident reports

Tiafenacil is a new active ingredient pending registration for use in Canada and, as of April 30, 2021, no incident reports had been submitted to the PMRA.

5.0 Value

Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide may be applied to small, emerged weeds prior to planting and/or postplanting but prior to emergence of field corn, soybean and spring wheat to reduce early-season weed competition. In grape, summerfallow and non-crop areas, these herbicides may be used to manage small-sized weeds throughout the season.

Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide will serve as additional weed management options that can be included as a component of integrated weed management programs that include tillage and other preplant, pre-emergent and/or postemergent herbicides.

Value information was submitted as efficacy and crop tolerance data generated in small-scale research trials, in addition to scientific rationales. Field and laboratory trials were conducted on a variety of weed species that were growing in either the absence or presence of a crop. It was demonstrated that single or sequential applications of Tiafenacil 70WG Herbicide or Tiafenacil 339SC Herbicide at 25 to 50 g a.i./ha (higher rates within this range for dense and/or more mature weed infestations) in combination with a methylated seed oil (MSO) adjuvant at 1% v/v to small weeds can be expected to provide early-season suppression of redroot pigweed, tall waterhemp, common lamb’s-quarters, prickly lettuce and wild buckwheat and early-season control of velvetleaf, kochia and Russian thistle.

Crop phytotoxicity data demonstrated that field corn, soybean and spring wheat were tolerant of tiafenacil applied prior to planting or crop emergence. Furthermore, as tiafenacil has limited residual soil activity, crop injury is not likely unless application is made too late, in other words, at crop emergence. Grape was also demonstrated to be tolerant of Tiafenacil 70WG Herbicide or Tiafenacil 339SC Herbicide applied as a directed application, such as to avoid contact of the spray with grape plants.

Value information in the form of a rationale, soil dissipation studies and metabolite efficacy studies demonstrated that in the event of a crop failure, field corn, soybean and spring wheat can be safely planted immediately after application of Tiafenacil 70WG Herbicide or Tiafenacil 339SC Herbicide. Based on this same information, all other crops may be safely grown following a tiafenacil-treated crop, provided that nine or more months have elapsed since the last application.

Supported uses are summarized in Appendix I, Table 27.

6.0 Pest control product policy considerations

6.1 Toxic substances management policy considerations

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

During the review process, tiafenacil and its transformation products were assessed in accordance with the PMRA Regulatory Directive DIR99-03[5] and evaluated against the Track 1 criteria. The PMRA has reached the conclusion that tiafenacil and its transformation products do not meet all of the TSMP Track 1 criteria.

Please refer to Appendix I, Table 26 for further information on the TSMP assessment.

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

6.2 Formulants and contaminants of health or environmental concern

During the review process, contaminants in the active ingredient as well as formulants and contaminants in the end-use products are compared against Parts 1 and 3 of the *List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern*,[6] The list is used as described in the PMRA Science Policy Note SPN2020-01[7] and is based on existing policies and regulations, including the *Toxic Substances Management Policy*[8] and *Formulants Policy*[9], and taking into consideration the *Ozone-depleting Substances and Halocarbon Alternatives Regulations* under the *Canadian Environmental Protection Act, 1999* (substances designated under the Montreal Protocol).

The PMRA has reached the conclusion that tiafenacil and its end-use products, Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide, do not contain any formulants or contaminants identified in the *List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern*.

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

7.0 Proposed regulatory decision

Health Canada's PMRA, under the authority of the *Pest Control Products Act*, is proposing registration for the sale and use of Tergeo Technical Herbicide, Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide containing the technical grade active ingredient tiafenacil, to control weeds in field corn, soybean, spring wheat, grapes, summerfallow and non-crop areas.

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

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

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

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

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

List of abbreviations

↑	increased
↓	decreased
♂	male
♀	female
°C	degree Celsius
µg	microgram(s)
µM or µmol	micromole(s)
a.i.	active ingredient
abs	absolute
AD	administered dose
ADI	acceptable daily intake
A/G	albumin/globulin ratio
AHETF	Agricultural Handler Exposure Task Force
ALP	alkaline phosphatase
ALS	acetolactate synthase
ALT	alanine aminotransferase
APTT	activated partial thromboplastin time
AR	applied radioactivity
ARfD	acute reference dose
ARTF	Agricultural Re-entry Task Force
ASAE	American Society of Agricultural Engineers
AST	aspartate aminotransferase
atm	atmosphere
ATPD	area treated per day
AUC	area under the curve
BAF	bioaccumulation factor
BBCH	Biologishe Bundesanstalt, Bundessortenamt and Chemical industry
BCF	bioconcentration Factor
bili	bilirubin
BUN	blood urea nitrogen
BW	body weight
bwg	body weight gain
CAF	composite assessment factor
CAS	Chemical Abstracts Service
CEPA	*Canadian Environmental Protection Act*
chol	cholesterol
cm	centimetre(s)
cm^3	cubic centimetre(s)
CR	chemical-resistant
d	day(s)
DAP	days after planting
DAT	days after treatment
DEEM	Dietary Exposure Evaluation Model
DFOP	double first-order in parallel

DFR	dislodgeable foliar residue
DIR	Directive
DT_{50}	dissipation time 50% (the time required to observe a 50% decline in concentration)
DT_{90}	dissipation time 90% (the time required to observe a 90% decline in concentration)
dw	dry weight
E_bC_{50}	effective concentration on 50% of the population (algae biomass)
EC_{50}	effective concentration on 50% of the population
ECG	electrocardiogram
EDE	estimated daily exposure
EEC	estimated environmental concentration
ELS	early life stage
Eos	eosinophils
ER_{50}	effective rate on 50% of the population
E_rC_{50}	effective concentration on 50% of the population (algae growth rate)
E_yC_{50}	effective concentration on 50% of the population (algae yield)
F1	first generation
F2	second generation
fc	food consumption
FCID	Food Commodity Intake Database
fe	food efficiency
FIR	food ingestion rate
g	gram(s)
GD	gestation day
GHS	Globally Harmonized System (of Classification and Labeling of Chemicals)
gluc	glucose
GI	gastrointestinal
ha	hectare(s)
HAFT	highest average field trial
Hb	hemoglobin
Hct	hematocrit
HDPE	high density polyethylene
hERG	the human Ether-à-go-go-Related Gene
Hg	mercury
HPLC	high performance liquid chromatography
hr(s) or h	hour(s)
HR_5	hazardous rate for 5% of species
HRAC	Herbicide Resistance Action Committee
IC_{50}	Median Inhibition Concentration (concentration that reduces the effect by 50%)
ILV	independent laboratory validation
IORE	indeterminate order rate equation
IUPAC	International Union of Pure and Applied Chemistry
JMAFF	Japanese Ministry of Agriculture, Forestry, and Fisheries
K	potassium
K_d	soil adsorption coefficient

kg	kilogram(s)
K_{oc}	adsorption quotient normalized to organic carbon
K_{ow}	octanol water partition coefficient
kPa	kilopascal(s)
L	litre(s)
LAFT	lowest average field trial
LC	liquid chromatography
LC_{50}	lethal concentration 50%
LD	lactation day
LD_{50}	lethal dose 50%
LDH	lactate dehydrogenase
LDPH	light-dependent peroxidizing herbicide
LLNA	local lymph node assay
LOAEL	lowest observed adverse effect level
LOC	level of concern
LOQ	limit of quantitation
LR_{50}	lethal rate 50%
Lymp	lymphocytes
m^3	cubic metres
mol	mole(s)
MAS	maximum average score for 24, 48 and 72 hours
MCH	mean corpuscular hemoglobin
MCHC	mean corpuscular hemoglobin concentration
MCV	mean corpuscular volume
MIS	maximum irritation score
mg	milligram(s)
min	minute(s)
mL	millilitre(s)
M/L/A	Mixer/Loader/Applicator
mmHg	Millimeter of mercury
MOA	mode of action
MOE	margin of exposure
MRL	maximum residue limit
MS	mass spectrometry
MS/MS	tandem mass spectrometry
MSO	methylated seed oil
N/A or NA	not applicable
NAFTA	North American Free Trade Agreement
NC	not calculated
ND	not detected
Neut	neutrophils
NHANES	National Health and Nutrition Examination Survey
nm	nanometre(s)
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
NOEL	no observed effect level

NR	not reported
NZW	New Zealand white
OC	organic carbon content
OECD	Organization for Economic Cooperation and Development
OM	organic matter content
P	parent or parental generation
Pa	Pascal(s)
PBI	plant-back interval
PCP	pest control product
PCPA	*Pest Control Products Act*
ph	phenyl label
PHED	Pesticide Handler Exposure Database
PHI	preharvest interval
p*K*a	dissociation constant
PMRA	Pest Management Regulatory Agency
PND	postnatal day
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
PPO	protoporphyrinogen IX oxidase
PWC	Pesticide in Water Calculator
pyr	pyrimidinyl label
QSAR	quantitative structure-activity relationship
RAC	raw agricultural commodity
RBC	red blood cells
RD	residue definition
RDW	red cell distribution width
rel	relative
REI	restricted-entry interval
Reti	reticulocytes
ROW	right-of-way
RQ	risk quotient
RTI	retreatment interval
S9	mammalian metabolic activation system
SC	suspension concentrate
SDEV	standard deviation
SFO	single first order
SI	stimulation index
SPE	solid phase extraction
STMdR	supervised trial median residue
$T_{1/2}$	half-life of elimination
T3	tri-iodothyronine
TC	transfer coefficient
TFA	trifuoroacetic acid
Tmax	time of maximum plasma concentration
TP	transformation product

TRR	total radioactive residue
TSMP	*Toxic Substances Management Policy*
USEPA	United States Environmental Protection Agency
UV	ultraviolet
v/v	volume per volume dilution
WA	Washington
WBC	white blood cells
WG	water dispersible granules
wk(s) or w	week(s)
WSSA	Weed Science Society of America
wt	weight
WWEIA	What We Eat in America
yr(s)	year(s)

Appendix I Tables and figures

Table 1A Residue analysis in environmental media

Matrix	Analyte	Method type	LOQ	Reference
Soil	Active	HPLC-MS/MS	0.1 ppm	PMRA #2866129, 2866081
	DCC3825-M-01	HPLC-MS/MS	0.1 ppm	PMRA #2866129, 2866081
	DCC3825-M-12	HPLC-MS/MS	0.1 ppm	PMRA #2866129, 2866081
	DCC3825-M-13	HPLC-MS/MS	0.1 ppm	PMRA #2866129, 2866081
	DCC3825-M-36	HPLC-MS/MS	0.1 ppm	PMRA #2866129, 2866081
	DCC3825-M-53	HPLC-MS/MS	0.1 ppm	PMRA #2866129, 2866081
	DCC3825-M-20	HPLC-MS/MS	0.1 ppm	PMRA #2866129, 2866081
	DCC3825-M-29	HPLC-MS/MS	0.1 ppm	PMRA #2866129, 2866081
	DCC3825-M-30	HPLC-MS/MS	0.1 ppm	PMRA #2866129, 2866081
	DCC3825-M-63	HPLC-MS/MS	0.1 ppm	PMRA #2866129, 2866081
	DCC3825-M-69	HPLC-MS/MS	0.1 ppm	PMRA #2866129, 2866081
	DCC3825-M-72	HPLC-MS/MS	0.1 ppm	PMRA #2866129, 2866081
	DCC3825-M-73	HPLC-MS/MS	0.1 ppm	PMRA #2866129, 2866081
Sediment	Active	HPLC-MS/MS	0.01 ppm	PMRA #2866085, 2866086
	DCC3825-M-01	HPLC-MS/MS	0.01 ppm	PMRA #2866085, 2866086
	DCC3825-M-12	HPLC-MS/MS	0.01 ppm	PMRA #2866085, 2866086
	DCC3825-M-13	HPLC-MS/MS	0.01 ppm	PMRA #2866085, 2866086
	DCC3825-M-36	HPLC-MS/MS	0.01 ppm	PMRA #2866085, 2866086
	DCC3825-M-53	HPLC-MS/MS	0.01 ppm	PMRA #2866085, 2866086
Water	Active	HPLC-MS/MS	0.1 ppb	PMRA #2866083, 2866084
	DCC3825-M-01	HPLC-MS/MS	0.1 ppb	PMRA #2866083, 2866084
	DCC3825-M-12	HPLC-MS/MS	0.1 ppb	PMRA #2866083, 2866084
	DCC3825-M-13	HPLC-MS/MS	0.1 ppb	PMRA #2866083, 2866084
	DCC3825-M-36	HPLC-MS/MS	0.1 ppb	PMRA #2866083, 2866084
	DCC3825-M-53	HPLC-MS/MS	0.1 ppb	PMRA #2866083, 2866084

Table 1B Residue analysis in plant and livestock matrices

Analytical methods	Matrix	Analytes	Method ID/ Type	LOQ	Reference
Livestock commodities					
Enforcement Method/Data-Gathering Method	Bovine muscle, fat, liver, kidney and milk; hen eggs	Tiafenacil and the metabolites M-01 and M-36	035315/ HPLC-MS/MS	0.01 ppm/analyte	PMRA #2866121, 2866122
ILV of Enforcement Method	Bovine liver, kidney, muscle, fat and milk; hen eggs	Tiafenacil and the metabolites M-01 and M-36	035315/ HPLC-MS/MS	0.01 ppm/analyte	PMRA #2866122
Radiovalidation	Goat muscle, fat, liver, kidney and milk; and hen yolks and whites	Metabolites M-01, M-36, M-87 and M-88	N/A	N/A	PMRA #2886815
Plant Commodities					
Enforcement Method/ Data-Gathering Method	Grape, soybean, apple [original method validation] Field corn [forage, grain and stover]; grapes, raisins and grape juice; soybean [forage, hay and seed]; and wheat [forage, hay, grain and straw]	Tiafenacil and the metabolites M-01, M-10, M-36, M-52, M-53 and M-56	IRA15016N/ HPLC-MS/MS [A revised version of the method (GPL-MTH-113; HPLC-MS/MS) includes alternate SPE clean-up procedures recommended by the ILV]	0.01 ppm/analyte	PMRA #2886816, 2865973, 2865971, 2865972, 2865969, 2865970, 2865975, 3040422 or 3040405

Analytical methods	Matrix	Analytes	Method ID/ Type	LOQ	Reference
ILV of Enforcement Method	Grapes, soybean seed and wheat forage, grain and straw		IRA15016N/ HPLC-MS/MS	0.01 ppm/analyte	PMRA #2886816
Radiovalidation	Soybean seed and straw, potato foliage and wheat grain and straw.		N/A	N/A	PMRA #2865782
Data-Gathering Method	Wheat forage, hay, straw and grain	Tiafenacil and the metabolites M-01, M-10, M-36, M-52, M-53, M-56, M-63, M-72 and M-73	IRA16019N/ LC-MS/MS	0.01 ppm/analyte	PMRA #2865975

Table 2 Identification of select metabolites of Tiafenacil

Code	Chemical name
Tiafenacil	methyl N-[2-[[2-chloro-5-[3,6-dihydro-3-methyl-2,6-dioxo-4-(trifluoromethyl)-1(2H)-pyrimidinyl]-4-fluorophenyl]thio]-1-oxopropyl]-β-alaninate
M-01	3-(2-(2-chloro-4-fluoro-5-(3-methyl-2,6-dioxo-4-(trifluoromethyl)-2,3-dihydropyrimidin-1(6H)-yl)phenylthio)propanamido)propanoic acid
M-05	Similar to M-01 (+ 2H)
M-06	methyl 3-(2-((2-chloro-4-fluoro-5-(3-methylureido)phenyl)thio)propanamido)propanoate
M-07	3-[2-({2-chloro-4-fluoro-5-[(methylcarbamoyl)amino]phenyl}sulfanyl)propanamido]propanoic acid
M-10	methyl 3-(2-(2-chloro-4-fluoro-5-(3-methyl-2,6-dioxo-4-(trifluoromethyl)-2,3-dihydropyrimidin-1(6H)-yl)phenylsulfinyl)propanamido)propanoate
M-12	3-(2-(2-chloro-4-fluoro-5-(3-methyl-2,6-dioxo-4-(trifluoromethyl)-2,3-dihydropyrimidin-1(6H)-yl)phenylthio)propanoic acid
M-13	2-((2-chloro-4-fluoro-5-(3-methyl-2,6-dioxo-4-(trifluoromethyl)-3,6-dihydropyrimidin-1(2H)-yl)phenyl)thio)propanamide
M-20	2-((2-chloro-4-fluoro-5-(3-methylureido)phenyl)thio)propanoic acid
M-29	3-(3-(5-(1-carboxyethylsulfinyl)-4-chloro-2-fluorophenyl)-1-methyl ureido)-4,4,4-trifluoro butanoic acid

Code	Chemical name
M-30	3-(3-(5-(1-carboxyethylsulfonyl)-4-chloro-2-fluorophenyl)-1-methyl ureido)-4,4,4-trifluoro butanoic acid
M-32	2,2,2-trifluoroacetic acid
M-33	1,1,1-trifluoropropan-2-one
M-35	2-((2-chloro-4-fluoro-5-(3-methyl-2,6-dioxo-4-(trifluoromethyl)-3,6-dihydropyrimidin-1(2H)-yl)phenyl)sulfonyl)propanoic acid
M-36	2-(2-chloro-4-fluoro-5-(3-methyl-2,6-dioxo-4-(trifluoromethyl)-2,3-dihydropyrimidin-1(6H)-yl)phenylsulfinyl)propanoic acid
M-39	3-(2-((2-chloro-4-fluoro-5-(4,4,4-trifluoro-3-oxobutanamido)phenyl)thio)propanamido)propanoic acid
M-40	Z)-3-(3-(5-((1-((2-carboxyethyl)amino)-1-oxopropan-2-yl)thio)-4-chloro-2-fluorophenyl)-1-methylureido)-4,4,4-trifluorobut-2-enoic acid
M-41	None given
M-52	3-(2-(2-chloro-4-fluoro-5-(3-methyl-2,6-dioxo-4-(trifluoromethyl)-2,3-dihydropyrimidin-1(6H)-yl)phenylsulfinyl)propanamido)propanoic acid
M-53	2-(2-chloro-4-fluoro-5-(3-methyl-2,6-dioxo-4-(trifluoromethyl)-tetrahydropyrimidin-1(2H)-yl)phenylsulfinyl)propanoic acid
M-56	2-(2-chloro-5-(2,6-dioxo-4-(trifluoromethyl)-2,3-dihydropyrimidin-1(6H)-yl)-4-fluorophenylsulfinyl)propanoic acid
M-58	None given
M-59	None given
M-63	2-(2-chloro-4-fluoro-5-(3-methyl-2,6-dioxo-4-(trifluoromethyl)tetra-hydropyrimidin-1(2H)-yl)phenyl-sulfonyl)propanoic acid
M-69	2-((2-chloro-4-fluoro-5-(3-methylureido)phenyl)sulfinyl)propanoic acid
M-72	2-chloro-4-fluoro-5-(3-methyl-2,6-dioxo-4-(trifluoromethyl)-3,6-dihydropyrimidin-1(2H)-yl)benzenesulfonic acid
M-73	2-chloro-4-fluoro-5-[3-methyl-2,6-dioxo-4-(trifluoromethyl)-1,3-diazinan-1-yl]benzene-1-sulfonic acid

Table 3 Toxicity profile of end-use product - Tiafenacil 70WG Herbicide - containing tiafenacil

Effects are known or assumed to occur in both sexes unless otherwise noted.

Study type/Animal/PMRA #	Study results
Acute Oral Toxicity (gavage) Sprague-Dawley rats PMRA# 2865960	$LD_{50} \geq 2000$ mg/kg bw (♀) Low acute toxicity No clinical signs
Acute Dermal Toxicity Sprague-Dawley rats PMRA# 2865961	$LD_{50} \geq 2000$ mg/kg bw (♂/♀) Low acute toxicity Clinical signs: very slight erythema (Day 2)

Study type/Animal/PMRA #	Study results
Acute Inhalation Toxicity (nose-only) Sprague-Dawley rats PMRA# 2865962	LC_{50} > 5.29 mg/L (♂/♀) Low acute toxicity No clinical signs
Eye Irritation NZW rabbits PMRA# 2865964	MAS = 0.33/110 (unwashed eyes) MIS = 3.5/110 at 1 hr (unwashed eyes) Minimally irritating
Dermal Irritation NZW rabbits PMRA# 2865963	MAS = 0/8 MIS = 0/8 Non-irritating
Dermal Sensitization (LLNA) CBA/J mice PMRA# 2866002	SI = 0.9, 1.0, 1.0 at dose levels of 7%, 17.5%, and 35% of end-use product Negative

Table 4 Toxicity profile of end-use product, Tiafenacil 339SC Herbicide, containing tiafenacil

Effects are known or assumed to occur in both sexes unless otherwise noted.

Study type/Animal/PMRA #	Study results
Acute Oral Toxicity (gavage) Sprague-Dawley rats PMRA# 2866786	$LD_{50} \geq$ 2000 mg/kg bw (♀) Low toxicity No clinical signs
Acute Dermal Toxicity Sprague-Dawley rats PMRA# 2866787	$LD_{50} \geq$ 2000 mg/kg bw (♂/♀) Low toxicity No clinical signs
Acute Inhalation Toxicity (nose-only) Sprague-Dawley rats PMRA# 2866788	LC_{50} > 4.75 mg/L (♂/♀) Low toxicity Clinical signs: ↓ respiratory rate, hunched posture, pilo-erection, wet fur, stained fur (Day 1) (♂/♀); ↓ bw; ↓ bwg (2♀)

Study type/Animal/PMRA #	Study results
Eye Irritation NZW rabbits PMRA# 2866789	MAS = 0/110 (unwashed eyes) MIS = 0/110 (unwashed eyes) Non-irritating
Dermal Irritation NZW rabbits PMRA# 2866790	MAS = 0/8 MIS = 0/8 Non-irritating
Dermal Sensitization (LLNA) CBA/J mice PMRA# 2866791	SI = 1.0, 1.3, 1.3 at dose levels of 10%, 25% and 100% of test substance Negative

Table 5 Toxicity Profile of Technical Tiafenacil (Tergeo Technical Herbicide)

Effects observed in both sexes are presented first followed by sex-specific effects in males, then females, each separated by semi-colons. Organ weight effects reflect both absolute organ weights and relative organ to bodyweights unless otherwise noted. Effects seen above the LOAEL(s) have not been reported in this table for most studies for reasons of brevity.

Study type/Animal/PMRA #	Study results
Toxicokinetic and metabolism studies – Tiafenacil Technical Grade Active Ingredient (DCC-3825)	
Absorption, distribution, excretion and metabolism (gavage) Han Wistar rats Single dose of [Pyrimidinyl-4-^{14}C] or [Phenyl-^{14}C] at a dose of 10 mg/kg bw or 100 mg/kg bw For excretion kinetics, DCC-3825 was	**Absorption:** Tiafenacil (DCC-3825) was rapidly and extensively absorbed from the GI tract for both labels [Pyrimidinyl-4-^{14}C] and [Phenyl-^{14}C], in both sexes following a single- or repeat low-dose or a single high-dose. In bile duct-cannulated animals, most of the radioactivity was excreted via the bile. The absorption rate was calculated to be 86% in ♂ and 92% in ♀ for the single low-dose. Total radioactivity concentrations were higher in plasma than in whole blood. The maximum blood levels (T_{max}) were achieved 30 min after the single- or repeat low-dose in both sexes for both labels and the single high-dose for [phenyl-^{14}C] label. The T_{max} of the single high-dose for [pyrimidinyl-^{14}C] label was 75 min for ♂ and 45 min for ♀. The half-life ($T_{1/2}$) of the [pyrimidinyl-^{14}C] label was longer than the [phenyl-^{14}C] label at the low dose in both sexes; 40 hrs vs. 16 hrs for ♂, and 43 hrs vs. 27 hrs for ♀. In general, in single- or repeat low-dose or single high-dose groups for each label, the C_{max} values were

Study type/Animal/PMRA #	Study results
administered orally daily for 13 days, followed by a single dose of [Pyrimidinyl-4-^{14}C] or [Phenyl-^{14}C] at 10 mg/kg bw PMRA# 2866029	higher for ♂ than ♀. The area-under-the-curve (AUC) was also higher in the [pyrimidinyl-^{14}C] label. Following the repeat low-dose of tiafenacil, the $T_{1/2}$ and AUC of the [pyrimidinyl-^{14}C] label were similar to values observed after a single AD, suggesting that there is no change to the absorption or elimination pathways in the animal. The $T_{1/2}$ and AUC of the [phenyl-^{14}C] label increased up to approximately twofold in the repeat low-dose group. **Distribution:** The tissue distribution was similar between the sexes and labels, with the highest concentrations of radioactivity observed in the liver and kidneys (cortex) as well as increased levels observed in fat, lungs, adrenal gland, stomach, small intestine, and blood. Levels of total radioactivity decreased quickly in all tissues and the mean recovery of radioactivity in tissues/carcasses at sacrifice (at 168 hrs postdosing) was below 1% of the AD for both labels in single- or repeat low-dose or single high-dose groups indicating little potential for tissue retention. **Elimination:** Regardless of sex, dose level, or radiolabeled position, the majority of the radioactivity administered to rats was excreted via the feces (>80%). Elimination was rapid, with most of the AD (>90%) excreted within 48 hrs post-dose from the single- or repeat low-dose or single high-dose groups with [pyrimidinyl-4-^{14}C] or with [phenyl-^{14}C] labels. By 168 hrs, excretion was complete with no detectable radioactivity remaining in the carcass or tissues. No radioactivity was present in the expired air of animals in a preliminary study. A sex difference was noted in the urinary excretion of total radioactivity, with a higher amount being excreted in the urine of ♀ in each dose group (7%-12% for ♂ and 14%-17% for ♀ respectively). Following low-dose administration to bile duct-cannulated rats, excretion was fairly rapid, with 86.4-91.7% of the AD recovered after 24 hrs post-dose. **Metabolism:** The majority of the administered tiafenacil was rapidly transformed into M-01 by the cleavage of methyl ester. M01 was further metabolized by the degradation of thioalkyl chain (for example M-12 and M-13), the oxidation of sulphur atom (for example M-36 and M-52), the modification of pyrimidine ring (for example, reduction: M-05 and M-53, demethylation: M-05 and M-58, ring opening: M-29, M-40 and M-41) and the combination of these. M-12 is transformed into M-58 and M-59 following the methylation of free thiol and its oxidation. Metabolism of tiafenacil was qualitatively similar between ♂ and ♀ rats, however slight quantitative differences were noted. The main metabolite in the tissues was M-01. In the repeated dose group, M-05 was the main metabolite in the feces. Metabolites accounting >5% of the AD in the excreta were M-01, M-05, M-07, M-52 and M-59. Minor components detected in the excreta were M-10, M-12, M-13, M-20, M-29, M-32, M-33, M-36, M-39, M-40, M-41, M-53 and M-58. Unidentified metabolites

Study type/Animal/PMRA #	Study results
	in feces accounted for ≤4.9% of the AD with no single region exceeding 2.4% of the AD. No significant differences in the excreted metabolite profile were observed between labeled forms. Metabolite M05 was only detected in repeat-dosed rats and accounted for 35.7 and 8.5% of the AD in ♂ and ♀ respectively. The distribution of radioactivity in the feces of rats that had received phenyl labelled tiafenacil was consistent with the pyrimidinyl dosed rats. No significant differences were observed between the labeled forms of [^{14}C]-tiafenacil. The major metabolites were consistent across most matrices except for metabolites in excreta following repeated dosing to ♂.
Acute toxicity studies – Tiafenacil Technical Grade Active Ingredient (DCC-3825)	
Acute Oral Toxicity (gavage) Sprague Dawley rats PMRA# 2865996	LD_{50} > 2000 mg/kg bw (♀) Low toxicity Clinical signs: salivation after dosing
Acute Dermal Toxicity Sprague Dawley rats PMRA# 2865997	LD_{50} > 2000 mg/kg/bw Low toxicity Clinical signs: slight erythema (resolved by Day 10); brown staining on the head; wt loss
Acute Inhalation Toxicity (nose-only) Wistar rats PMRA# 2865998	LC_{50} > 5.38 mg/L Low toxicity No clinical signs
Eye Irritation NZW rabbits PMRA# 2865998	MAS[a] = 0.7/110 (unwashed eyes) MIS[b] = 2.7/110 at 1 hr (unwashed eyes) Minimally irritating
Dermal Irritation NZW rabbits PMRA# 2866000	MAS[a] = 0/8 MIS[b] = 0/8 Non-irritating
Dermal Sensitization (Maximization Method) Dunkin Hartley guinea pigs PMRA# 2866001	Negative
Dermal Sensitization (LLNA) CBA/J mice PMRA# 2866002	SI = 1.8, 2.0, 2.0 at dose levels of 10%, 25% and 50% a.i. Negative

Study type/Animal/PMRA #	Study results
Short-Term toxicity studies - Tiafenacil Technical Grade Active Ingredient (DCC-3825)	
14-Day Oral Toxicity (dietary) (Range-finding study) CD-1 mice PMRA# 2866005	Supplemental **≥ 139/132 mg/kg bw/day:** ↑ liver wt, ↑ lung wt (♂) **958/969 mg/kg bw/day:** bw loss, ↑ prominent lobular architecture in the liver (♂/♀); ↓ prostate wt, ↑ testes wt (♂); ↑ liver wt, ↑ pale liver, ↑ spleen wt, ↑ enlarged spleen, ↓ adrenal wt, ↓ uterus wt (♀)
28-Day Oral Toxicity (dietary) CD-1 mice PMRA# 2866007	NOAEL = could not be established LOAEL = 75/79 mg/kg bw/day (♂/♀) Effects at LOAEL: ↓ Hb, ↓ Hct, ↑ ALT, ↑ RDW (♂/♀); ↓ MCH, ↓ MCV (♂); ↓ bw, ↓ bwg, ↓ RBC, ↑ AST, ↑ LDH, ↑ K (♀)
90-Day Oral Toxicity (dietary) CD-1 mice PMRA# 2866010	NOAEL = could not be established/13 mg/kg bw/day (♂/♀) LOAEL = 11/43 mg/kg bw/day (♂/♀) Effects at LOAEL: ↑ platelets, ↑ liver wt, ↑ prominent lobular architecture (liver), ↑ centrilobular hypertrophy, ↑ centrilobular vacuolation, ↑ necrosis (hepatocytes) (♂/♀); ↑ ALT, ↑ LDH (♀)
90-Day Oral Toxicity (dietary) CD-1 mice PMRA# 2866011	NOAEL = 1.7/14 mg/kg bw/day (♂/♀) LOAEL = 13/47 mg/kg bw/day (♂/♀) Effects at LOAEL: ↑ liver wt, ↑ centrilobular hypertrophy, ↑ centrilobular vacuolation, ↑ prominent lobular architecture of the liver (♂/♀)
14-Day Oral toxicity (dietary) (Range-finding study) Han Wistar rats PMRA# 2866004	Supplemental **≥ 132/137 mg/kg bw/day:** ↓ bwg, ↓fc (days 1-4), ↑ rel liver wt, rel spleen wt (♂/♀); ↑ thyroid wt (♂) **≥456/432 mg/kg bw/day:** ↓ bw, ↓ rel liver, ↑ rel spleen wt (♂/♀); ↑ rel epididymides wt, ↑ thyroid wt (♂) **512/720 mg/kg bw/day:** bw loss, dark discolored livers (3/5) (♂)

Study type/Animal/PMRA #	Study results
28-Day Oral Toxicity (dietary) Han Wistar rats PMRA# 2866006	NOAEL could not be established. LOAEL = 87/92 mg /kg bw/day (♂/♀) Effects at LOAEL: ↓ bw, ↓ bwg, bw loss, ↓ fc, ↓ Hb, ↓ Hct, ↑ RDW, ↑ WBC, ↑ platelets, ↓ gluc (♂/♀); ↓ RBC, ↓ spleen wt, ↑ erythroid cellularity of the sternum (♂); ↓ A/G (♀)
90-Day Oral Toxicity (dietary) Han wistar rats PMRA# 2866009	NOAEL = 25/28 mg/kg bw/day (♂/♀) LOAEL = 84/94 mg/kg bw/day (♂/♀) Effects at LOAEL: ↓ bwg, ↓ Hct, ↓ MCV, ↑ RDW, ↑ Reti, ↑ WBC, ↑ Lymp, ↑ ALP, ↑ ALT, ↑ AST (♂/♀); ↓ bw, ↓ fe, ↓ abs liver wt, ↑ spleen wt, ↑ extramedullary haemopoiesis (spleen), ↑ erythroid cellularity (sternum and femur) (♂)
28-Day Oral Toxicity (capsule) (Range-finding study) Beagle dogs PMRA# 2866008	Supplemental **≥ 50 mg/kg bw/day**: ↑ Reti, ↑ bili, ↓ chol (♂/♀) **≥ 250 mg/kg bw/day:** ↓ bw, ↓ bwg, ↓ fc, ↓ Hb, ↓ Hct, ↓ Reti, ↑ monocytes, ↓ AST, ↓ creatinine, ↑ bili (Urine), ↓ A/G (♂/♀); ↑ liver wt (♂) **500 mg/kg bw/day:** bw loss (♀), ↓ activity, hunched posture, vomiting (1♀ on Day 14)
30-Day Oral Toxicity for Telemetric Evaluation of Cardiovascular Effects (capsule) Beagle dogs PMRA# 2988674	Supplemental No adverse toxicology effects were observed in this study. There were no effects on arterial blood pressure, heart rate or lead II ECG intervals or morphology observed in the treated animals at any dose level.
90-Day Oral Toxicity (capsule) Beagle dogs PMRA# 2866012	NOAEL = 10 mg/kg bw/day (♂/♀) LOAEL = 50 mg/kg bw/day (♂/♀) Effects at LOAEL: ↑ anisocytosis, ↑ microcytosis, ↑ bili, ↓ chol, ↓ spleen wt, ↑ pigmented macrophages (♂/♀); ↓ bw, ↓ bwg (♂)

Study type/Animal/PMRA #	Study results
1-year Oral Toxicity (capsule) Beagle dogs PMRA# 2866017	NOAEL = 20 mg/kg bw/day (♂/♀) LOAEL = 120 mg/kg bw/day (♂/♀) Effects at LOAEL: ↓ bw, ↓ Hb, ↓ Hct, ↓ MCV, ↓ MCH, ↓ MCHC, ↑ platelets, ↑ anisocytosis, ↑ microcytosis, ↑ hypochromasis (Weeks 13-26), ↑ extramedullary haematopoiesis (spleen) (♂/♀); thin appearance, ↑ liver wt, ↑ adrenal gland wt, ↓ spleen wt, ↓ thymus wt, ↓ thymus size, ↑ glycogen vacuolation (liver) (♂);↓ bwg, ↑ prothrombin time, ↑ APTT, ↑ urea, ↓ abs liver wt, ↑ cellularity in the bone marrow (sternum) (♀)
28-Day Dermal Toxicity Han Wistar rats PMRA# 2866013	NOAEL = 1000 mg/kg bw/day (♂/♀) LOAEL = could not be established No treatment-related effects were observed in this study.
90-Day Inhalation Toxicity Waiver Request PMRA #2866014	Waiver granted on the basis of physical-chemical properties and overall toxicity profile.
Chronic Toxicity/Oncogenicity studies - Tiafenacil Technical Grade Active Ingredient (DCC-3825)	
78-Week Carcinogenicity (dietary) CD-1 mice PMRA# 2866018	NOAEL = 0.35/1.3 mg/kg bw/day (♂/♀) LOAEL =1.1/9.7 mg/kg bw/day (♂/♀) Effects at LOAEL: ↑ pigmented Kupffer cells* (liver) (♂/♀); ↑ rel spleen wt, ↑ centrilobular hepatocellular hypertrophy (♂); ↑ centrilobular hepatocellular vacuolation (♀) No evidence of tumourigenicity. *Kupffer cells were a marker for changes in hematological parameters not assessed in the study and not considered adverse in and of themselves.
52/104-Week Chronic Toxicity/Oncogenicity (dietary) Han Wistar rats	NOAEL = 8/4 mg/kg bw/day (♂/♀) LOAEL = 28/18 mg/kg bw/day (♂/♀) Note: unless otherwise stated, the changes were seen at both 52 wks and 104 wks

Study type/Animal/PMRA #	Study results
PMRA# 2866016	Effects at LOAEL: ↓ bw, ↓ bwg, ↓ MCV, ↑ WBC (104 wks), ↑ Lymph, ↑ RDW, ↑ Neut, ↑ Reti, ↑ biliary hyperplasia (liver) (♂/♀); ↓ Eos, ↑ Eos infiltration (liver) (♂); ↓ Hb, ↓ Hct, ↓ MCH (52 wks) (♀) No evidence of tumourigenicity.
Developmental/Reproductive toxicity studies - Tiafenacil Technical Grade Active Ingredient (DCC-3825)	
1-Generation Reproductive Toxicity (dietary) (Range-finding study) Sprague-Dawley rats PMRA# 2866023	Supplemental Parental Toxicity **69/81 mg/kg bw/day**: ↑ liver porphyrins (♂/♀); ↑ mortality (2), ↓ bw, ↓ bwg, ↓ fc, ↓ RBC, ↓ Hb, ↓ Hct, ↑ Reti, ↑ AST, ↑ ALT, ↑ ALP, ↑ BUN (♂) Offspring Toxicity **≥ 0.7/0.9 mg/kg bw/day**: ↑ spleen wt (F1♂/♀); ↓ bw (PND 0-4) (♂)
2-Generational Reproductive Toxicity (dietary) Sprague-Dawley rats PMRA# 2866024	Parental Toxicity NOAEL = 2.6/4.3 mg/kg bw/day (♂/♀) LOAEL = 8.0/13 mg/kg bw/day (♂/♀) Effects at LOAEL: ↑ liver porphyrins (P/F1 ♂/♀) Offspring Toxicity NOAEL = 4.3 mg/kg bw/day (F1/F2 ♀) LOAEL =13 mg/kg bw/day (F1/F2 ♀) Effects at LOAEL: ↑ kidney cysts (F1/F2), ↑ liver porphyrins (F1) (♂/♀) Reproductive Toxicity NOAEL = 8.0/13 mg/kg bw/day (♂/♀) LOAEL could not be established No evidence of sensitivity of the young No evidence of reproductive toxicity
Developmental toxicity (gavage) (Range-finding study) Sprague-Dawley rats	Supplemental Maternal Toxicity **≥ 80 mg/kg bw/day**: ↓ gravid uterine wt (Note: not enough live implants for calculation at 150 or 300 mg/kg bw/day)

Study type/Animal/PMRA #	Study results
PMRA# 2866019	**≥ 150 mg/kg bw/day**: ↑ viscous fluid in uterus, ↑ vaginal discharge, ↑ post-implantation loss Developmental Toxicity **≥80 mg/kg bw/day:** ↓ gravid uterine wt, ↓ mean litter fetal wt, one fetus with whole body oedema, two litters with small size **≥ 150 mg/kg bw/day**: ↑ post-implantation loss
Developmental toxicity (gavage) Sprague-Dawley rats PMRA# 2866021	Maternal Toxicity NOAEL = 50 mg/kg bw/day LOAEL could not be established Developmental Toxicity NOAEL = 20 mg/kg bw/day LOAEL = 50 mg/kg bw/day Effects at LOAEL: ↓ fetal wt, ↑ ossification of phalanges No evidence of treatment-related malformations Evidence of sensitivity of the young
Developmental toxicity (gavage) (Range-finding study) NZW rabbits PMRA# 2866020	Supplemental: Two-Phase study for maternal toxicity (the first unmated phase determined dose level range for the mated phase) Maternal Toxicity Unmated phase: **800 mg/kg bw/day**: ↑ mortality (1) Mated phase: **≥100 mg/kg bw/day**: ↑ discoloration of amniotic sacs **≥300 mg/kg bw/day**: ↓ fc (GD 8 to 14) **800 mg/kg bw/day**: ↓ bwg, ↑ mortality (2) Developmental Toxicity (Mated phase) **≥300 mg/kg bw/day**: ↓ litters, ↓ live fetuses (due to maternal toxicity)

Study type/Animal/PMRA #	Study results
Developmental toxicity (gavage) NZW rabbits PMRA# 2866022	Maternal Toxicity NOAEL = 300 mg/kg bw/day LOAEL could not be established Developmental Toxicity NOAEL = 300 mg/kg bw/day LOAEL could not be established No evidence of treatment-related malformations. No evidence of sensitivity of the young.
Genotoxicity studies – Tiafenacil Technical Grade Active Ingredient (DCC-3825)	
Bacterial Reverse Mutation Assay *S. typhimurium* (TA98, TA100, TA1535, TA1537) *E. coli* (WP2 uvrA, pKM 101) PMRA# 2866025	Negative ± metabolic activation Tested up to limit concentration
Mammalian Cell Forward Gene Mutation Assay Mouse lymphoma L5178Y PMRA# 2866026	Negative ± metabolic activation Tested up to limit of solubility under culture conditions
In vitro Mammalian Clastogenicity (chromosomal aberration assay) Human lymphocytes PMRA# 2866027	Negative ± metabolic activation Tested up to limit of solubility under culture conditions

Study type/Animal/PMRA #	Study results
In vivo Micronucleus Assay CD1 mouse bone marrow PMRA# 2866028	Negative No signs of toxicity at any dose level.
Neurotoxicity studies - Tiafenacil Technical Grade Active Ingredient (DCC-3825)	
Acute Neurotoxicity (gavage) Han Wistar rats PMRA# 2866003	NOAEL = 2000 mg/kg bw/day (♂/♀) LOAEL could not be established No evidence of selective neurotoxicity.
Acute neurotoxicity study (oral) Han wistar rats PMRA# 2988672	Supplemental follows Japanese guideline JMAFF 2-2-1 No adverse toxicological effects were observed in this study.
90-Day Subchronic Neurotoxicity (dietary) Han wistar rats PMRA# 2866015	NOAEL = 9/29 mg/kg bw/day (♂/♀) LOAEL = 26/105 mg/kg bw/day (♂/♀) Effects at LOAEL: ↓ bw (♂/♀) No evidence of selective neurotoxicity.
Immunotoxicity studies - Tiafenacil Technical Grade Active Ingredient (DCC-3825)	
28-Day Oral Toxicity (dietary) CD1 mice PMRA# 2866030	NOAEL = 3.9 mg/kg bw/day (♂) LOAEL = 31 mg/kg bw/day (♂) Effects at LOAEL: ↑ liver wt, ↑ thymus wt, ↑ prominent lobular architecture of the liver (♂) No evidence of immune dysregulation.

Study type/Animal/PMRA #	Study results
Special studies – Tiafenacil Technical Grade Active Ingredient (DCC-3825)	
QSAR software TOPKAT 4.5 PMRA# 2866130	Predicted LD_{50} = 3361 mg/kg bw Experimental value > 2000 mg/kg bw GHS Category 5 Actual and predicted LD_{50} varies by factor of up to 5.1 within similar structures (similarity: 34-38%)
In vitro Neutral Red Uptake Phototoxicity Assay BALB/c 3T3 mouse fibroblasts PMRA# 2988676	Negative No signs of cytotoxicity or phototoxicity. Tested up to limit of solubility under culture conditions. Solubility evaluation revealed a solubility limit of 316 µg/mL.
In vitro hERG tail current amplitude assay HEK-293 cells PMRA# 2988673	The concentration-response curve showed that tiafenacil produced only a partial block of hERG current (29.00%) at 124 µM. IC_{50} could not be derived.
Whole Body Bias Flow Plethysmography (oral) Han Wistar rats PMRA# 2988673	Negative There were no statistically significant or biologically relevant effects on any of the respiratory parameters.
14-day oral MOA study ICR mice PMRA# 3129070	Supplemental – non-guideline **≥ 10 mg/kg bw/day:** ↓ BUN **(**♂/♀**);** ↓ Hb, ↑ platelets, ↑ CYP2B10 (♂); ↑ WBC, ↓ Mono (♀) **≥ 100 mg/kg bw/day:** ↑ CAR, ↑ CYP4A (♂/♀); ↑ WBC, ↓ Mono, ↑ ALT, ↑ AST, ↑ liver wt, ↑ centrilobular hypertrophy, cytoplasmic vacuolation and mixed inflammatory cell infiltration (liver) (♂);↓ HDW, ↑ CYP2B10 (♀) MOA: ↑ CYP2B via the CAR signaling pathway in males; minor ↑ CYP4A expression via PPARα signaling pathway.

Study type/Animal/PMRA #	Study results
In vitro PPO inhibition assay Mouse and Human PPOs PMRA# 3129070	Supplemental – non-guideline Mouse IC_{50} = 53.6±3.3 nM (Tiafenacil) Human IC_{50} = 1,012.9±40.4 nM (Tiafenacil) Mouse IC_{50} = 116.4±5.5 nM (Saflufenacil) Human IC_{50}= 1,774.5±102.5 nM (Saflufenacil) Limitations: no positive control
In vitro PPO inhibition assay Mouse, Rat, Rabbit and Human PPOs PMRA# 3129071	Supplemental – non-guideline Mouse IC_{50} = 47±2.7 nM (Tiafenacil) Rat IC_{50} = 92±14 nM (Tiafenacil) Rabbit IC_{50} = 666±41 nM (Tiafenacil) Human IC_{50} = 934±25 nM (Tiafenacil) Positive Control: Flumioxazin Mouse IC_{50} = 76±18nM Rat IC_{50} = 148±27 nM Rabbit IC_{50} = 604±81 nM Human IC_{50} = 755±66 nM
Special studies – metabolite DCC-3825 M-36	
QSAR software TOPKAT 4.5 PMRA# 2866130	Predicted LD_{50} = 917 mg/kg bw Experimental value > 2000 mg/kg bw GHS Category 4 or moderately acutely toxic Actual and predicted LD_{50} varies by factor of up to 5.8 within similar structures (similarity: 35-40%)
Acute Oral Toxicity (gavage) Sprague-Dawley rats PMRA# 2866031	$LD_{50} \geq$ 2000 mg/kg bw (♀) Low toxicity No clinical signs
Bacterial Reverse Mutation Assay *S. typhimurium* (TA98, TA100, TA1535, TA1537) *E. coli* (WP2 uvrA) PMRA# 2866033	Negative ± metabolic activation Tested up to limit of solubility.

Study type/Animal/PMRA #	Study results
Special studies – metabolite DCC-3825 M-53	
QSAR software TOPKAT 4.5 PMRA# 2866130	Predicted LD_{50} = 1261 mg/kg bw Experimental value > 2000 mg/kg bw GHS Category 4 or slightly acutely toxic Actual and predicted LD_{50} varies by factor of up to 5.8 within similar structures (similarity: 35-40%)
Acute Oral Toxicity (gavage) Sprague-Dawley rats PMRA# 2866032	$LD_{50} \geq 2000$ mg/kg bw (♀) Low toxicity No clinical signs
Bacterial Reverse Mutation Assay *S. typhimurium* (TA98, TA100, TA1535, TA1537) *E. coli* (WP2 uvrA) PMRA# 2866034	Negative ± metabolic activation Tested up to limit of solubility.
Special studies – metabolites of tiafenacil (DCC-3825)	
QSAR software TOPKAT 4.5 PMRA# 2866130	The predicted acute oral toxicity of metabolite M-69 led to classification as GHS category 3 or highly acutely toxic. The predicted acute oral toxicities of metabolites M-12, M-13, M-29, M-30, M-32, M-35, M-36, and M-53 led to classification of these substances as GHS category 4 or slight to moderate acute toxicity. The predicted acute oral toxicities of metabolites M-01 and M-63 are classified as GHS category 5 or low acute toxicity. The predicted acute oral toxicities of metabolites M-72 and M-73 were both >5000 mg/kg bw and therefore not subject to GHS categorization.
DEREK NEXUS (version 4.1.0, Lhasa Limited) evaluation on PMRA# 2866130	No trigger for any alerts for genotoxicity or mutagenicity in bacteria or mammals for DCC-3825 metabolites M-01, M-06, M-07, M-10, M-12, M-13, M-20, M-29, M-30, M-32, M-35, M-36, M-39, M-53, M-63, M-69, M-72, M-73

Table 6 Toxicology reference values for use in health risk assessment for Tiafenacil

Exposure Scenario	Study	Point of Departure and Endpoint	CAF[1] or Target MOE
Acute dietary	An endpoint of concern attributable to a single exposure was not identified in the oral toxicity studies		
	ARfD was not established		
Repeated dietary	78-week mouse carcinogenicity study	NOAEL = 0.35 mg/kg bw/day Based on increased hepatocyte hypertrophy, and increase in pigmented Kupffer cells (liver)*	100
	ADI = 0.004 mg/kg bw/day		
Short-term, intermediate-term dermal	28-day dermal toxicity study in rats	NOAEL = 1000 mg/kg bw/day No adverse effects up to the highest dose tested	100
Short-term, intermediate-term inhalation[2]	90-day oral toxicity study in mice	NOAEL = 1.7 mg/kg bw/day Based on increased liver weight, increased hepatocyte centrilobular vacuolation and necrosis	100
Cancer	A cancer risk assessment was not required		

[1] CAF (composite assessment factor) refers to a total of uncertainty and PCPA factors for dietary assessments; MOE refers to a target MOE for occupational assessments.
[2] Since an oral NOAEL was selected, an inhalation absorption factor of 100% (default value) was used in route-to-route extrapolation.
*Kupffer cells were a marker for changes in hematological parameters not assessed in the study and not considered adverse in and of themselves.

Table 7 AHETF/PHED unit exposure estimates for mixer/loaders and applicators handling Tiafenacil 70WG Herbicide and Tiafenacil 339SC Herbicide (µg/kg a.i. handled)

Exposure scenario & PPE		Dermal[1]	Inhalation[2]
PPE for all scenarios: Single layer and chemical-resistant gloves			
Mixer/loader AHETF estimates			
A	Open Mix/Load Dry Flowable	84.1	21.8
B	Open Mix/Load Liquid	58.5	0.63
Applicator AHETF/PHED estimates			
C	Open Cab Groundboom (AHETF)	25.4	1.68
D	Right-of-Way Sprayer (PHED)	872.5	5.00
Mixer/loader + applicator AHETF/PHED estimates (WG formulation)			
A+C	Open Mix/Load Dry Flowable +	109.5	23.5

Exposure scenario & PPE		Dermal[1]	Inhalation[2]
	Open Cab Groundboom (AHETF)		
A+E	Open Mix/Load Dry Flowable (AHETF) + M/L/A Liquid Low Pressure Handwand (for manually-pressurized handwand) (PHED)	1027.5	67.0
A+F	Open Mix/Load Dry Flowable (AHETF) + M/L/A Liquid Backpack (PHED)	5530.0	83.9
A+G	Open Mix/Load Dry Flowable (AHETF) + M/L/A Liquid High Pressure Handwand (for mechanically-pressurized handwand) (PHED)	5669.6	172.8
A+D	Open Mix/Load Dry Flowable (AHETF) + Right-of-Way Sprayer (PHED)	956.7	26.8
Mixer/loader + applicator AHETF/PHED estimates (SC formulation)			
B+C	Open Mix/Load Liquid + Open Cab Groundboom (AHETF)	83.9	2.31
E	Open Mix/Load Liquid (AHETF), Low Pressure Handwand (for manually-pressurized handwand) (PHED)	943.4	45.2
F	Open Mix/Load Liquid (AHETF) Backpack (PHED)	5445.9	62.1
G	Open Mix/Load Liquid (AHETF), High Pressure Handwand (for mechanically-pressurized handwand) (PHED)	5585.5	151
B+D	Open Mix/Load Liquid (AHETF) + Right-of-Way Sprayer (PHED)	931.0	5.63

[1] No adjustment since the dermal reference value is based on a dermal study (refer to Section 3.3).
[2] Light inhalation rate (except for backpack = moderate inhalation rate)

Table 8 Mixer/loader/applicator risk assessment for Tiafenacil 70WG Herbicide

Exposure scenario	Unit exposure (µg/kg a.i. handled)[1]		ATPD (ha/day)[2]	Rate (kg a.i./ha)	Daily exposure (mg/kg bw/day)[3]		MOE[4]	
	Dermal	Inhalation			Dermal	Inhalation	Dermal	Inhalation
PPE for all scenarios: Single layer and chemical-resistant gloves								
Open Mix/Load Dry Flowable + Open Cab Groundboom	109.5	23.5	107	0.050	0.0073	1.57×10^{-3}	1.37×10^{4}	1083
			360		0.0246	5.28×10^{-3}	4060	322
Open Mix/Load Dry Flowable + Low Pressure Handwand (for manually-pressurized handwand)	1027.5	67.0	1.07	0.050	0.000687	4.48×10^{-5}	1.46×10^{6}	3.79×10^{4}
Open Mix/Load Dry Flowable + Backpack	5530.0	83.9	1.07	0.050	0.00370	5.61×10^{-5}	2.70×10^{5}	3.03×10^{4}
Open Mix/Load Dry Flowable + High Pressure Handwand (for mechanically-pressurized handwand)	5669.6	172.8	27.1	0.050	0.0960	2.93×10^{-3}	1.04×10^{4}	581
Open Mix/Load	956.7	26.8	27.1	0.050	0.0462	4.54×10^{-4}	6.17×10^{4}	3750

Exposure scenario	Unit exposure (µg/kg a.i. handled)[1]		ATPD (ha/day)[2]	Rate (kg a.i./ha)	Daily exposure (mg/kg bw/day)[3]		MOE[4]	
	Dermal	Inhalation			Dermal	Inhalation	Dermal	Inhalation
Dry Flowable + Right-of-Way Sprayer								

ATPD = Area treated per day; MOE = Margin of exposure

[1] Unit exposure based on AHETF/PHED from Table 1.

[2] Default Area Treated per Day table (2017-09-20), ATPDs for handheld and ROW equipment were calculated using the formula ATPD (ha/day) = Liters applied per day (3800 L/day for mechanically pressurized handwand and ROW sprayer and 150 L/day for manually pressurized handwand and backpack sprayer) ÷ Labelled spray volume (140 L/ha)

[3] Daily exposure = (Unit exposure × ATPD × Rate) / (80 kg bw × 1000 µg/mg)

[4] Based on dermal NOAEL = 1000 mg/kg bw/day; inhalation NOAEL = 1.7 mg/kg bw/day; and target MOE = 100 for all exposure scenarios.

Table 9 Mixer/loader/applicator risk assessment for Tiafenacil 339SC Herbicide

Exposure Scenario	Unit Exposure (µg/kg a.i. handled)[1]		ATPD (ha/day)[2]	Rate (kg a.i./ha)	Daily Exposure (mg/kg bw/day)[3]		MOE[4]	
	Dermal	Inhalation			Dermal	Inhalation	Dermal	Inhalation
PPE for all scenarios: Single layer and chemical-resistant gloves								
Open Mix/Load Liquid + Open Cab Groundboom	83.9	2.31	107	0.050	0.00561	1.54×10^{-4}	1.78×10^{5}	1.1×10^{4}
			360		0.01890	5.20×10^{-4}	5.3×10^{4}	3300
Open Mix/Load Liquid + Low Pressure Handwand (for manually-pressurized handwand)	943.4	45.2	27.1	0.050	0.000631	3.20×10^{-5}	1.59×10^{6}	5.62×10^{4}
Open Mix/Load Liquid + Backpack	5445.9	62.1	1.07	0.050	0.00363	4.15×10^{-5}	2.75×10^{5}	4.1×10^{4}
Open Mix/Load	5585.5	151	27.1	0.050	0.0946	2.56×10^{-3}	1.06×10^{4}	665

Exposure Scenario	Unit Exposure (µg/kg a.i. handled)[1]		ATPD (ha/day)[2]	Rate (kg a.i./ha)	Daily Exposure (mg/kg bw/day)[3]		MOE[4]	
	Dermal	Inhalation			Dermal	Inhalation	Dermal	Inhalation
Liquid + High Pressure Handwand (for mechanically-pressurized handwand)								
Open Mix/Load Liquid + Right-of-Way Sprayer	931.0	5.63	27.1	0.050	0.0158	9.54×10^{-5}	6.34×10^{4}	1.78×10^{4}

ATPD = Area treated per day; MOE = Margin of exposure
[1] Unit exposure based on AHETF/PHED from Table 1.
[2] Default Area Treated per Day table (2017-09-20), ATPDs for handheld and ROW equipment were calculated using the formula ATPD (ha/day) = Liters applied per day (3800 L/day for mechanically pressurized handwand and ROW sprayer and 150 L/day for manually pressurized handwand and backpack sprayer) ÷ Labelled spray volume (140 L/ha)
[3] Daily exposure = (Unit exposure × ATPD × Rate) / (80 kg bw × 1000 µg/mg)
[4] Based on dermal NOAEL = 1000 mg/kg bw/day; inhalation NOAEL = 1.7 mg/kg bw/day; and target MOE = 100 for all exposure scenarios.

Table 10 Postapplication worker exposure and risk estimate for Tiafenacil 70WG Herbicide on day 0 after a single application to grapes (0.0504 kg a.i./ha)

Postapplication Activity	Peak DFR (µg/cm^2)[1]	Transfer Coefficient (TC) (cm^2/hr)[2]	Dermal Exposure (mg/kg bw/day)[3]	MOE[4]	REI[5]
Hand-set irrigation (grapes)	0.125	1750	0.0219	4.57×10^{4}	12 hrs
Scouting, pruning (grapes)	0.125	640	0.0080	1.25×10^{5}	12 hrs

DFR = Dislodgeable foliar residue; TC = Transfer Coefficient; MOE = Margin of exposure; REI = Restricted-entry interval
[1] Calculated using the default 25% dislodgeable on the day of application and 10% dissipation per day (outdoor scenario)
[2] Transfer coefficients obtained from PMRA Agricultural TCs Table (last updated on 02-24-2021)
[3] Exposure = (Peak DFR [µg/cm^2] × TC [cm^2/hr] × 8 hours) / (80 kg bw × 1000 µg/mg)
[4] Based on a dermal NOAEL of 1000 mg/kg bw/day, Target MOE = 100
[5] Minimum REI is 12 hours to allow residues to dry, suspended particles to settle and vapours to dissipate.

Table 11 Postapplication worker exposure and risk estimate for Tiafenacil 339SC Herbicide on day 0 after a single application to grapes (0.0502 kg a.i./ha)

Postapplication Activity	Peak DFR (µg/cm^2)[1]	Transfer Coefficient (TC) (cm^2/hr)[2]	Dermal Exposure (mg/kg bw/day)[3]	MOE[4]	REI[5]
Hand-set irrigation (grapes)	0.126	1750	0.0220	4.55×10^4	12 hrs
Scouting, pruning (grapes)	0.126	640	0.0080	1.25×10^5	12 hrs

DFR = Dislodgeable foliar residue; TC = Transfer Coefficient; MOE = Margin of exposure; REI = Restricted-entry interval
[1] Calculated using the default 25% dislodgeable on the day of application and 10% dissipation per day (outdoor scenario)
[2] Transfer coefficients obtained from PMRA Agricultural TCs Table (last updated on 02-24-2021)
[3] Exposure = (Peak DFR [µg/cm^2] × TC [cm^2/hr] × 8 hours) / (80 kg bw × 1000 µg/mg)
[4] Based on a dermal NOAEL of 1000 mg/kg bw/day, Target MOE = 100
[5] Minimum REI is 12 hours to allow residues to dry, suspended particles to settle and vapours to dissipate.

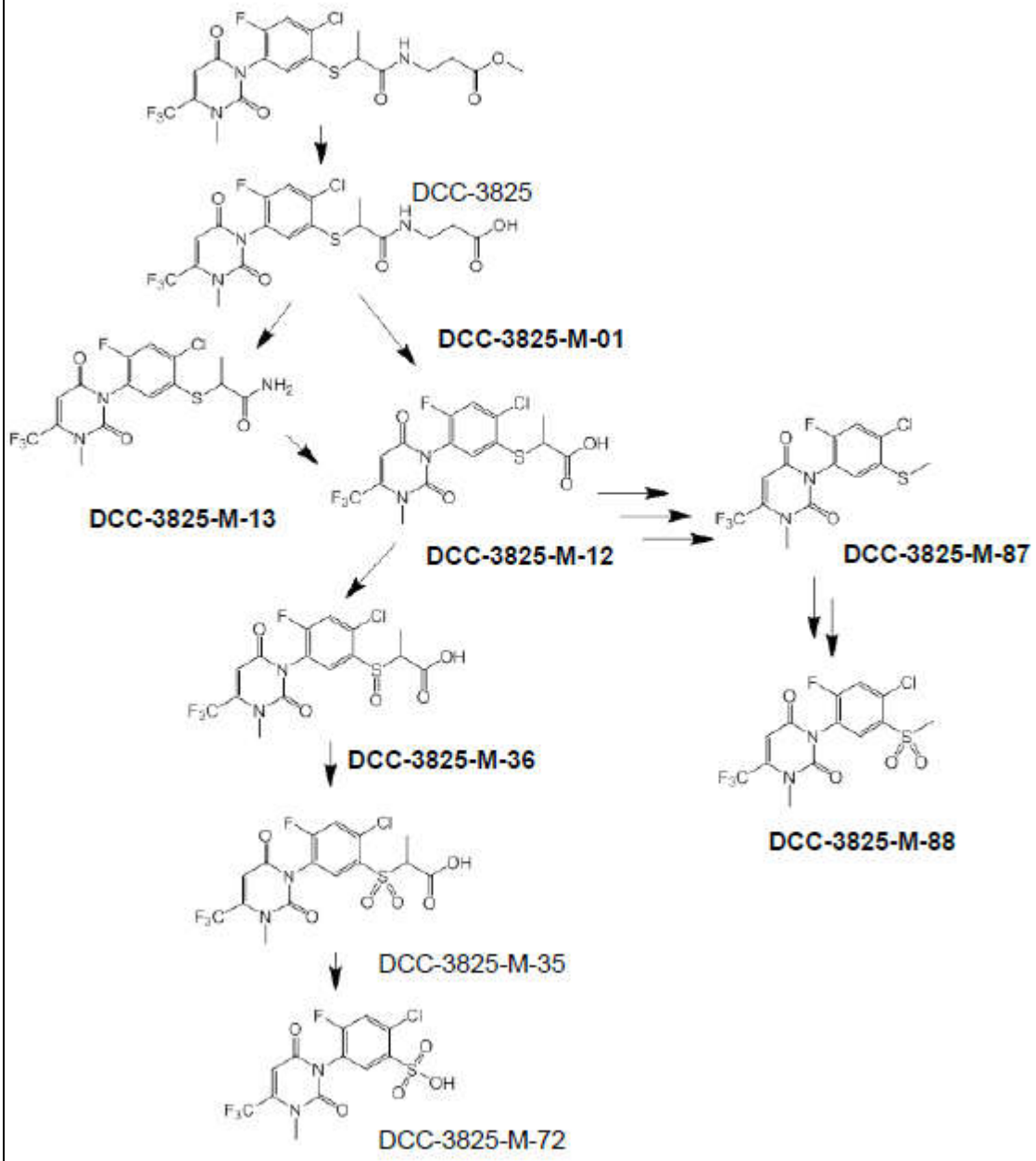
Table 12 Integrated food residue chemistry summary

NATURE OF THE RESIDUE IN LAYING HEN	PMRA #2866119
Species and Numbers	Five laying hens (species not reported)
Radiolabel position	[^{14}C-U-phenyl]-tiafenacil (specific activity: 2.09 MBq/mg) and [^{14}C-4-pyrimidinyl]-tiafenacil (specific activity: 2.20 MBq/mg)
Average dose	[^{14}C-U-phenyl]-tiafenacil: 11.7 mg/kg feed (corresponding to 0.875 mg/kg bw/day) [^{14}C-4-pyrimidinyl]-tiafenacil: 11.6 mg/kg feed (corresponding to 0.902 mg/kg bw/day)
Treatment Regimen	Animals were dosed once daily via capsule
Study period	14 consecutive days
Collection time	Eggs were collected twice daily and separated into yolks and whites. Excreta were collected prior to the initial dose and at 24-hour intervals thereafter until sacrifice.
Tissues collected	Liver, kidneys, muscle (leg plus thigh and breast), fat (peritoneal fat and skin plus fat), bile, partially formed eggs in oviduct, GI tract and GI tract contents.
Interval from last dose to sacrifice	Approximately 6 hours.
Plateau of residues in eggs	Residues in egg yolk increased throughout the dosing period for the pyrimidinyl-label, reaching a maximum on Day 14; whereas, residues in egg yolk from the phenyl-label plateaued by Day 9. Residues in egg white from both labels plateaued by Days 3-4.
Extraction solvents	Liver, kidney, muscle, egg white and excreta were extracted sequentially with acetonitrile/water. Samples of pooled fat and egg yolk were extracted sequentially with dichloromethane and acetonitrile/water.

Matrices	[^{14}C-U-phenyl]		[^{14}C-4-pyrimidinyl]	
	TRRs (ppm)	% of Administered dose	TRRs (ppm)	% of Administered dose
Excreta	N/A	74.5	N/A	76.8
Cage Wash	N/A	11.0	N/A	9.0
GI Tract & Contents	N/A	0.9	N/A	0.12
Pooled Egg Yolk (Day 9-13)	0.075	<0.1	0.084	0.1
Pooled Egg White (Day 9-13)	0.036	0.1	0.041	0.1
Partly Formed Eggs	0.074	<0.1	0.092	<0.1
Liver	0.208	<0.1	0.279	<0.1
Kidney	0.289	<0.1	0.332	<0.1
Fat (pooled)	0.194	<0.1	0.164	<0.1
Muscle (pooled)	0.048	<0.1	0.040	<0.1

Summary of major identified metabolites in hen matrices		
Radiolabel position	**[^{14}C-U-phenyl]**	**[^{14}C-4-pyrimidinyl]**
Metabolites identified	**Major metabolites**	**Major metabolites**
Liver	M-01, M-12, M-88	M-01, M-12, M-88
Kidney	M-12, M-13, M-88	M-12, M-13, M-88
Muscle	M-88	M-01, M-88
Fat	M-87, M-88	M-87, M-88
Egg white	M-36, M-88	M-87, M-88
Egg yolk	M-88	M-87, M-88
Excreta	Tiafenacil, M-01, M-12, M-36	M-01, M-12, M-36

Proposed metabolic scheme in poultry



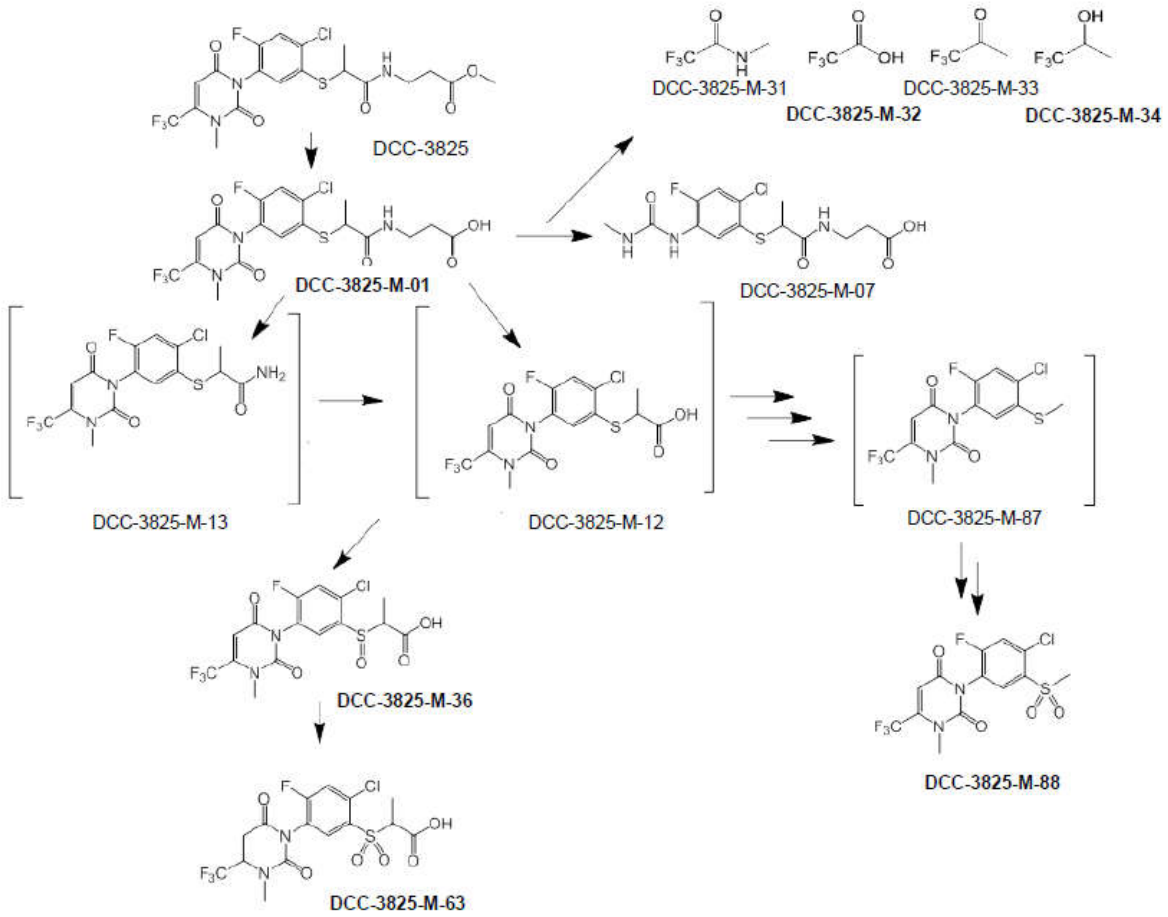
NATURE OF THE RESIDUE IN LACTATING GOAT	PMRA #2866120
Species and Numbers	One goat each was used for dosing with phenyl-label (species: Sannen Toggenburg) and pyrimidinyl-label (species: Toggenburg)
Radiolabel position	[^{14}C-U-phenyl]-tiafenacil (specific activity: 2.11 MBq/mg) and [^{14}C-4-pyrimidinyl]-tiafenacil (specific activity: 2.13 MBq/mg)
Average dose	[^{14}C-U-phenyl]-tiafenacil: 13.5 mg/kg feed (corresponding to

	0.281 mg/kg bw/day) [^{14}C-4-pyrimidinyl]-tiafenacil: 31.1 mg/kg feed (corresponding to 0.256 mg/kg bw/day)
Treatment Regimen	Animals were dosed once daily via capsule.
Study period	7-8 consecutive days
Collection time	Milk was collected twice daily, and just prior to sacrifice. Composited milk samples from Day 6-7 were centrifuged to obtain cream and skim milk samples. Urine and feces were collected prior to initial dose and at 24-hour intervals thereafter until sacrifice.
Tissues collected	Liver; kidneys; loin and flank muscle; omental, perirenal, and subcutaneous fat; GI tract and contents; and bile.
Interval from last dose to sacrifice	Approximately 6 hours
Plateau of residues in milk	Residues in milk increased throughout the dosing period for the pyrimidinyl label, reaching a maximum on Day 7 in the PM sample, whereas residues in milk from the phenyl-label plateaued by Day 3. For both labels, residues concentrated in cream by 1.6-2.1-fold.
Extraction solvents	Liver, kidney, pooled muscle and feces were extracted sequentially with acetonitrile/water. Pooled fat samples were extracted sequentially with dichloromethane and acetonitrile/water. Milk samples were extracted sequentially with hexane, acetonitrile/water and acetone.

Matrices	**[^{14}C-U-phenyl]**		**[^{14}C-4-pyrimidinyl]**	
	TRRs (ppm)	**% of Administered Dose**	**TRRs (ppm)**	**% of Administered Dose**
Urine	N/A	11.9	N/A	22.3
Feces	N/A	60.8	N/A	46.9
Cage Wash	N/A	7.5	N/A	1.6
GI Tract & Contents	N/A	10.6	N/A	19.8
Pooled Milk (Day 2-3)	N/A	N/A	0.017	<0.1
Pooled Milk (Day 4-6)	0.007	<0.1	0.033	<0.1
Cream (Day 6-7)	0.017	N/A	0.075	N/A
Skim Milk (Day 6-7)	0.007	N/A	0.041	N/A
Liver	0.222	0.2	0.551	0.2
Kidney	0.141	<0.1	0.162	<0.1
Fat (Pooled)	0.012	<0.1	0.019	<0.1
Muscle (Pooled)	0.009	<0.1	0.021	<0.1

Summary of major identified metabolites in goat matrices		
Radiolabel position	**[^{14}C-U-phenyl]**	**[^{14}C-4-pyrimidinyl]**
Metabolites identified	**Major metabolites**	**Major metabolites**
Liver	M-01, M-63	M-01, M-34
Kidney	M-01, M-36	M-01, M-32 (TFA, trifluoroacetic acid)
Muscle	M-01, M-36, M-88	M-32, M-34
Fat	M-88	M-88
Milk (Day 2-3)	None	None
Milk (Day 4-6)	None	M-32
Urine	M-01, M-07	M-01, M-32, M-33
Feces	Tiafenacil, M-01	Tiafenacil, M-01, M-63

Proposed metabolic scheme in ruminant



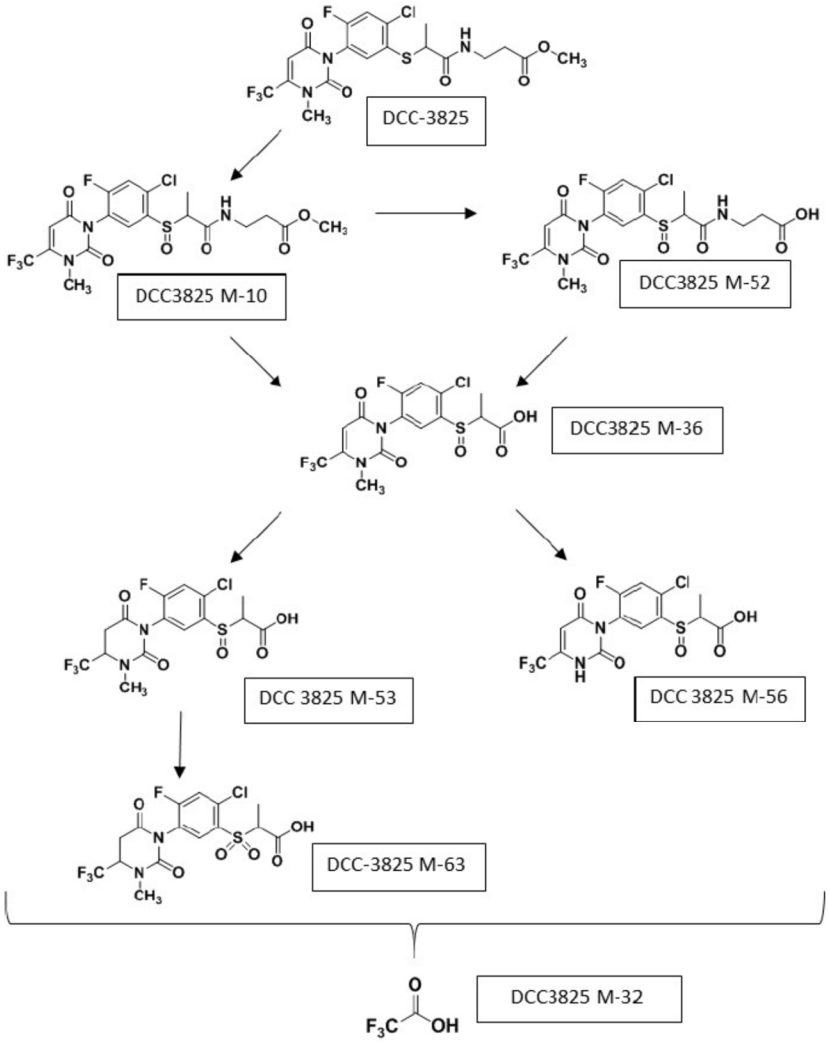
LIVESTOCK FEEDING – Dairy cattle

A feeding study was not required based on the low dietary burden. Therefore, the goat metabolism study was used to estimate the anticipated residues in the relevant livestock matrices.

Anticipated Residues in Animal Matrices			
Matrices	**Residue Definition**	**Dietary Burden (ppm)**	**Anticipated Residues (ppm)**
Beef/Dairy Cattle			
Whole milk	Tiafenacil	0.12	$<3.9 \times 10^{-6}$
Fat			ND
Liver			5.3×10^{-5}
Kidney			6.2×10^{-5}
Muscle			ND
Swine			
Fat	Tiafenacil	0.01	ND
Liver			4.4×10^{-6}
Kidney			5.2×10^{-6}
Muscle			ND
ND = Not Detected Note: The only matrices in which tiafenacil was detected in the goat metabolism study was milk (<0.001 ppm, Day 2-3; pyrimidinyl label), liver (0.006 ppm; phenyl label) and kidney (0.007 ppm; phenyl label).			
LIVESTOCK FEEDING – Laying hens			
A feeding study was not required on the low dietary burden. Therefore, the hen metabolism study was used to estimate the anticipated residues in the relevant livestock matrices.			
Anticipated Residues in Poultry Matrices			
Matrices	**Residue Definition**	**Dietary Burden (ppm)**	**Anticipated Residues (ppm)**
Eggs	Tiafenacil	0.01	ND
Fat			ND
Liver			ND
Muscle			ND
ND = Not Detected Note: Tiafenacil was not detected in any matrix from the hen metabolism study.			

NATURE OF THE RESIDUE IN CORN [PREPLANT SOIL TREATMENT]	**PMRA # 2866113**
Radiolabel Position	[^{14}C-U-phenyl]-tiafenacil (specific activity: 2.21 MBq/mg) and [^{14}C-4-pyrimidinyl]-tiafenacil (specific activity: 2.14 MBq/mg)
Treatment	
Test Site	Corn plants were grown in pots.
Treatment	Single application to bare soil 14 days prior to planting of corn seed.
Total Rate	[^{14}C-U-phenyl]-label: 153.3 g a.i./ha; [^{14}C-4-pyrimidinyl]-label: 154.1 g a.i./ha
Formulation	Micro-emulsion (5%)
Harvest	Immature (BBCH 78) forage, grain and cobs (145 days after

	planting, DAP; 159 days after treatment, DAT); mature (BBCH 89) stover, grain and cobs (173-DAP; 187-DAT).			
Extraction solvent	Acetonitrile/water containing 0.1% formic acid			
Matrices	**Harvest Intervals (days)**		**[^{14}C-U-phenyl]**	**[^{14}C-4-pyrimidinyl]**
	DAP	**DAT**	**TRR (ppm)**	**TRR (ppm)**
Immature Forage	145	159	0.014	0.025
Immature Grain			0.001	0.002
Immature Cob			<0.001	0.002
Mature Stover	173	187	0.010	0.039
Mature Grain			0.001	0.002
Mature Cob			0.001	0.005
Note: Samples of cobs and grain were not subjected to extraction and analysis procedures due to low radioactivity levels.				
Summary of Major Identified Metabolites in Corn Matrices				
Radiolabel Position	**[^{14}C-U-phenyl]**		**[^{14}C-4-pyrimidinyl]**	
Metabolites Identified	**Major Metabolites**		**Major Metabolites**	
Forage	M-36, M-52, M-56		M-32	
Stover	M-36, M-52, M-56		M-32	
Proposed Metabolic Scheme in Corn: Preplant Soil Application				

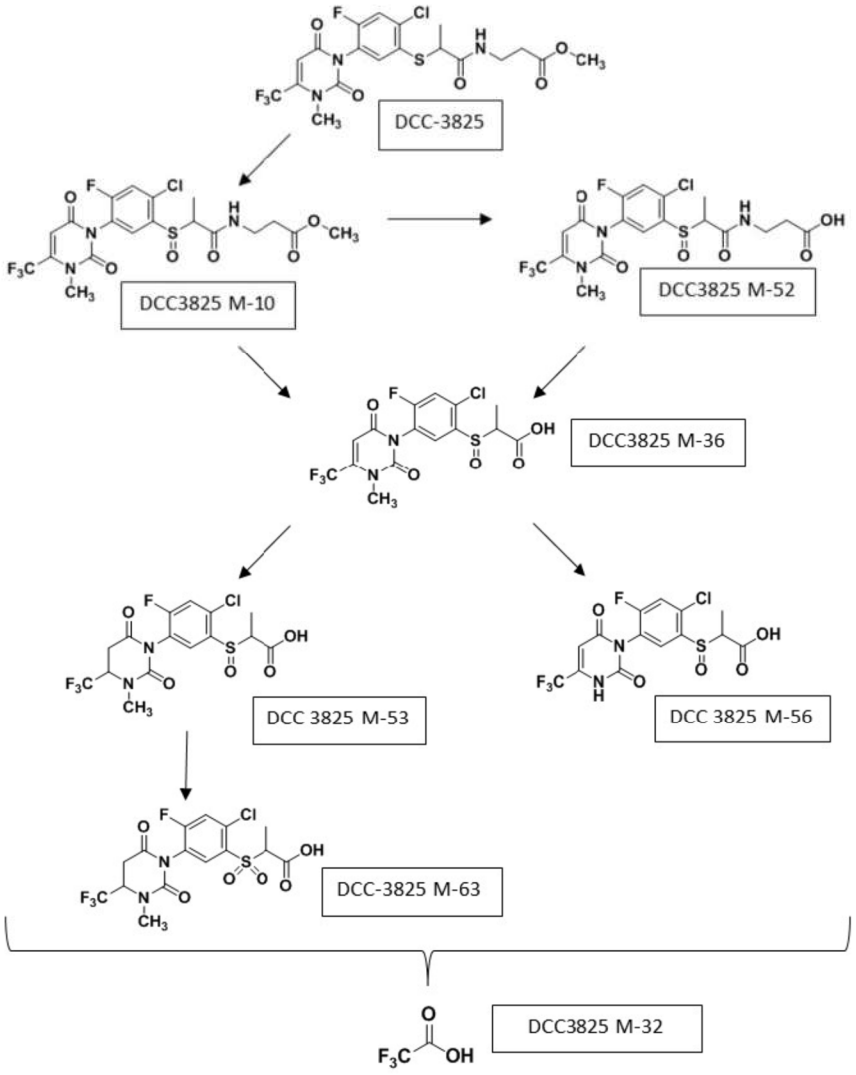


NATURE OF THE RESIDUE IN POTATO [PREPLANT SOIL TREATMENT]	**PMRA #2866114**
Radiolabel Position	[^{14}C-U-phenyl]-tiafenacil (specific activity: 4.60 MBq/mg) and [^{14}C-4-pyrimidinyl]-tiafenacil (specific activity: 4.63 MBq/mg)
Treatment	
Test Site	The plants were grown in wooden containers.
Treatment	Single application to bare soil 14 days prior to planting of seed potatoes.
Total Rate	[^{14}C-U-phenyl]-label: 149.9 g a.i./ha; [^{14}C-4-pyrimidinyl]-label: 147.2 g a.i./ha
Formulation	Micro-emulsion (5%)
Harvest	Immature foliage (leaves and stems) and tubers (42-DAP) were collected and not analyzed; mature (BBCH 91) foliage (leaves and stems) and tubers (131-DAP; 145-DAT).

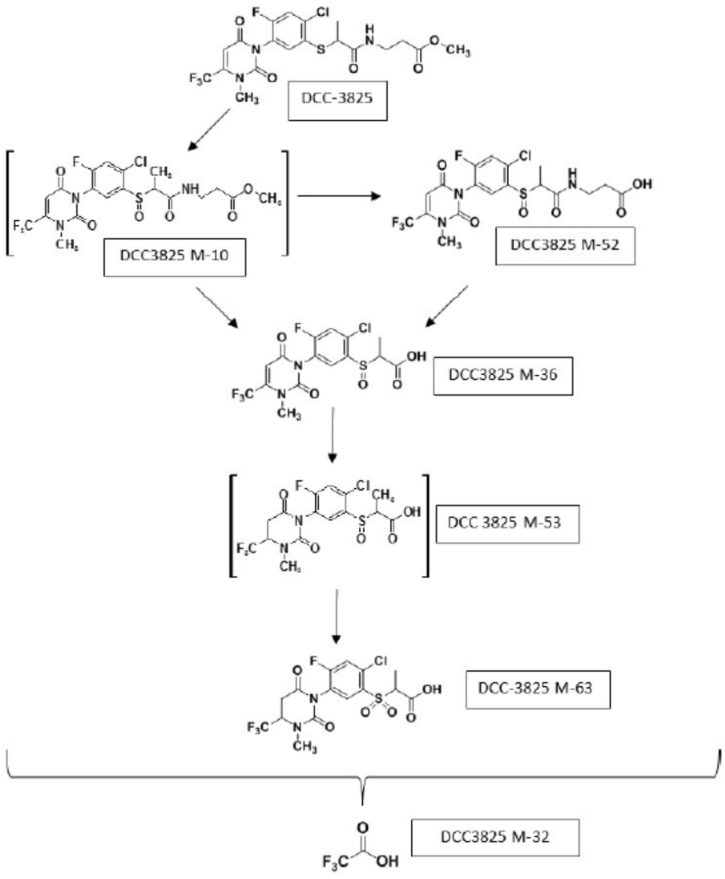
Extraction solvent	Acetonitrile/water containing 0.1% formic acid			
Matrices	**Harvest Intervals (days)**		**[^{14}C-U-phenyl]**	**[^{14}C-4-pyrimidinyl]**
	DAP	**DAT**	**TRR (ppm)**	**TRR (ppm)**
Mature Foliage	131	145	0.058	0.267
Mature Tubers			0.002	0.001
Note: Samples of potato tubers were not subjected to extraction and analysis procedures due to low radioactivity levels.				

Summary of Major Identified Metabolites in Potato Matrices		
Radiolabel Position	**[^{14}C-U-phenyl]**	**[^{14}C-4-pyrimidinyl]**
Metabolites Identified	**Major Metabolites**	**Major Metabolites**
Foliage	M-36, M-52, M-56	M-32, M-36, M-52

Proposed Metabolic Scheme in Potatoes: Preplant Soil Application



NATURE OF THE RESIDUE IN MANDARIN [SOIL TREATMENT]				PMRA #2866115
Radiolabel Position	[^{14}C-U-phenyl]-tiafenacil (specific activity: 4.28 MBq/mg) and [^{14}C-4-pyrimidinyl]-tiafenacil (specific activity: 4.24 MBq/mg)			
Treatment				
Test Site	Mandarin trees were grown in containers.			
Treatment	Single application to bare soil around the base of the tree. For each radiolabel, one tree was treated 30 days before harvest, and the second tree was treated 60 days before harvest.			
Total Rate	[^{14}C-U-phenyl]-label: 476.2 g a.i./ha; [^{14}C-4-pyrimidinyl]-label: 432.5 g a.i./ha			
Formulation	Micro-emulsion (5%)			
Harvest	Immature foliage and fruit were harvested once from each tree at either 10-DAT for the 30-day PHI, or 40-DAT for the 60-day PHI. Mature foliage and fruit were harvested at 30- and 60-DAT. The fruit was separated into peel and pulp.			
Extraction solvent	Acetonitrile/water containing 0.1% formic acid			
Matrices	**Harvest Interval (days)**		**[^{14}C-U-phenyl]**	**[^{14}C-4-pyrimidinyl]**
	PHI	**DAT**	**TRR (ppm)**	**TRR (ppm)**
Foliage - immature	30	10	0.001	0.002
Fruit - immature			<0.001	<0.001
Foliage - mature		30	0.002	0.028
Peel - mature			<0.001	0.004
Pulp - mature			<0.001	0.001
Foliage - immature	60	40	0.001	0.013
Fruit - immature			<0.001	0.001
Foliage - mature		60	0.002	0.036
Peel - mature			0.001	0.002
Pulp - mature			<0.001	<0.001
Note: Samples of all phenyl-label matrices and pyrimidinyl-label matrices, except foliage from 30-, 40- and 60-DAT, were not subjected to extraction and analysis procedures due to low radioactivity levels.				
Summary of Major Identified Metabolites in Mandarin Matrices				
Radiolabel Position	**[^{14}C-4-pyrimidinyl]**			
Metabolites Identified	**Major Metabolites**			
Foliage – mature [30-DAT]	M-32			
Foliage – mature [40-DAT]	M-32			
Foliage – mature [60-DAT]	M-32			
Proposed Metabolic Scheme in Mandarin: Soil Treatment				



FREEZER STORAGE STABILITY IN PLANT MATRICES				PMRA #2865969, 2996931
Tested Matrices	**Analytes**	**Tested Intervals (months)**	**Temperature (°C)**	**Category**
Grapes	Tiafenacil, M-01, M-10, M-36, M-52, M-53 and M-56	0 ,1, 3, 6, 12, 18 and 24, except for grape juice and raisins	≤-16	High-acid
Raisins	Tiafenacil, M-01, M-10, M-36, M-52, M-53 and M-56	0, 1, 3, 6 and 12 for grape juice and raisins		N/A
Grape juice	Tiafenacil, M-01, M-10, M-36, M-52, M-53 and M-56			N/A
Soybean seed	Tiafenacil,			High-oil

	M-01, M-10, M-36, M-52, M-53 and M-56			
Wheat forage	Tiafenacil, M-01, M-10, M-36, M-52, M-53, M-56, M-63, M-72 and M-73			High-water
Wheat straw	Tiafenacil, M-01, M-10, M-36, M-52, M-53, M-56, M-63, M-72 and M-73			N/A
Wheat grain	Tiafenacil, M-01, M-10, M-36, M-52, M-53, M-56, M-63, M-72 and M-73			High-starch

CROP FIELD TRIALS & RESIDUE DECLINE ON GRAPES **PMRA # 2865973**

Crop field trials were conducted in 2015 and 2016 in Canada and the United States. Trials were conducted in North American growing regions 1 (2 trials), 5 (3 trials), 10 (8 trials) and 11 (2 trials) for a total of 15 trials. A 70% WG formulation of tiafenacil was applied to grapes (BBCH 81-89) once as a spray directed under the vines at a rate of 145-154 g a.i./ha. Adjuvants (methylated seed oil and ammonium sulfate) were added to the spray mixture for all applications. At one trial, samples were collected at additional PHIs of 0, 14 and 21 days to assess residue decline.

In the decline trial, residues of tiafenacil were below the LOQ (in other words, <0.01 ppm) in/on grapes at all sampling intervals. Therefore, no decline trend could be determined.

Crop	Total Application Rate (g a.i./ha)	PHI (days)	Analyte	Residue Levels (ppm)					
				n	LAFT	HAFT	Median	Mean	SDEV
Grapes	145-154	6-7	Tiafenacil	15	<0.010	<0.010	<0.010	<0.010	0

n = number of independent trials, LAFT = lowest average field trial, HAFT = highest average field trial, SDEV = standard deviation

CROP FIELD TRIALS & RESIDUE DECLINE ON CORN	PMRA #2865970

Crop field trials were conducted in 2015 and 2016 in the United States, including growing regions representative of Canada. Trials were conducted in North American growing regions 1 (1 trial), 2 (1 trial), 5 (17 trials) and 6 (1 trial) for a total of 20 trials for field corn, and for popcorn trials were conducted in North American growing regions 5 (3 trials). A 70% WG formulation of tiafenacil was applied as a single preplant or pre-emergence broadcast application to the soil at a rate of 148-154 g a.i./ha for field corn and 150-151 g a.i./ha for popcorn. Adjuvants (methylated seed oil and ammonium sulfate) were added to the spray mixture for all applications. At two field corn trials, additional RAC samples were harvested 7 days before, and 7 and 13-14 days after harvest to assess residue decline.

In the decline trials, residues of tiafenacil were below the LOQ (in other words, <0.01 ppm) in/on field corn forage, grain and stover at all sampling intervals. Therefore, no decline trend could be determined.

Crop	Total Application Rate (g a.i./ha)	PHI (days)	Analyte	Residue Levels (ppm)					
				n	LAFT	HAFT	Median	Mean	SDEV
Field corn forage	148-154	77-108	Tiafenacil	20	<0.010	<0.010	<0.010	<0.010	0
Field corn grain	148-154	115-159	Tiafenacil	20	<0.010	<0.010	<0.010	<0.010	0
Field corn stover	148-154	115-159	Tiafenacil	20	<0.010	<0.010	<0.010	<0.010	0
Popcorn grain	150-151	132-140	Tiafenacil	3	<0.010	<0.010	<0.010	<0.010	0

n = number of independent trials, LAFT = lowest average field trial, HAFT = highest average field trial, SDEV = standard deviation

CROP FIELD TRIALS & RESIDUE DECLINE ON WHEAT	PMRA # 2865972

Crop field trials were conducted in 2015 and 2016 in Canada and the United States. Trials were conducted in North American growing regions 5 (2 trials), 7 (7 trials), 7A (1 trial), 11 (1 trial) and 14 (9 trials) for a total of 20 trials on spring wheat, and for winter wheat trials were conducted in North American growing regions 2 (1 trial), 4 (1 trial), 5 (4 trials), 6 (2 trials) and 8 (4 trials) for a total of 12 trials on winter wheat. A 70% WG formulation of tiafenacil was applied as a single preplant or pre-emergence broadcast application to the soil at a rate of 141-156 g a.i./ha. Adjuvants (methylated seed oil and ammonium sulfate) were added to the spray mixture for all applications. In two trials (one spring wheat and one winter wheat), samples were collected at additional time intervals to monitor residue decline (7 days prior to normal maturity, 7 days after normal maturity, 11-14 days after normal maturity).

In the decline trials, residues of tiafenacil were below the LOQ (in other words, <0.01 ppm) in/on wheat forage, hay, grain and straw at all sampling intervals. Therefore, no decline trend could be determined.

Crop	Total Application Rate (g a.i./ha)	PHI (days)	Analyte	Residue Levels (ppm)					
				n	LAFT	HAFT	Median	Mean	SDEV
Wheat forage	141-156	29-197	Tiafenacil	32	<0.010	<0.010	<0.010	<0.010	0
Wheat hay	141-156	50-247	Tiafenacil	32	<0.010	<0.010	<0.010	<0.010	0
Wheat straw	141-156	87-279	Tiafenacil	32	<0.010	<0.010	<0.010	<0.010	0
Wheat grain	141-156	87-279	Tiafenacil	32	<0.010	<0.010	<0.010	<0.010	0

n = number of independent trials, LAFT = lowest average field trial, HAFT = highest average field trial, SDEV = standard deviation

CROP FIELD TRIALS & RESIDUE DECLINE ON SOYBEAN | **PMRA # 2865971**

Crop field trials were conducted in 2015 and 2016 in the United States, including growing regions representative of Canada. Trials were conducted in North American growing regions 2 (2 trials), 4 (4 trials) and 5 (15 trials) for a total of 21 trials. A 70% WG formulation of tiafenacil was applied as a single preplant or pre-emergence broadcast application to the soil at a rate of 148-155 g a.i./ha. Adjuvants (methylated seed oil and ammonium sulfate) were added to the spray mixture for all applications. At three trials, additional RAC samples were harvested 6-8 days before, and 6-8 and 14-15 days after nominal harvest to access residue decline; at one trial, seed samples were not collected as the crop was destroyed by a hurricane.

In the decline trials, residues of tiafenacil were below the LOQ (<0.01 ppm) in/on soybean forage, hay and seed at all sampling intervals. Therefore, no decline trend could be determined.

Crop	Total Application Rate (g a.i./ha)	PHI (days)	Analyte	Residue Levels (ppm)					
				n	LAFT	HAFT	Median	Mean	SDEV
Soybean forage	148-155	33-71	Tiafenacil	21	<0.010	<0.010	<0.010	<0.010	0
Soybean hay		42-92	Tiafenacil	21	<0.010	<0.010	<0.010	<0.010	0
Soybean seed		106-170	Tiafenacil	20	<0.010	<0.010	<0.010	<0.010	0

n = number of independent trials, LAFT = lowest average field trial, HAFT = highest average field trial, SDEV = standard deviation

PROCESSED FOOD AND FEED – GRAPE, CORN, WHEAT, and SOYBEAN	**PMRA # 2865973, 2865970, 2865972, 2865971**
During the grape, corn, wheat and soybean field trials, additional plots were allocated for treatment rates corresponding to 1.50 kg a.i./ha (30-fold of maximum seasonal rate). As residues of tiafenacil were non-quantifiable in/on wheat grain, corn grain, and soybean seed, samples were not processed. Tiafenacil residues were non-quantifiable in grapes and processed commodities (in other words, juice and raisins). As such, processing factors could not be calculated for tiafenacil in any processed fractions.	

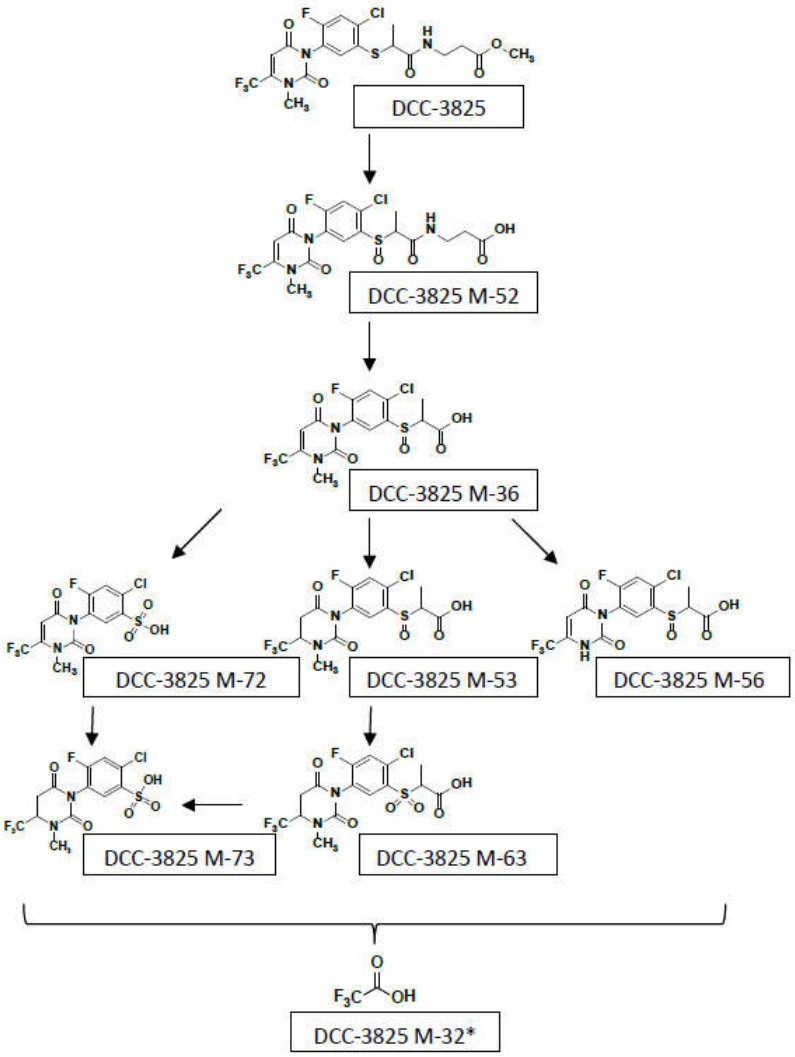
CONFINED ACCUMULATION IN ROTATIONAL CROPS – Lettuce, radish and wheat			**PMRA # 2865974**
Radiolabel Position	[phenyl-U-^{14}C]tiafenacil (specific activity: 2.21 MBq/mg); [pyrimidinyl-4-^{14}C]tiafenacil (specific activity: 2.23 MBq/mg)		
Treatment			
Test Site	Rotational crops were grown in a greenhouse in open plastic-sided crates filled with soil.		
Soil Type	Sandy loam		
Treatment	Application to bare soil at a rate of 144.7 g a.i./ha or 145.8 g a.i./ha.		
Formulation	5% micro-emulsion formulation		
Plant-back interval (PBI)	30, 120 or 180 (lettuce) and 365 days		
Extraction solvent	Acetonitrile/water containing 0.1% formic acid		
Matrices	**PBI (days)**	**[^{14}C-U-phenyl] TRR (ppm)**	**[^{14}C-4-pyrimidinyl] TRR (ppm)**
Radish root	30	0.011	0.011
	120	<0.010	<0.010
	365	<0.010	<0.010
Radish tops	30	0.048	0.103
	120	0.024	0.054
	365	0.014	0.048
Immature lettuce	30	0.020	0.052
	180	<0.010	0.030
	365	0.011	0.038
Mature lettuce	30	0.013	0.038
	180	<0.010	0.041
	365	<0.010	0.021
Wheat forage	30	0.106	0.104
	120	0.111	0.081
	365	0.023	0.052
Wheat hay	30	0.089	0.169
	120	0.036	0.074
	365	0.029	0.073
Wheat straw	30	0.491	0.626
	120	0.454	0.413
	365	0.232	0.342

Wheat chaff	30	0.369	0.532
	120	0.254	0.390
	365	0.128	0.306
Wheat grain	30	0.093	0.068
	120	0.051	0.047
	365	0.026	0.067

Summary of Major Identified Metabolites in Rotated Crops

Plant-back Intervals (PBI)	**1st Rotation (30-day PBI)**		**2nd Rotation (120/180-day PBI)**		**3rd Rotation (365-day PBI)**	
Radiolabel Position	**[^{14}C-U-phenyl]**	**[^{14}C-4-pyrimidinyl]**	**[^{14}C-U-phenyl]**	**[^{14}C-4-pyrimidinyl]**	**[^{14}C-U-phenyl]**	**[^{14}C-4-pyrimidinyl]**
Metabolites Identified	**Major Metabolites**	**Major Metabolites**	**Major Metabolites**	**Major Metabolites**	**Major Metabolites**	**Major Metabolites**
Radish root	M-36 M-52 M-72	M-32 M-36 M-72	None	None	None	None
Radish tops	M-36 M-52 M-72	M-32 M-52	M-36 M-52 M-72	M-32 M-72	M-36 M-52 M-72	M-32
Lettuce, immature	M-36 M-52 M-53	M-32 M-36 M-52 M-53	None	M-32	M-36 M-52 M-53	M-32
Lettuce, mature	M-36 M-52 M-53	M-32 M-36 M-52 M-53	None	M-32 M-36 M-52	None	M-32
Wheat forage	M-36 M-52	M-36 M-52 M-53	M-36 M-52 M-53	M-32 M-36 M-52 M-53 M-63	M-36 M-52 M-53 M-63	M-32 M-36 M-53
Wheat hay	M-36 M-52	M-32 M-36 M-52	M-36 M-52 M-53	M-32 M-36 M-52	M-36 M-53	M-32 M-36 M-53
Wheat straw	M-36 M-52 M-53	M-36 M-52 M-53	M-36 M-52 M-53	M-32 M-36 M-52 M-53	M-36 M-53	M-32 M-36 M-53
Wheat chaff	M-36 M-52 M-53	M-32 M-36	M-36 M-52 M-53	M-32 M-36 M-52	M-36 M-53	M-32 M-36
Wheat grain	M-36	M-32 M-36	M-36 M-56	M-32 M-36	M-36	M-32 M-36

Proposed Metabolic Scheme in Rotational Crops



* DCC-3825 M-32 can theoretically derive from any of the observed metabolites

RESIDUE DATA IN ROTATIONAL CROPS - Wheat	**PMRA #2865975**

Six trials were conducted during the 2015-2017 growing seasons in North American growing region 2 (1 trial), 5 (1 trial), 7A (1 trial), 8 (1 trial) and 14 (2 trials). A single broadcast application was made to bare soil with a 70% WG formulation of tiafenacil at a rate of 145-152 g a.i./ha. No adjuvant was used.

Commodity	**Total Application Rate (g a.i./ha)**	**PBI (days)**	**Tiafenacil Residue Levels (ppm)**					
			n	**LAFT**	**HAFT**	**Median**	**Mean**	**SDEV**
Wheat forage	145-152	28-30	6	<0.010	<0.010	<0.010	<0.010	0
		90-120	6	<0.010	<0.010	<0.010	<0.010	0
Wheat hay		28-30	6	<0.010	<0.010	<0.010	<0.010	0
		90-120	6	<0.010	<0.010	<0.010	<0.010	0

Wheat straw		28-30	6	<0.010	<0.010	<0.010	<0.010	0
Wheat grain		28-30	6	<0.010	<0.010	<0.010	<0.010	0
n = number of independent trials, LAFT = lowest average field trial, HAFT = highest average field trial, SDEV = standard deviation								

Table 13 Food residue chemistry overview of metabolism studies and risk assessment

PLANT STUDIES	
RESIDUE DEFINITION FOR ENFORCEMENT **Primary crops (Preplant soil treatment: corn, potato and mandarin)** **Rotational crops**	Tiafenacil
RESIDUE DEFINITION FOR RISK ASSESSMENT **Primary crops (Preplant soil treatment only)** **Rotational crops**	Tiafenacil [Human food]; Tiafenacil and metabolites M-36, M-53 and M-56, expressed as parent equivalents [Livestock feed] Tiafenacil + M-32 (TFA) , expressed as parent equivalents [Human food]; Tiafenacil, and metabolites M-36, M-53 and M-56, expressed as parent equivalents [Livestock feed]
METABOLIC PROFILE IN DIVERSE CROPS	Preplant soil application: Corn (OECD crop category cereal/grass), potato (OECD crop category root crop) and mandarin (OECD crop category fruit). As similar metabolism (similar metabolic pathways and resulting metabolites) has been demonstrated in 3 dissimilar crops, then the metabolism data can be extended to all plant commodities for preplant soil applications.
ANIMAL STUDIES	
ANIMALS	**Ruminant and Poultry**
RESIDUE DEFINITION FOR ENFORCEMENT	Tiafenacil
RESIDUE DEFINITION FOR RISK ASSESSMENT	Tiafenacil
METABOLIC PROFILE IN ANIMALS (goat, hen, rat)	Similar metabolic profile in goat, rat and hen.

FAT SOLUBLE RESIDUE		Yes			
DIETARY RISK FROM FOOD AND DRINKING WATER					
	POPULATION	**ESTIMATED RISK % of ACCEPTABLE DAILY INTAKE (ADI)**			
		Food Alone		**Food and Drinking Water**	
		Tiafenacil	Tiafenacil + TFA	Tiafenacil	Tiafenacil + TFA
Basic chronic dietary exposure analysis **ADI = 0.004 mg/kg bw/day** **Estimated chronic drinking water concentration = 0.046 ppm**	All infants <1 year	5.2	14.7	92.0	101.5
	Children 1–2 years	15.8	29.9	47.8	61.8
	Children 3–5 years	10.3	21.9	36.3	47.9
	Children 6–12 years	6.1	13.8	25.4	33.2
	Youth 13–19 years	3.3	8.2	19.6	24.6
	Adults 20–49 years	2.4	6.6	25.5	29.7
	Adults 50+ years	2.1	5.4	24.5	27.9
	Females 13-49 years	2.4	6.4	25.1	29.1
	Total population	3.5	8.5	26.7	31.7

Table 14 Fate and behaviour of tiafenacil in the environment

Fate Process	Substance	Conditions	Degradation Characteristics			Major TPs[1]	Comments	PMRA #
			DT_{50} (d)	DT_{90} (d)	Model			
Abiotic transformation								
Hydrolysis	Tiafenacil	pH 4 (50 °C)	Stable			N/A		2866088
		pH 7 (45 °C)	5.86	NC	SFO	**M-01 M-06 M-07 M-33 M-49**		
		pH 7 (40 °C)	12.7	NC	SFO			
		pH 7 (35 °C)	24.0	NC	SFO			
		pH 7 (25 °C;	111	NC	SFO	N/A		

Fate Process	Substance	Conditions	Degradation Characteristics			Major TPs[1]	Comments	PMRA #
			DT_{50} (d)	DT_{90} (d)	Model			
		Arrhenius estimate)					Hydrolysis is temperature and pH-dependent (base-catalyzed): stable at pH 4, predicted to be only slightly susceptible to hydrolysis at pH 7 at 20°C, and fairly rapid transformation at pH 9	
		pH 7 (20 °C; Arrhenius estimate)	245	NC	SFO			
		pH 9 (25 °C)	0.973	NC	SFO	**M-01 M-06 M-07 M-33 M-39 M-40 M-50**		
		pH 9 (20 °C)	1.99	NC	SFO			
		pH 9 (15 °C)	4.33	NC	SFO			
	M-01	pH 7 (50 °C)	7.0	23.3	Linear regression	NC	Endpoints were determined by the study author. No half-life information is available at environmentally relevant temperatures because test was conducted at only one temperature (50°C). Study did not identify the products of hydrolysis.	3141069
	M-12	pH 7 (50 °C)	8.0	26.7	Linear regression	NC		
	M-13	pH 7 (50 °C)	4.6	15.2	Linear regression	NC		
	M-36	pH 7 (50 °C)	5.6	18.5	Linear regression	NC		
	M-53	pH 7 (50 °C)	4.8	16.1	Linear regression	NC		
	M-63	pH 7 (50 °C)	3.6	11.8	Linear regression	NC		

Fate Process	Substance	Conditions	Degradation Characteristics			Major TPs[1]	Comments	PMRA #
			DT_{50} (d)	DT_{90} (d)	Model			
Phototransformation on soil	Tiafenacil	20 °C	197	NC	SFO	N/A	Not a major route of transformation	2866090
		Corrected for equivalent summer sunlight	405					
Phototransformation in water	Tiafenacil	20 °C	6.46	21.5	SFO	**M-71 M-72 M-85**	Expected to be an important route of transformation	2866089
		Corrected for equivalent summer sunlight	5.89	NC	SFO			
Biotransformation								
Aerobic soil	Tiafenacil	MSL-PF (20 °C; pH 6.6-6.8; sandy clay loam)	0.0247	0.746	IORE	M-01 M-12 M-13 **M-29** **M-30** **M-32** M-35 M-36 M-53 **M-63** **M-69** M-72 **M-73**	Not persistent	2866091
		MCL-PF (20 °C; pH 7.1-7.4; light clay)	0.0336	0.112	DFOP			
		LAD-SCL-PF (20 °C; pH 8.0-8.1; light clay)	0.0433	0.144	SFO			
		CA-SL (20 °C; pH 6.7-7.5; sand)	0.116	0.621	IORE			
	M-20	MSL-PF[2]	3.93	13.1	SFO	M-69	Endpoints were determined by the study authors. Major TPs formed from TPs tested determined based on observations of ≥ 10% AR.	3129073
		MCL-PF[2]	5.43	18	SFO	M-69		
		LAD-SCL-PF[2]	14.0	46.4	SFO	M-69		
		CA-SL[2]	8.79	19.2	SFO	M-69		
	M-36	MSL-PF[2]	127	>1 y	SFO	N/A		3129074
		MCL-PF[2]	87.7	291	SFO	N/A		
		LAD-SCL-PF[2]	70.1	233	SFO	M-69		
		CA-SL[2]	354	>1 y	SFO	N/A		
	M-63	MSL-PF[2]	637	2120	SFO	N/A		3129075
		MCL-PF[2]	97.4	324	SFO	N/A		
		LAD-SCL-PF[2]	40.7	135	SFO	**M-30**		

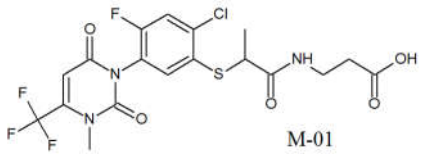
Fate Process	Substance	Conditions	Degradation Characteristics			Major TPs[1]	Comments	PMRA #
			DT_{50} (d)	DT_{90} (d)	Model			
		CA-SL[2]	508	1690	SFO	**M-30**		
Anaerobic soil	Tiafenacil	MSL-PF (20 °C; pH 6.3; sandy clay loam)	0.277	1.86	DFOP	M-01 **M-07** M-12 M-16 **M-20** **M-26** M-33 M-34 **M-39** **M-86**	Not persistent	2866092
		MCL-PF (20 °C; pH 7.2; light clay)	0.344	1.64	IORE			
		LAD-SCL-PF (20 °C; pH 8.1; light clay)	0.342	2.3	DFOP			
		CA-SL (20 °C; pH 7.4; loamy sand)	1.37	8.93	DFOP			
Aerobic water/ sediment system	Tiafenacil	Calwich Abbey Lake (20 °C; pH 7.9; silt loam)	3.16	10.5	SFO	M-01 M-06 M-07 M-12 M-13 **M-16** M-20 **M-32** **M-40**	Not persistent	2866093
		Swiss Lake (20 °C; pH 5.9; sand)	7.79	27.1	SFO			
Anaerobic aquatic (total system)	Tiafenacil	Calwich Abbey Lake (20 °C; pH 7.5; silt loam)	2.52	8.36	SFO	M-01 M-06 M-07 **M-20** **M-26** M-33 M-34 M-39 M-49	Not persistent	2866094
		Swiss Lake (20 °C; pH 6.6; sand)	4.88	16.2	SFO			
Mobility								
Adsorption/ desorption in soil	Tiafenacil	-	*K*oc = 1965			N/A	Low mobility	2866096
	M-01	-	*K*oc = 14.1 - 25.4			N/A	High to very high mobility	2965567

Fate Process	Substance	Conditions	Degradation Characteristics			Major TPs[1]	Comments	PMRA #
			DT_{50} (d)	DT_{90} (d)	Model			
	M-07	-	*K*oc = 60.8 - 320			N/A	Low to very high mobility	29655 60
	M-10	-	*K*oc = 18.5 - 59.4			N/A	Moderate to very high mobility	29655 71
	M-12	-	K_{oc} = 5.8 - 21.9			N/A	Very high mobility	29655 68
	M-13	-	K_{oc} = 44.0 - 75.5			N/A	Moderate to very high mobility	29655 69
	M-20	-	K_{oc} = 39.3 - 127			N/A	Moderate to very high mobility	29655 61
	M-29	-	K_{oc} = 5.79 - 22.2			N/A	Very high mobility	29655 62
	M-30	-	K_{oc} = 2.20 - 19.1			N/A	Very high mobility	29655 75
	M-35	-	K_{oc} = 4.10 - 16.1			N/A	Very high mobility	29655 63
	M-36	-	K_{oc} = 3.29 - 21.4			N/A	Very high mobility	29655 74
	M-53	-	K_{oc} = 13.8 - 19.4			N/A	High to very high mobility	29655 70
	M-63	-	K_{oc} = 17.8 - 50.8			N/A	High to very high mobility	29655 72
	M-69	-	K_{oc} = 46.6 - 155			N/A	Moderate to very high mobility	29655 64
	M-72	-	K_{oc} = 1.76 - 36.0			N/A	Very high mobility	29655 65
	M-73	-	K_{oc} = 3.3 – 45.1			N/A	High to very high mobility	29655 66
Bioaccumulation								
Bioconcentration in fish	Tiafenacil	Not required (Log K_{ow} 1.95-2)				N/A	Not expected to bioaccumulate.	N/A
Field Studies								
Field dissipation	Tiafenacil	Ephrata, WA,	0.00074	2.43	IORE	Rapid dissipation of tiafenacil under field conditions (last detect		28659 77

Fate Process	Substance	Conditions	Degradation Characteristics			Major TPs[1]	Comments	PMRA #
			DT_{50} (d)	DT_{90} (d)	Model			
		United States (pH 8.2 – 8.7; sand to loamy sand)				at 5 days after application; greatest depth detect of 7.5 cm). Several TPs formed (%AR not determined): M-01 M-12 M-13 M-36 M-72 Last TP detect at 10 days after application (M-36) and greatest depth detect of 90 cm (M-36).		
		Northwood, ND, United States (pH 6.4 – 8.4; sandy loam to sandy clay loam)	0.61	8.42	DFOP	Fairly rapid dissipation of tiafenacil under field conditions (last detect at 14 days after application; greatest depth detect of 7.5 cm). Several TPs formed (%AR not determined): M-01 M-12 M-13 M-36 M-53 M-63 M-69 M-72 Last TP detect at 310 days after application (M-53) and greatest depth detect of 30 cm (M-53).		2865978

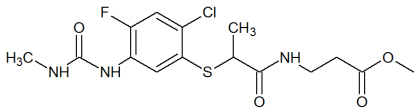
[1] Major transformation products are defined as those forming ≥10%, or increasing steadily during a fate study in the laboratory. TP in **bold font** if reached peak concentration at end of study.
[2] Same soil used for parent study.

Table 15 Major transformation products of tiafenacil and their occurrence

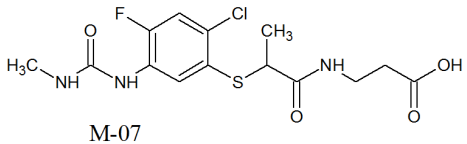
TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
M-01 Details **Molecular Structure:**  M-01 **Molecular Formula:** $C_{18}H_{16}ClF_4N_3O_5S$ **Molecular Weight:** 497.85						
M-01	**Hydrolysis**	2866088	pH 4, 50 °C	ph	ND (NR)	ND (NR)
			pH 4, 50 °C	pyr	ND (NR)	ND (NR)
			pH 7, 35 °C	ph	**20.8 (30)**	**20.8 (30)**
			pH 7, 35 °C	pyr	**21.2 (30)**	**21.2 (30)**
			pH 7, 40 °C	ph	**16.3 (20)**	**16.2 (30)**
			pH 7, 40 °C	pyr	**16.4 (30)**	**16.4 (30)**
			pH 7, 45 °C	ph	**16.7 (7)**	15.2 (10)
			pH 7, 45 °C	pyr	**17.1 (10)**	**17.1 (10)**
			pH 9, 15 °C	ph	**20.7 (14)**	**20.7 (14)**
			pH 9, 15 °C	pyr	**21.1 (10)**	18.8 (14)
			pH 9, 20 °C	ph	**21.2 (6)**	**21.2 (6)**
			pH 9, 20 °C	pyr	**19.9 (6)**	**19.9 (6)**
			pH 9, 25 °C	ph	**18.6 (2)**	14.8 (5)
			pH 9, 25 °C	pyr	**29.2 (3)**	19 (5)
M-01	**Aerobic soil**	2866091	CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	ph	**51 (0.5)**	ND (180)
			CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	pyr	**53.9 (0.5)**	ND (180)
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	ph	**67.3 (0.25)**	ND (180)
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	pyr	**62.9 (0.25)**	ND (180)
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	ph	**42.5 (0.25)**	ND (180)

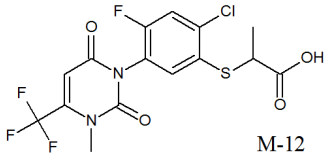
TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	pyr	**45.2 (0.25)**	ND (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	ph	**62.7 (0.25)**	ND (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	pyr	**63.4 (0.25)**	ND (180)
M-01	**Anaerobic soil**	2866092	CA-SL (sand to loamy sand; pH 7.4; 20 ± 2 °C)	ph	**55.3 (7)**	3.2 (180)
			CA-SL (sand to loamy sand; pH 7.4; 20 ± 2 °C)	pyr	**66.3 (7)**	18.9 (180)
			LAD-SCL-PF (light clay to clay; pH 8.1; 20 ± 2 °C)	ph	**62.5 (2)**	10.3 (180)
			LAD-SCL-PF (light clay to clay; pH 8.1; 20 ± 2 °C)	pyr	**73.1 (2)**	18 (180)
			MCL-PF (light clay to clay loam; pH 7.2; 20 ± 2 °C)	ph	**51.4 (7)**	10.1 (180)
			MCL-PF (light clay to clay loam; pH 7.2; 20 ± 2 °C)	pyr	**66.1 (2)**	12.6 (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.3; 20 ± 2 °C)	ph	**79.9 (7)**	2.7 (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.3; 20 ± 2 °C)	pyr	**99.2 (7)**	17.8 (180)
M-01	**Aerobic aquatic**	2866093	Calwich Abbey Lake (silt loam; pH 7.9) Sediment	ph	8.6 (10)	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Sediment	pyr	**11.6 (14)**	1.3 (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Total	ph	**43.2 (10)**	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Total	pyr	**40.3 (7)**	1.8 (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Water	ph	**34.6 (10)**	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Water	pyr	**37.1 (7)**	0.5 (100)
			Swiss lake (sand; pH 6.7) Sediment	ph	3.8 (7)	ND (100)
			Swiss lake (sand; pH 6.7) Sediment	pyr	9.7 (14)	1.9 (100)
			Swiss lake (sand; pH 6.7) Total	ph	**65.2 (0.5)**	ND (100)
			Swiss lake (sand; pH 6.7) Total	pyr	**62.1 (28)**	1.9 (100)

TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
			Swiss lake (sand; pH 6.7) Water	ph	**65.2 (0.5)**	ND (100)
			Swiss lake (sand; pH 6.7) Water	pyr	**53.7 (28)**	ND (100)
M-01	**Anaerobic aquatic**	2866094	Calwich Abbey Lake (silt loam; pH 7.5) Sediment	ph	7.3 (28)	2.8 (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Sediment	pyr	**10.1 (50)**	3.8 (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Total	ph	**28.7 (28)**	4.1 (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Total	pyr	**26.7 (7)**	4.7 (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Water	ph	**21.4 (28)**	1.3 (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Water	pyr	**24.9 (7)**	1.2 (100)
			Swiss lake (sand; pH 6.6) Sediment	ph	5.4 (14)	4.1 (100)
			Swiss lake (sand; pH 6.6) Sediment	pyr	7.5 (14)	3.8 (100)
			Swiss lake (sand; pH 6.6) Total	ph	**27.4 (14)**	7 (100)
			Swiss lake (sand; pH 6.6) Total	pyr	**36.4 (28)**	7.3 (100)
			Swiss lake (sand; pH 6.6) Water	ph	**22.6 (14)**	2.9 (100)
			Swiss lake (sand; pH 6.6) Water	pyr	**30.1 (28)**	3.5 (100)
M-01	Field studies (250 g a.i./ha bare ground)	2865977	Ephrata, Washington; sand (0.1-0.23 % OM); June	0-3 inches	109 ppb (0.04)	ND (60)
			Ephrata, Washington; sand (0.1-0.23 % OM); June	12-18 inches	-- (--)	ND (60)
			Ephrata, Washington; sand (0.1-0.23 % OM); June	30-36 inches	-- (--)	-- (60)
			Ephrata, Washington; sand (0.1-0.23 % OM); June	3-6 inches	12.1 ppb (1)	ND (60)
			Ephrata, Washington; sand (0.1-0.23 % OM); June	6-12 inches	ND (--)	ND (60)
M-01	Field studies (250 g a.i./ha bare ground)	2865976	Kerman, California; sandy loam (0.05-0.4 %OM); July	0-3 inches	62.2 ppb (1)	-- (92)
			Kerman, California; sandy loam (0.05-0.4 %OM); July	12-18 inches	-- (--)	-- (92)
			Kerman, California; sandy loam (0.05-0.4 %OM); July	30-36 inches	-- (--)	-- (92)

TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
			Kerman, California; sandy loam (0.05-0.4 %OM); July	3-6 inches	19.2 ppb (1)	-- (92)
			Kerman, California; sandy loam (0.05-0.4 %OM); July	6-12 inches	-- (--)	-- (92)
M-01	Field studies (250 g a.i./ha bare ground)	2865978	Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	0-3 inches	132 ppb (2)	-- (366)
			Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	12-18 inches	-- (--)	-- (366)
			Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	30-36 inches	-- (--)	-- (366)
			Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	3-6 inches	-- (--)	-- (366)
			Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	6-12 inches	-- (--)	-- (366)
M-01	Field studies (250 g a.i./ha bare ground)	2865979	Seven Springs, North Carolina (0.13-0.56 % OM); July	0-3 inches	117.2 ppb (0.04)	-- (90)
			Seven Springs, North Carolina (0.13-0.56 % OM); July	12-18 inches	-- (--)	-- (90)
			Seven Springs, North Carolina (0.13-0.56 % OM); July	30-36 inches	-- (--)	-- (90)
			Seven Springs, North Carolina (0.13-0.56 % OM); July	3-6 inches	-- (--)	-- (90)
			Seven Springs, North Carolina (0.13-0.56 % OM); July	6-12 inches	-- (--)	-- (90)
M-06 Details  M-06 **Molecular Structure:** **Molecular Formula:** $C_{15}H_{19}ClFN_3O_4S$ **Molecular Weight:** 391.85						
M-06	**Hydrolysis**	2866088	pH 4, 50 °C	ph	Parent stable	Parent stable

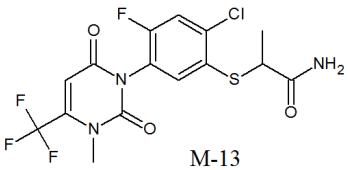
TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
			pH 7, 35 °C	ph	**36.6 (30)**	**36.6 (30)**
			pH 7, 40 °C	ph	**30.9 (30)**	**30.9 (30)**
			pH 7, 45 °C	ph	**33.6 (7)**	31.8 (10)
			pH 9, 15 °C	ph	**24.4 (10)**	23.3 (14)
			pH 9, 20 °C	ph	**26.3 (6)**	**26.3 (6)**
			pH 9, 25 °C	ph	**26.6 (2)**	23.3 (5)
M-06	**Anaerobic soil**	2866092	CA-SL (sand to loamy sand; pH 7.4; 20 ± 2 °C)	ph	5.3 (7)	ND (180)
			LAD-SCL-PF (light clay to clay; pH 8.1; 20 ± 2 °C)	ph	2.1 (60)	ND (180)
			MCL-PF (light clay to clay loam; pH 7.2; 20 ± 2 °C)	ph	2.9 (30)	ND (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.3; 20 ± 2 °C)	ph	NA (NA)	NA (NA)
M-06	**Aerobic aquatic**	2866093	Calwich Abbey Lake (silt loam; pH 7.9) Sediment	ph	ND	-- (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Total	ph	**10.2 (7)**	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Water	ph	**10.2 (7)**	ND (100)
			Swiss lake (sand; pH 6.7) Sediment	ph	ND	-- (100)
			Swiss lake (sand; pH 6.7) Total	ph	ND	-- (100)
			Swiss lake (sand; pH 6.7) Water	ph	ND	-- (100)
M-06	**Anaerobic aquatic**	2866094	Calwich Abbey Lake (silt loam; pH 7.5) Sediment	ph	0.6 (14)	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Total	ph	**25.5 (7)**	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Water	ph	**25.5 (7)**	ND (100)
			Swiss lake (sand; pH 6.6) Sediment	ph	1.1 (28)	ND (100)
			Swiss lake (sand; pH 6.6) Total	ph	**25.6 (7)**	ND (100)
			Swiss lake (sand; pH 6.6) Water	ph	**25.6 (7)**	ND (100)

TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
M-07 Details  M-07 **Molecular Structure:** **Molecular Formula:** $C_{14}H_{16}ClFN_3O_4S$ **Molecular Weight:** 377.82						
M-07	**Hydrolysis**	2866088	pH 4, 50 °C	ph	Parent stable	Parent stable
			pH 7, 35 °C	ph	8.9 (30)	**8.9 (30)**
			pH 7, 40 °C	ph	**19.4 (30)**	**19.4 (30)**
			pH 7, 45 °C	ph	**11.9 (7)**	9.2 (10)
			pH 9, 15 °C	ph	**28.1 (14)**	**28.1 (14)**
			pH 9, 20 °C	ph	**21.6 (6)**	**21.6 (6)**
			pH 9, 25 °C	ph	**32.3 (5)**	**32.3 (5)**
M-07	**Anaerobic soil**	2866092	CA-SL (sand to loamy sand; pH 7.4; 20 ± 2 °C)	ph	**48.8 (60)**	10.4 (180)
			LAD-SCL-PF (light clay to clay; pH 8.1; 20 ± 2 °C)	ph	**48.4 (90)**	22.2 (180)
			MCL-PF (light clay to clay loam; pH 7.2; 20 ± 2 °C)	ph	**37.8 (120)**	24.5 (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.3; 20 ± 2 °C)	ph	**40.9 (180)**	**40.9 (180)**
M-07	**Aerobic aquatic**	2866093	Calwich Abbey Lake (silt loam; pH 7.9) Sediment	ph	4.7 (50)	1.6 (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Total	ph	**14.3 (14)**	1.6 (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Water	ph	**10 (14)**	ND (100)
			Swiss lake (sand; pH 6.7) Sediment	ph	ND	ND
			Swiss lake (sand; pH 6.7) Total	ph	ND	ND
			Swiss lake (sand; pH 6.7) Water	ph	ND	ND
M-07	**Anaerobic aquatic**	2866094	Calwich Abbey Lake (silt loam; pH 7.5) Sediment	ph	**10.6 (50)**	8.2 (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Total	ph	**52.3 (28)**	36.7 (100)

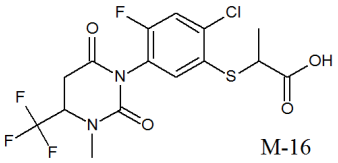
TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
			Calwich Abbey Lake (silt loam; pH 7.5) Water	ph	**44.8 (14)**	28.7 (100)
			Swiss lake (sand; pH 6.6) Sediment	ph	9.8 (75)	8.8 (100)
			Swiss lake (sand; pH 6.6) Total	ph	**58.1 (50)**	52.6 (100)
			Swiss lake (sand; pH 6.6) Water	ph	**49.6 (50)**	43.8 (100)
M-12 Details **Molecular Structure:**  M-12 **Molecular Formula:** $C_{15}H_{11}ClF_4N_2O_4S$ **Molecular Weight:** 426.77						
M-12	**Aerobic soil**	2866091	CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	ph	**37.8 (3)**	ND (180)
			CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	pyr	**42.4 (3)**	ND (180)
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	ph	**47.3 (3)**	ND (180)
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	pyr	**52.2 (3)**	ND (180)
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	ph	**24.7 (0.5)**	ND (180)
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	pyr	**22.6 (0.5)**	ND (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	ph	**15.9 (1)**	ND (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	pyr	**18.2 (1)**	ND (180)
M-12	**Anaerobic soil**	2866092	CA-SL (sand to loamy sand; pH 7.4; 20 ± 2 °C)	ph	**15.1 (7)**	ND (180)
			CA-SL (sand to loamy sand; pH 7.4; 20 ± 2 °C)	pyr	**19.5 (7)**	ND (180)
			LAD-SCL-PF (light clay to clay; pH 8.1; 20 ± 2 °C)	ph	**19.4 (2)**	ND (180)
			LAD-SCL-PF (light clay to clay; pH 8.1; 20 ± 2 °C)	pyr	**14.7 (30)**	ND (180)

TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
			MCL-PF (light clay to clay loam; pH 7.2; 20 ± 2 °C)	ph	**33.8 (30)**	ND (180)
			MCL-PF (light clay to clay loam; pH 7.2; 20 ± 2 °C)	pyr	**41.1 (7)**	1.6 (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.3; 20 ± 2 °C)	ph	**21.8 (14)**	6.4 (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.3; 20 ± 2 °C)	pyr	**22.4 (14)**	3.4 (180)
M-12	**Aerobic aquatic**	2866093	Calwich Abbey Lake (silt loam; pH 7.9) Sediment	ph	6.6 (28)	4.1 (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Sediment	pyr	8.2 (50)	6.9 (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Total	ph	**22.2 (28)**	13 (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Total	pyr	**22.4 (50)**	21.6 (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Water	ph	**15.6 (28)**	9.7 (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Water	pyr	**17.4 (50)**	14.7 (100)
			Swiss lake (sand; pH 6.7) Sediment	ph	8.5 (50)	8.1 (100)
			Swiss lake (sand; pH 6.7) Sediment	pyr	8.7 (75)	8.5 (100)
			Swiss lake (sand; pH 6.7) Total	ph	**56.7 (50)**	45.5 (100)
			Swiss lake (sand; pH 6.7) Total	pyr	**56.7 (75)**	39.2 (100)
			Swiss lake (sand; pH 6.7) Water	ph	**48.2 (50)**	39 (100)
			Swiss lake (sand; pH 6.7) Water	pyr	**49.4 (75)**	32.5 (100)
M-12	Anaerobic aquatic	2866094	Calwich Abbey Lake (silt loam; pH 7.5) Sediment	ph	2.2 (28)	1 (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Sediment	pyr	3.3 (50)	0.9 (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Total	ph	5.2 (28)	2.4 (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Total	pyr	5.4 (50)	2.3 (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Water	ph	3 (28)	1.4 (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Water	pyr	2.1 (50)	1.4 (100)
			Swiss lake (sand; pH 6.6) Sediment	ph	0.6 (28)	0.3 (100)
			Swiss lake (sand; pH 6.6) Sediment	pyr	0.6 (28)	0.5 (100)

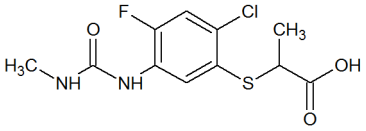
TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
			Swiss lake (sand; pH 6.6) Total	ph	3.1 (28)	0.9 (100)
			Swiss lake (sand; pH 6.6) Total	pyr	2.5 (28)	1.2 (100)
			Swiss lake (sand; pH 6.6) Water	ph	2.1 (14)	0.6 (100)
			Swiss lake (sand; pH 6.6) Water	pyr	1.9 (28)	1 (100)
M-12	Field studies (250 g a.i./ha bare ground)	2865977	Ephrata, Washington; sand (0.1-0.23 % OM); June	0-3 inches	ND (--)	ND (60)
			Ephrata, Washington; sand (0.1-0.23 % OM); June	12-18 inches	ND (10)	ND (60)
			Ephrata, Washington; sand (0.1-0.23 % OM); June	30-36 inches	-- (10)	-- (60)
			Ephrata, Washington; sand (0.1-0.23 % OM); June	3-6 inches	11.1 ppb (7)	ND (60)
			Ephrata, Washington; sand (0.1-0.23 % OM); June	6-12 inches	ND (10)	ND (60)
M-12	Field studies (250 g a.i./ha bare ground)	2865976	Kerman, California; sandy loam (0.05-0.4 %OM); July	All depths when measured	-- (--)	-- (92)
M-12	Field studies (250 g a.i./ha bare ground)	2865978	Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	0-3 inches	17.6 ppb (9)	-- (366)
			Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	12-18 inches	-- (--)	-- (366)
			Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	30-36 inches	-- (--)	-- (366)
			Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	3-6 inches	-- (--)	-- (366)
			Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	6-12 inches	-- (--)	-- (366)
M-12	Field studies (250 g a.i./ha bare ground)	2865979	Seven Springs, North Carolina (0.13-0.56 % OM); July	All depths when measured	-- (--)	-- (90)

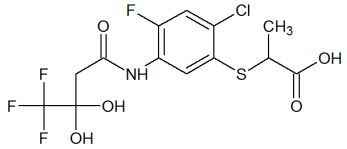
TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
M-13 Details **Molecular Structure:**  M-13 **Molecular Formula:** $C_{15}H_{12}ClF_4N_3O_3S$ **Molecular Weight:** 425.79						
M-13	**Aerobic soil**	2866091	CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	ph	**35.9 (1)**	ND (180)
			CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	pyr	**34.7 (3)**	ND (180)
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	ph	**38.4 (1)**	ND (180)
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	pyr	**33.2 (1)**	ND (180)
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	ph	**25.3 (0.5)**	ND (180)
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	pyr	**24.8 (0.5)**	ND (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	ph	**19.7 (0.5)**	ND (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	pyr	**18.5 (0.5)**	ND (180)
M-13	Anaerobic soil	2866092	CA-SL (sand to loamy sand; pH 7.4; 20 ± 2 °C)	ph	2 (1)	ND (180)
			CA-SL (sand to loamy sand; pH 7.4; 20 ± 2 °C)	pyr	8.4 (14)	ND (180)
			LAD-SCL-PF (light clay to clay; pH 8.1; 20 ± 2 °C)	ph	5.3 (1)	ND (180)
			LAD-SCL-PF (light clay to clay; pH 8.1; 20 ± 2 °C)	pyr	5.3 (1)	ND (180)
			MCL-PF (light clay to clay loam; pH 7.2; 20 ± 2 °C)	ph	3.4 (2)	1.7 (180)
			MCL-PF (light clay to clay loam; pH 7.2; 20 ± 2 °C)	pyr	3.4 (1)	ND (180)

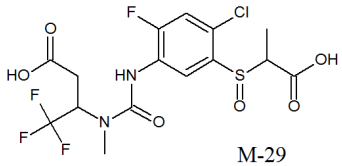
TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
			MSL-PF (sandy clay loam to sandy loam; pH 6.3; 20 ± 2 °C)	ph	3.6 (14)	ND (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.3; 20 ± 2 °C)	pyr	3.4 (2)	ND (180)
M-13	**Aerobic aquatic**	2866093	Calwich Abbey Lake (silt loam; pH 7.9) Sediment	ph	3.7 (14)	0.3 (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Sediment	pyr	5.8 (10)	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Total	ph	**16.2 (14)**	0.3 (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Total	pyr	**16.8 (10)**	0.6 (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Water	ph	**13.3 (14)**	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Water	pyr	**11.5 (10)**	0.6 (100)
			Swiss lake (sand; pH 6.7) Sediment	ph	4.8 (28)	1.6 (100)
			Swiss lake (sand; pH 6.7) Sediment	pyr	3.8 (14)	ND (100)
			Swiss lake (sand; pH 6.7) Total	ph	**26.1 (28)**	9.6 (100)
			Swiss lake (sand; pH 6.7) Total	pyr	**28.7 (14)**	2.5 (100)
			Swiss lake (sand; pH 6.7) Water	ph	**21.3 (28)**	8 (100)
			Swiss lake (sand; pH 6.7) Water	pyr	**24.9 (14)**	2.5 (100)
M-13	Field studies (250 g a.i./ha bare ground)	2865977	Ephrata, Washington; sand (0.1-0.23 % OM); June	0-3 inches	ND (--)	ND (60)
			Ephrata, Washington; sand (0.1-0.23 % OM); June	12-18 inches	-- (--)	ND (60)
			Ephrata, Washington; sand (0.1-0.23 % OM); June	30-36 inches	-- (--)	-- (60)
			Ephrata, Washington; sand (0.1-0.23 % OM); June	3-6 inches	9.6 ppb (7)	ND (60)
			Ephrata, Washington; sand (0.1-0.23 % OM); June	6-12 inches	ND (10)	ND (60)
M-13	Field studies (250 g a.i./ha bare ground)	2865976	Kerman, California; sandy loam (0.05-0.4 %OM); July	0-3 inches	11.1 ppb (10)	-- (92)
			Kerman, California; sandy loam (0.05-0.4 %OM); July	12-18 inches	-- (--)	-- (92)

TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
			Kerman, California; sandy loam (0.05-0.4 %OM); July	30-36 inches	-- (--)	-- (92)
			Kerman, California; sandy loam (0.05-0.4 %OM); July	3-6 inches	-- (--)	-- (92)
			Kerman, California; sandy loam (0.05-0.4 %OM); July	6-12 inches	-- (--)	-- (92)
M-13	Field studies (250 g a.i./ha bare ground)	2865978	Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	0-3 inches	13.1 ppb (9)	-- (366)
			Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	12-18 inches	-- (--)	-- (366)
			Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	30-36 inches	-- (--)	-- (366)
			Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	3-6 inches	-- (--)	-- (366)
			Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	6-12 inches	-- (--)	-- (366)
M-13	Field studies (250 g a.i./ha bare ground)	2865979	Seven Springs, North Carolina (0.13-0.56 % OM); July	All depths when measured	-- (--)	-- (90)
M-16 Details **Molecular Structure:**  M-16 **Molecular Formula:** $C_{15}H_{13}ClF_4N_2O_4S$ **Molecular Weight:** 428.79						
M-16	Aerobic soil	2866091	CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	ph	1.4 (0.25)	ND (180)
			CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	pyr	ND	ND
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	ph	1.4 (0.5)	ND (180)

TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	pyr	ND	ND
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	ph	4 (0.5)	ND (180)
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	pyr	4.9 (0.5)	ND (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	ph	2.7 (0.5)	ND (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	pyr	1.9 (0.5)	ND (180)
M-16	**Anaerobic soil**	2866092	CA-SL (sand to loamy sand; pH 7.4; 20 ± 2 °C)	ph	NA (NA)	NA (NA)
			CA-SL (sand to loamy sand; pH 7.4; 20 ± 2 °C)	pyr	NA (NA)	NA (NA)
			LAD-SCL-PF (light clay to clay; pH 8.1; 20 ± 2 °C)	ph	NA (NA)	NA (NA)
			LAD-SCL-PF (light clay to clay; pH 8.1; 20 ± 2 °C)	pyr	NA (NA)	NA (NA)
			MCL-PF (light clay to clay loam; pH 7.2; 20 ± 2 °C)	ph	5.9 (7)	ND (180)
			MCL-PF (light clay to clay loam; pH 7.2; 20 ± 2 °C)	pyr	6.3 (14)	ND (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.3; 20 ± 2 °C)	ph	5.6 (14)	2.4 (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.3; 20 ± 2 °C)	pyr	**11.9 (60)**	ND (180)
M-16	**Aerobic aquatic**	2866093	Calwich Abbey Lake (silt loam; pH 7.9) Sediment	ph	ND	ND
			Calwich Abbey Lake (silt loam; pH 7.9) Sediment	pyr	ND	ND
			Calwich Abbey Lake (silt loam; pH 7.9) Total	ph	1.6 (50)	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Total	pyr	1.5 (100)	**1.5 (100)**
			Calwich Abbey Lake (silt loam; pH 7.9) Water	ph	1.6 (50)	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Water	pyr	1.5 (100)	**1.5 (100)**

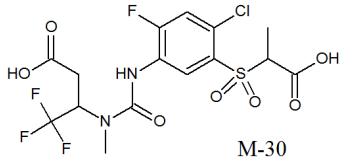
TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
			Swiss lake (sand; pH 6.7) Sediment	ph	ND	ND
			Swiss lake (sand; pH 6.7) Sediment	pyr	3.4 (100)	**3.4 (100)**
			Swiss lake (sand; pH 6.7) Total	ph	8.2 (75)	7.5 (100)
			Swiss lake (sand; pH 6.7) Total	pyr	**14.3 (100)**	**14.3 (100)**
			Swiss lake (sand; pH 6.7) Water	ph	8.2 (75)	7.5 (100)
			Swiss lake (sand; pH 6.7) Water	pyr	**10.9 (100)**	**10.9 (100)**
M-20 Details  **Molecular Structure:** M-20 **Molecular Formula:** $C_{11}H_{12}ClFN_2O_3S$ **Molecular Weight:** 306.74						
M-20	**Anaerobic soil**	2866092	CA-SL (sand to loamy sand; pH 7.4; 20 ± 2 °C)	ph	**67.8 (90)**	64.6 (180)
			LAD-SCL-PF (light clay to clay; pH 8.1; 20 ± 2 °C)	ph	**63.7 (180)**	**63.7 (180)**
			MCL-PF (light clay to clay loam; pH 7.2; 20 ± 2 °C)	ph	**40.4 (180)**	**40.4 (180)**
			MSL-PF (sandy clay loam to sandy loam; pH 6.3; 20 ± 2 °C)	ph	**21 (180)**	**21 (180)**
M-20	**Aerobic aquatic**	2866093	Calwich Abbey Lake (silt loam; pH 7.9) Sediment	ph	**18.2 (75)**	15.9 (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Total	ph	**47.1 (75)**	41.9 (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Water	ph	**30.1 (50)**	26 (100)
			Swiss lake (sand; pH 6.7) Sediment	ph	2.4 (100)	**2.4 (100)**
			Swiss lake (sand; pH 6.7) Total	ph	**11.3 (50)**	5.4 (100)
			Swiss lake (sand; pH 6.7) Water	ph	8.9 (50)	3 (100)
M-20	**Anaerobic aquatic**	2866094	Calwich Abbey Lake (silt loam; pH 7.5) Sediment	ph	**11.9 (100)**	**11.9 (100)**
			Calwich Abbey Lake (silt loam; pH 7.5) Total	ph	**32.9 (100)**	**32.9 (100)**
			Calwich Abbey Lake (silt loam; pH 7.5) Water	ph	**21.1 (100)**	**21.1 (100)**

TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
			Swiss lake (sand; pH 6.6) Sediment	ph	5.7 (100)	**5.7 (100)**
			Swiss lake (sand; pH 6.6) Total	ph	**24.6 (100)**	**24.6 (100)**
			Swiss lake (sand; pH 6.6) Water	ph	**18.9 (100)**	**18.9 (100)**
M-20	Field studies (250 g a.i./ha bare ground)	2865977	Ephrata, Washington; sand (0.1-0.23 % OM); June	All depths when measured	ND	--(60)
M-20	Field studies (250 g a.i./ha bare ground)	2865976	Kerman, California; sandy loam (0.05-0.4 %OM); July	All depths when measured	ND	-- (92)
M-20	Field studies (250 g a.i./ha bare ground)	2865978	Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	All depths when measured	ND	--(310)
M-20	Field studies (250 g a.i./ha bare ground)	2865979	Seven Springs, North Carolina (0.13-0.56 % OM); July	All depths when measured	ND	--(90)
M-26 Details  M-26 **Molecular Structure:** **Molecular Formula:** $C_{13}H_{12}ClF_4NO_5S$ **Molecular Weight:** 405.75						
M-26	**Anaerobic soil**	2866092	CA-SL (sand to loamy sand; pH 7.4; 20 ± 2 °C)	ph	6.6 (180)	**6.6 (180)**
			CA-SL (sand to loamy sand; pH 7.4; 20 ± 2 °C)	pyr	NA (NA)	NA (NA)
			LAD-SCL-PF (light clay to clay; pH 8.1; 20 ± 2 °C)	ph	7.2 (180)	**7.2 (180)**
			LAD-SCL-PF (light clay to clay; pH 8.1; 20 ± 2 °C)	pyr	NA (NA)	NA (NA)
			MCL-PF (light clay to clay loam; pH 7.2; 20 ± 2 °C)	ph	5.6 (180)	**5.6 (180)**

TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
			MCL-PF (light clay to clay loam; pH 7.2; 20 ± 2 °C)	pyr	NA (NA)	NA (NA)
			MSL-PF (sandy clay loam to sandy loam; pH 6.3; 20 ± 2 °C)	ph	9.3 (180)	**9.3 (180)**
			MSL-PF (sandy clay loam to sandy loam; pH 6.3; 20 ± 2 °C)	pyr	NA (NA)	NA (NA)
M-26	**Anaerobic aquatic**	2866094	Calwich Abbey Lake (silt loam; pH 7.5) Sediment	ph	ND	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Sediment	pyr	ND	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Total	pyr	8.1 (100)	**8.1 (100)**
			Calwich Abbey Lake (silt loam; pH 7.5) Total	ph	6.1 (100)	**6.1 (100)**
			Calwich Abbey Lake (silt loam; pH 7.5) Water	ph	7 (100)	**7 (100)**
			Calwich Abbey Lake (silt loam; pH 7.5) Water	pyr	8.1 (100)	**8.1 (100)**
			Swiss lake (sand; pH 6.6) Sediment	ph	ND	ND (100)
			Swiss lake (sand; pH 6.6) Sediment	pyr	ND	ND (100)
			Swiss lake (sand; pH 6.6) Total	ph	9.1 (100)	**9.1 (100)**
			Swiss lake (sand; pH 6.6) Total	pyr	8.9 (100)	**8.9 (100)**
			Swiss lake (sand; pH 6.6) Water	ph	9.1 (100)	**9.1 (100)**
			Swiss lake (sand; pH 6.6) Water	pyr	8.9 (100)	**8.9 (100)**
M-29 Details **Molecular Structure:**  M-29 **Molecular Formula:** $C_{15}H_{15}ClF_4N_2O_6S$ **Molecular Weight:** 462.8						
M-29	**Aerobic soil**	2866091	CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	ph	3.4 (180)	**3.4 (180)**
			CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	pyr	ND	-- (180)
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	ph	**23.4 (120)**	17.3 (180)

TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	pyr	**17.2 (120)**	16.1 (180)
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	ph	ND	-- (180)
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	pyr	ND	-- (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	ph	ND	-- (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	pyr	ND	-- (180)
M-29	Field studies (250 g a.i./ha bare ground)	2865977	Ephrata, Washington; sand (0.1-0.23 % OM); June	All depths when measured	ND	-- (60)
M-29	Field studies (250 g a.i./ha bare ground)	2865976	Kerman, California; sandy loam (0.05-0.4 %OM); July	All depths when measured	ND	-- (92)
M-29	Field studies (250 g a.i./ha bare ground)	2865978	Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	All depths when measured	ND	-- (366)
M-29	Field studies (250 g a.i./ha bare ground)	2865979	Seven Springs, North Carolina (0.13-0.56 % OM); July	All depths when measured	ND	-- (90)

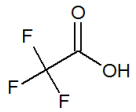
M-30 Details

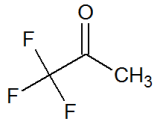


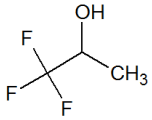
M-30

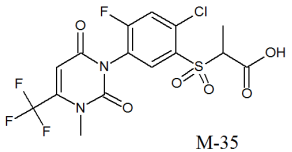
Molecular Structure:
Molecular Formula: $C_{15}H_{15}CL_1F_4N_2O_7S$
Molecular Weight: 478.8

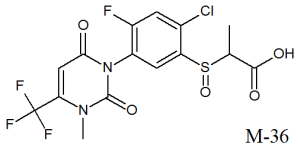
TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
M-30	**Aerobic soil**	2866091	CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	ph	2.7 (180)	**2.7 (180)**
			CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	pyr	ND	ND (180)
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	ph	7.9 (120)	7.8 (180)
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	pyr	7.3 (180)	**7.3 (180)**
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	ph	ND	ND (180)
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	pyr	ND	ND (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	ph	ND	ND (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	pyr	ND	ND (180)
M-30	Field studies (250 g a.i./ha bare ground)	2865977	Ephrata, Washington; sand (0.1-0.23 % OM); June	All depths when measured	-- (--)	-- (60)
M-30	Field studies (250 g a.i./ha bare ground)	2865976	Kerman, California; sandy loam (0.05-0.4 %OM); July	All depths when measured	-- (--)	-- (92)
M-30	Field studies (250 g a.i./ha bare ground)	2865978	Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	All depths when measured	-- (--)	-- (366)
M-30	Field studies (250 g a.i./ha bare ground)	2865979	Seven Springs, North Carolina (0.13-0.56 % OM); July	All depths when measured	-- (--)	-- (90)

TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
M-32 Details  M-32 **Molecular Structure:** **Molecular Formula:** $C_2HF_3O_2$ **Molecular Weight:** 114.02						
M-32	**Aerobic soil**	2866091	CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	pyr	**30.1 (150)**	15.7 (180)
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	pyr	**21.2 (180)**	**21.2 (180)**
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	pyr	5.5 (30)	4.7 (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	pyr	3 (180)	**3 (180)**
M-32	**Anaerobic soil**	2866092	CA-SL (sand to loamy sand; pH 7.4; 20 ± 2 °C)	pyr	8.1 (120)	1.6 (180)
			LAD-SCL-PF (light clay to clay; pH 8.1; 20 ± 2 °C)	pyr	3.2 (180)	**3.2 (180)**
			MCL-PF (light clay to clay loam; pH 7.2; 20 ± 2 °C)	pyr	4.3 (180)	**4.3 (180)**
			MSL-PF (sandy clay loam to sandy loam; pH 6.3; 20 ± 2 °C)	pyr	2.2 (180)	**2.2 (180)**
M-32	**Aerobic aquatic**	2866093	Calwich Abbey Lake (silt loam; pH 7.9) Sediment	pyr	**11.4 (50)**	5.3 (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Total	pyr	**20.9 (50)**	16.4 (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Water	pyr	**15.6 (14)**	14.3 (100)
			Swiss lake (sand; pH 6.7) Sediment	pyr	1 (100)	**1 (100)**
			Swiss lake (sand; pH 6.7) Total	pyr	6.7 (100)	**6.7 (100)**
			Swiss lake (sand; pH 6.7) Water	pyr	5.7 (100)	**5.7 (100)**
M-32	Anaerobic aquatic	2866094	Calwich Abbey Lake (silt loam; pH 7.5) Sediment	pyr	0.8 (50)	0.5 (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Total	pyr	0.8 (50)	0.5 (100)

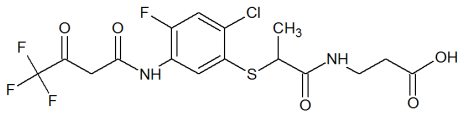
TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
			Calwich Abbey Lake (silt loam; pH 7.5) Water	pyr	ND	ND (100)
			Swiss lake (sand; pH 6.6) Sediment	pyr	0.7 (75)	0.3 (100)
			Swiss lake (sand; pH 6.6) Total	ph	ND	ND (100)
			Swiss lake (sand; pH 6.6) Total	pyr	0.7 (75)	0.3 (100)
			Swiss lake (sand; pH 6.6) Water	pyr	ND	ND (100)
M-33 Details  **Molecular Structure:** M-33 **Molecular Formula:** $C_3H_3F_3O$ **Molecular Weight:** 112.06						
M-33	**Hydrolysis**	2866088	pH 4, 50 °C	pyr	ND	ND (30)
			pH 7, 35 °C	pyr	**40.5 (30)**	**40.5 (30)**
			pH 7, 40 °C	pyr	**47.1 (30)**	**47.1 (30)**
			pH 7, 45 °C	pyr	**47.1 (10)**	**47.1 (10)**
			pH 9, 15 °C	pyr	**44.3 (14)**	**44.3 (14)**
			pH 9, 20 °C	pyr	**44.3 (6)**	**44.3 (6)**
			pH 9, 25 °C	pyr	**61.6 (5)**	**61.6 (5)**
M-33	**Anaerobic soil**	2866092	CA-SL (sand to loamy sand; pH 7.4; 20 ± 2 °C)	pyr	**27.7 (30)**	ND (180)
			LAD-SCL-PF (light clay to clay; pH 8.1; 20 ± 2 °C)	pyr	**33.7 (7)**	11.3 (180)
			MCL-PF (light clay to clay loam; pH 7.2; 20 ± 2 °C)	pyr	6.3 (7)	ND (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.3; 20 ± 2 °C)	pyr	ND	ND (180)
M-33	**Aerobic aquatic**	2866093	Calwich Abbey Lake (silt loam; pH 7.9) Sediment	pyr	2.1 (7)	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Total	pyr	**10.3 (28)**	3.9 (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Water	pyr	8.6 (28)	3.9 (100)
			Swiss lake (sand; pH 6.7) Sediment	pyr	ND	ND (100)

TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
			Swiss lake (sand; pH 6.7) Total	pyr	ND	ND (100)
			Swiss lake (sand; pH 6.7) Water	pyr	ND	ND (100)
M-33	**Anaerobic aquatic**	2866094	Calwich Abbey Lake (silt loam; pH 7.5) Sediment	pyr	6 (50)	1.7 (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Total	pyr	**40.6 (14)**	5.3 (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Water	pyr	**38.6 (14)**	3.6 (100)
			Swiss lake (sand; pH 6.6) Sediment	pyr	4.1 (28)	0.5 (100)
			Swiss lake (sand; pH 6.6) Total	pyr	**35.5 (28)**	6.2 (100)
			Swiss lake (sand; pH 6.6) Water	pyr	**31.4 (28)**	5.7 (100)
M-34 Details  **Molecular Structure:** M-34 **Molecular Formula:** $C_3H_4F_3O$ **Molecular Weight:** 113.07						
M-34	**Anaerobic soil**	2866092	CA-SL (sand to loamy sand; pH 7.4; 20 ± 2 °C)	pyr	**16.5 (60)**	3.5 (180)
			LAD-SCL-PF (light clay to clay; pH 8.1; 20 ± 2 °C)	pyr	**11.7 (60)**	4.9 (180)
			MCL-PF (light clay to clay loam; pH 7.2; 20 ± 2 °C)	pyr	9.2 (90)	ND (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.3; 20 ± 2 °C)	pyr	**17.9 (60)**	1.5 (180)
M-34	Aerobic aquatic	2866093	Calwich Abbey Lake (silt loam; pH 7.9) Sediment	pyr	1.3 (10)	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Total	pyr	1.7 (100)	**1.7 (100)**
			Calwich Abbey Lake (silt loam; pH 7.9) Water	pyr	1.7 (100)	**1.7 (100)**
			Swiss lake (sand; pH 6.7) Sediment	pyr	ND	ND (100)
			Swiss lake (sand; pH 6.7) Total	pyr	ND	ND (100)
			Swiss lake (sand; pH 6.7) Water	pyr	ND	ND (100)

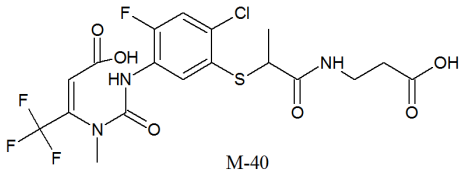
TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
M-34	**Anaerobic aquatic**	2866094	Calwich Abbey Lake (silt loam; pH 7.5) Sediment	pyr	7.9 (50)	1.4 (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Total	pyr	**17.2 (50)**	6.5 (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Water	pyr	9.3 (50)	5.1 (100)
			Swiss lake (sand; pH 6.6) Sediment	pyr	2.2 (28)	0.5 (100)
			Swiss lake (sand; pH 6.6) Total	pyr	8.1 (50)	1.4 (100)
			Swiss lake (sand; pH 6.6) Water	pyr	6.3 (50)	1 (100)
M-35 Details **Molecular Structure:**  M-35 **Molecular Formula:** $C_{15}H_{11}ClF_4N_2O_6S$ **Molecular Weight:** 458.77						
M-35	**Aerobic soil**	2866091	CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	ph	**11.4 (120)**	8.8 (180)
			CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	pyr	**10.5 (150)**	9.3 (180)
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	ph	4.9 (7)	1.4 (180)
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	pyr	6.6 (14)	1 (180)
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	ph	3.9 (1)	0.3 (180)
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	pyr	3.5 (1)	0.1 (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	ph	1.7 (14)	0.6 (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	pyr	1.6 (14)	0.5 (180)
M-35	Field studies (250 g a.i./ha bare ground)	2865977	Ephrata, Washington; sand (0.1-0.23 % OM); June	All depths when measured	ND	-- (60)

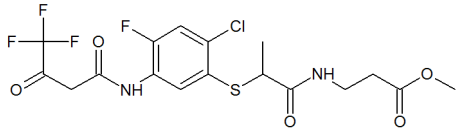
TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
M-35	Field studies (250 g a.i./ha bare ground)	2865976	Kerman, California; sandy loam (0.05-0.4 %OM); July	All depths when measured	ND	-- (92)
M-35	Field studies (250 g a.i./ha bare ground)	2865978	Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	All depths when measured	ND	-- (366)
M-35	Field studies (250 g a.i./ha bare ground)	2865979	Seven Springs, North Carolina (0.13-0.56 % OM); July	All depths when measured	ND	-- (90)
M-36 Details  M-36 **Molecular Structure:** **Molecular Formula:** $C_{15}H_{11}ClF_4N_2O_5S$ **Molecular Weight:** 442.77						
M-36	**Aerobic soil**	2866091	CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	ph	**60.3 (30)**	26.1 (180)
			CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	pyr	**62.9 (30)**	31.4 (180)
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	ph	**50.3 (14)**	7.5 (180)
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	pyr	**54.7 (30)**	9.8 (180)
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	ph	**44.9 (3)**	6.2 (180)
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	pyr	**51.3 (3)**	6.4 (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	ph	**46.8 (7)**	11.5 (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	pyr	**54.7 (3)**	14.3 (180)

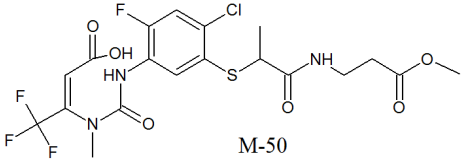
TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
M-36	Field studies (250 g a.i./ha bare ground)	2865977	Ephrata, Washington; sand (0.1-0.23 % OM); June	0-3 inches	ND (--)	ND (60)
			Ephrata, Washington; sand (0.1-0.23 % OM); June	12-18 inches	ND (--)	ND (60)
			Ephrata, Washington; sand (0.1-0.23 % OM); June	30-36 inches	-- (--)	-- (60)
			Ephrata, Washington; sand (0.1-0.23 % OM); June	3-6 inches	7.87 ppb (7)	ND (60)
			Ephrata, Washington; sand (0.1-0.23 % OM); June	6-12 inches	6.69 ppb (10)	ND (60)
M-36	Field studies (250 g a.i./ha bare ground)	2865976	Kerman, California; sandy loam (0.05-0.4 %OM); July	0-3 inches	27.6 ppb (15)	9.4 ppb (92)
			Kerman, California; sandy loam (0.05-0.4 %OM); July	12-18 inches	ND (--)	ND (92)
			Kerman, California; sandy loam (0.05-0.4 %OM); July	30-36 inches	-- (--)	-- (92)
			Kerman, California; sandy loam (0.05-0.4 %OM); July	3-6 inches	16.8 ppb (22)	ND (92)
			Kerman, California; sandy loam (0.05-0.4 %OM); July	6-12 inches	ND (--)	ND (92)
M-36	Field studies (250 g a.i./ha bare ground)	2865978	Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	0-3 inches	45.4 (9)	ND (366)
			Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	12-18 inches	ND (--)	ND (366)
			Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	30-36 inches	-- (--)	-- (366)
			Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	3-6 inches	13.9 ppb (29)	ND (366)
			Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	6-12 inches	ND (--)	ND (366)
M-36	Field studies (250 g a.i./ha	2865979	Seven Springs, North Carolina (0.13-0.56 % OM); July	0-3 inches	26.8 ppb (7)	-- (90)

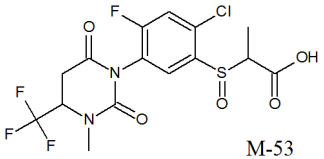
TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
	bare ground)		Seven Springs, North Carolina (0.13-0.56 % OM); July	12-18 inches	ND (--)	-- (90)
			Seven Springs, North Carolina (0.13-0.56 % OM); July	30-36 inches	-- (--)	-- (90)
			Seven Springs, North Carolina (0.13-0.56 % OM); July	3-6 inches	7.62 ppb (10)	-- (90)
			Seven Springs, North Carolina (0.13-0.56 % OM); July	6-12 inches	ND (--)	-- (90)
M-39 Details  M-39 **Molecular Structure:** **Molecular Formula:** $C_{16}H_{15}ClF_4N_2O_5S$ **Molecular Weight:** 458.81						
M-39	**Hydrolysis**	2866088	pH 4, 50 °C	ph	ND	ND
			pH 4, 50 °C	pyr	ND	ND
			pH 7, 35 °C	ph	0.8 (21)	ND (30)
			pH 7, 35 °C	pyr	ND	ND
			pH 7, 40 °C	ph	4.8 (30)	**4.8 (30)**
			pH 7, 40 °C	pyr	4.7 (30)	**4.7 (30)**
			pH 7, 45 °C	ph	2.4 (7)	ND (10)
			pH 7, 45 °C	pyr	3.6 (10)	**3.6 (10)**
			pH 9, 15 °C	ph	7.7 (14)	**7.7 (14)**
			pH 9, 15 °C	pyr	7 (14)	**7 (14)**
			pH 9, 20 °C	ph	5 (6)	**5 (6)**
			pH 9, 20 °C	pyr	6 (6)	**6 (6)**
			pH 9, 25 °C	ph	6.8 (5)	**6.8 (5)**
			pH 9, 25 °C	pyr	**16.2 (5)**	**16.2 (5)**
M-39	**Anaerobic soil**	2866092	CA-SL (sand to loamy sand; pH 7.4; 20 ± 2 °C)	ph	**15.1 (120)**	11.8 (180)
			CA-SL (sand to loamy sand; pH 7.4; 20 ± 2 °C)	pyr	**17.4 (90)**	4.4 (180)

TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
			LAD-SCL-PF (light clay to clay; pH 8.1; 20 ± 2 °C)	ph	8.3 (30)	ND (180)
			LAD-SCL-PF (light clay to clay; pH 8.1; 20 ± 2 °C)	pyr	**11.7 (60)**	6.7 (180)
			MCL-PF (light clay to clay loam; pH 7.2; 20 ± 2 °C)	ph	6.1 (90)	ND (180)
			MCL-PF (light clay to clay loam; pH 7.2; 20 ± 2 °C)	pyr	6.1 (150)	3.8 (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.3; 20 ± 2 °C)	ph	7.5 (150)	6.7 (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.3; 20 ± 2 °C)	pyr	**10.5 (180)**	**10.5 (180)**
M-39	**Anaerobic aquatic**	2866094	Calwich Abbey Lake (silt loam; pH 7.5) Sediment	ph	1.7 (50)	1.1 (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Sediment	pyr	3.6 (50)	1.2 (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Total	pyr	**13.5 (50)**	8.1 (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Total	ph	**10.9 (50)**	7.7 (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Water	ph	9.2 (50)	6.6 (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Water	pyr	9.9 (50)	6.9 (100)
			Swiss lake (sand; pH 6.6) Sediment	ph	2.3 (75)	**2.3 (100)**
			Swiss lake (sand; pH 6.6) Sediment	pyr	2.3 (50)	1.4 (100)
			Swiss lake (sand; pH 6.6) Total	ph	**12.3 (50)**	10.6 (100)
			Swiss lake (sand; pH 6.6) Total	pyr	**13.3 (75)**	12.5 (100)
			Swiss lake (sand; pH 6.6) Water	ph	**10.3 (50)**	8.5 (100)
			Swiss lake (sand; pH 6.6) Water	pyr	**11.5 (75)**	11.1 (100)

TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
M-40 Details **Molecular Structure:**  M-40 **Molecular Formula:** $C_{18}H_{18}ClF_4N_3O_6S$ **Molecular Weight:** 515.87						
M-40	**Hydrolysis**	2866088	pH 4, 50 °C	ph	ND	ND
			pH 4, 50 °C	pyr	ND	ND
			pH 7, 35 °C	ph	ND	ND
			pH 7, 35 °C	pyr	ND	ND
			pH 7, 40 °C	ph	0.9 (30)	0.9 (30)
			pH 7, 40 °C	pyr	ND	ND
			pH 7, 45 °C	ph	1.1 (5)	ND (10)
			pH 7, 45 °C	pyr	ND	ND
			pH 9, 15 °C	ph	3.8 (10)	1.8 (14)
			pH 9, 15 °C	pyr	3.7 (14)	**3.7 (14)**
			pH 9, 20 °C	ph	3.8 (3)	2.2 (6)
			pH 9, 20 °C	pyr	3.3 (6)	**3.3 (6)**
			pH 9, 25 °C	ph	5.7 (5)	**5.7 (5)**
			pH 9, 25 °C	pyr	7.9 (5)	**7.9 (5)**
M-40	**Aerobic aquatic**	2866093	Calwich Abbey Lake (silt loam; pH 7.9) Sediment	ph	ND	ND
			Calwich Abbey Lake (silt loam; pH 7.9) Sediment	pyr	ND	ND
			Calwich Abbey Lake (silt loam; pH 7.9) Total	ph	ND	ND
			Calwich Abbey Lake (silt loam; pH 7.9) Total	pyr	ND	ND
			Calwich Abbey Lake (silt loam; pH 7.9) Water	ph	ND	ND
			Calwich Abbey Lake (silt loam; pH 7.9) Water	pyr	ND	ND
			Swiss lake (sand; pH 6.7) Sediment	ph	ND	ND

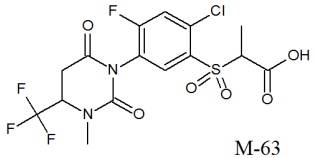
TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
			Swiss lake (sand; pH 6.7) Sediment	pyr	ND	ND
			Swiss lake (sand; pH 6.7) Total	ph	5.4 (100)	**5.4 (100)**
			Swiss lake (sand; pH 6.7) Total	pyr	7.5 (100)	**7.5 (100)**
			Swiss lake (sand; pH 6.7) Water	ph	5.4 (100)	**5.4 (100)**
			Swiss lake (sand; pH 6.7) Water	pyr	7.5 (100)	**7.5 (100)**
M-49 Details  M-49 **Molecular Structure:** **Molecular Formula:** $C_{17}H_{17}ClF_4N_2O_5S$ **Molecular Weight:** 472.84						
M-49	**Hydrolysis**	2866088	pH 4, 50 °C	ph	ND	ND
			pH 4, 50 °C	pyr	ND	ND
			pH 7, 35 °C	ph	9.2 (30)	**9.2 (30)**
			pH 7, 35 °C	pyr	9.1 (30)	**9.1 (30)**
			pH 7, 40 °C	ph	**10.6 (30)**	**10.6 (30)**
			pH 7, 40 °C	pyr	9.9 (30)	**9.9 (30)**
			pH 7, 45 °C	ph	9.8 (7)	9.2 (10)
			pH 7, 45 °C	pyr	**10.1 (10)**	**10.1 (10)**
			pH 9, 15 °C	ph	7.8 (14)	**7.8 (14)**
			pH 9, 15 °C	pyr	7.7 (10)	**7.5 (14)**
			pH 9, 20 °C	ph	6.9 (6)	**6.9 (6)**
			pH 9, 20 °C	pyr	7.6 (6)	**7.6 (6)**
			pH 9, 25 °C	ph	6.8 (1)	**6.6 (5)**
			pH 9, 25 °C	pyr	8.7 (3)	6.2 (5)
M-49	**Anaerobic aquatic**	2866094	Calwich Abbey Lake (silt loam; pH 7.5) Sediment	ph	0.1 (28)	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Sediment	pyr	0.3 (14)	ND (100)

TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
			Calwich Abbey Lake (silt loam; pH 7.5) Total	pyr	5.8 (7)	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Total	ph	5.8 (7)	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Water	ph	5.8 (7)	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Water	pyr	5.8 (7)	ND (100)
			Swiss lake (sand; pH 6.6) Sediment	ph	0.3 (14)	ND (100)
			Swiss lake (sand; pH 6.6) Sediment	pyr	0.5 (14)	ND (100)
			Swiss lake (sand; pH 6.6) Total	ph	**10 (7)**	ND (100)
			Swiss lake (sand; pH 6.6) Total	pyr	4.7 (14)	ND (100)
			Swiss lake (sand; pH 6.6) Water	ph	**10 (7)**	ND (100)
			Swiss lake (sand; pH 6.6) Water	pyr	4.2 (14)	ND (100)
M-50 Details **Molecular Structure:**  M-50 **Molecular Formula:** $C_{19}H_{22}ClF_4N_3O_6S$ **Molecular Weight:** 499.89						
M-50	**Hydrolysis**	2866088	pH 4, 50 °C	ph	ND	ND
			pH 4, 50 °C	pyr	ND	ND
			pH 7, 35 °C	ph	ND	ND
			pH 7, 35 °C	pyr	ND	ND
			pH 7, 40 °C	ph	ND	ND
			pH 7, 40 °C	pyr	ND	ND
			pH 7, 45 °C	ph	1.4 (1)	ND (7)
			pH 7, 45 °C	pyr	1 (1)	ND (10)
			pH 9, 15 °C	ph	7.6 (7)	4.3 (14)
			pH 9, 15 °C	pyr	7.8 (3)	4.8 (14)
			pH 9, 20 °C	ph	**10.6 (3)**	4.8 (6)
			pH 9, 20 °C	pyr	**10.4 (3)**	5.9 (6)
			pH 9, 25 °C	ph	**11.1 (2)**	5.7 (5)
			pH 9, 25 °C	pyr	**11.6 (2)**	5.9 (5)

TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
M-50	Anaerobic aquatic	2866094	Calwich Abbey Lake (silt loam; pH 7.5) Sediment	ph	ND	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Sediment	pyr	ND	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Total	ph	9.3 (3)	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Total	pyr	9.1 (3)	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Water	ph	9.3 (3)	ND (100)
			Calwich Abbey Lake (silt loam; pH 7.5) Water	pyr	9.1 (3)	ND (100)
			Swiss lake (sand; pH 6.6) Sediment	ph	ND	ND (100)
			Swiss lake (sand; pH 6.6) Sediment	pyr	ND	ND (100)
			Swiss lake (sand; pH 6.6) Total	ph	6.1 (7)	ND (100)
			Swiss lake (sand; pH 6.6) Total	pyr	5.7 (7)	ND (100)
			Swiss lake (sand; pH 6.6) Water	ph	6.1 (7)	ND (100)
			Swiss lake (sand; pH 6.6) Water	pyr	5.7 (7)	ND (100)
M-53 Details **Molecular Structure:**  M-53 **Molecular Formula:** $C_{15}H_{13}ClF_4N_2O_5S$ **Molecular Weight:** 444.79						
M-53	**Aerobic soil**	2866091	CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	ph	**14.3 (30)**	9.1 (180)
			CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	pyr	**13.1 (30)**	7.4 (180)
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	ph	**21.3 (30)**	3 (180)
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	pyr	**17.8 (30)**	2.3 (180)
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	ph	**44.9 (14)**	28.5 (180)
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	pyr	**47.8 (14)**	25.4 (180)

TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	ph	**56.3 (90)**	39.4 (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	pyr	**50.4 (60)**	44.5 (180)
M-53	Field studies (250 g a.i./ha bare ground)	2865977	Ephrata, Washington; sand (0.1-0.23 % OM); June	All depths when measured	ND (--)	ND (10)
M-53	Field studies (250 g a.i./ha bare ground)	2865976	Kerman, California; sandy loam (0.05-0.4 %OM); July	All depths when measured	ND (--)	ND (92)
M-53	Field studies (250 g a.i./ha bare ground)	2865978	Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	0-3 inches	13.9 ppb (29)	ND (366)
			Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	12-18 inches	-- (--)	ND (366)
			Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	30-36 inches	-- (--)	-- (366)
			Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	3-6 inches	10 ppb (310)	ND (366)
			Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	6-12 inches	-- (--)	ND (366)
M-53	Field studies (250 g a.i./ha bare ground)	2865979	Seven Springs, North Carolina (0.13-0.56 % OM); July	All depths when measured	ND (--)	ND (90)

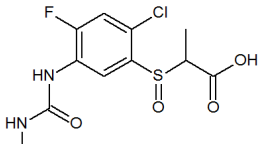
M-63 Details

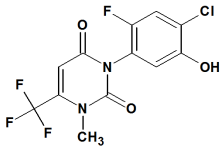
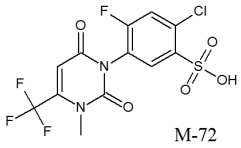


M-63

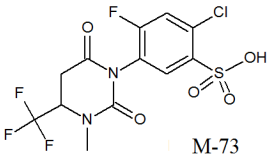
Molecular Structure:
Molecular Formula: $C_{15}H_{13}ClF_4N_2O_6S$
Molecular Weight: 460.79

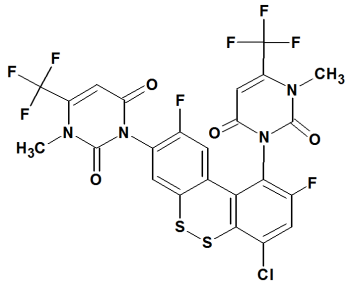
TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
M-63	**Aerobic soil**	2866091	CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	ph	8.4 (150)	7.7 (180)
			CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	pyr	6.2 (180)	**6.2 (180)**
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	ph	2.1 (60)	1.2 (180)
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	pyr	1.7 (90)	0.7 (180)
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	ph	**25.3 (90)**	22.3 (180)
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	pyr	**32.9 (30)**	20.2 (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	ph	**20.8 (150)**	18 (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	pyr	**21.2 (180)**	**21.2 (180)**
M-63	Field studies (250 g a.i./ha bare ground)	2865977	Ephrata, Washington; sand (0.1-0.23 % OM); June	All depths when measured	-- (--)	-- (10)
M-63	Field studies (250 g a.i./ha bare ground)	2865976	Kerman, California; sandy loam (0.05-0.4 %OM); July	All depths when measured	-- (--)	-- (92)
M-63	Field studies (250 g a.i./ha bare ground)	2865978	Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	All depths when measured	-- (--)	-- (366)
M-63	Field studies (250 g a.i./ha bare ground)	2865979	Seven Springs, North Carolina (0.13-0.56 % OM); July	All depths when measured	-- (--)	-- (90)

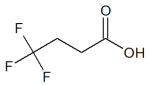
TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
M-69 Details  M-69 **Molecular Structure:** **Molecular Formula:** $C_{11}H_{12}ClFN_2O_4S$ **Molecular Weight:** 322.74						
M-69	**Aerobic soil**	2866091	CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	ph	**13.5 (180)**	**13.5 (180)**
			CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	pyr	ND	ND (180)
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	ph	**29.2 (120)**	21.8 (180)
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	pyr	ND	ND (180)
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	ph	ND	ND (180)
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	pyr	ND	ND (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	ph	ND	ND (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	pyr	ND	ND (180)
M-69	Field studies (250 g a.i./ha bare ground)	2865977	Ephrata, Washington; sand (0.1-0.23 % OM); June	All depths when measured	-- (--)	-- (10)
M-69	Field studies (250 g a.i./ha bare ground)	2865976	Kerman, California; sandy loam (0.05-0.4 %OM); July	All depths when measured	-- (--)	-- (92)
M-69	Field studies (250 g a.i./ha bare ground)	2865978	Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	All depths when measured	-- (--)	-- (366)

TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
M-69	Field studies (250 g a.i./ha bare ground)	2865979	Seven Springs, North Carolina (0.13-0.56 % OM); July	All depths when measured	-- (--)	-- (90)
M-71 Details  M-71 **Molecular Structure:** **Molecular Formula:** C12 H7 CL1 F4 N2 O3 **Molecular Weight:** 338.65						
M-71	**Aqueous Photo-transformation**	2866089	Dark control	ph	ND	ND
			Dark control	pyr	ND	ND
			Irradiated	ph	8.5 (15)	**8.5 (15)**
			Irradiated	pyr	7.2 (15)	**7.2 (15)**
M-72 Details  M-72 **Molecular Structure:** **Molecular Formula:** $C_{12}H_7ClF_4N_2O_5S$ **Molecular Weight:** 402.71						
M-72	**Aqueous Photo-transformation**	2866089	Dark control	ph	ND	ND (15)
			Dark control	pyr	ND	ND (15)
			Irradiated	ph	**22.5 (15)**	**22.5 (15)**
			Irradiated	pyr	**22.9 (15)**	**22.9 (15)**
M-72	**Aerobic soil**	2866091	CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	ph	**10.2 (150)**	9.2 (180)
			CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	pyr	**19.9 (150)**	12.4 (180)
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	ph	3.3 (30)	1.2 (180)

TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	pyr	6.2 (60)	1.8 (180)
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	ph	2.8 (90)	1.4 (180)
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	pyr	6.1 (30)	0.4 (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	ph	1.9 (150)	1.7 (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	pyr	2.4 (90)	1.8 (180)
M-72	Field studies (250 g a.i./ha bare ground)	2865977	Ephrata, Washington; sand (0.1-0.23 % OM); June	All depths when measured	-- (--)	-- (10)
M-72	Field studies (250 g a.i./ha bare ground)	2865976	Kerman, California; sandy loam (0.05-0.4 %OM); July	All depths when measured	-- (--)	-- (92)
M-72	Field studies (250 g a.i./ha bare ground)	2865978	Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	All depths when measured	-- (--)	-- (366)
M-72	Field studies (250 g a.i./ha bare ground)	2865979	Seven Springs, North Carolina (0.13-0.56 % OM); July	0-3 inches	26.4 ppb (7)	ND (90)
			Seven Springs, North Carolina (0.13-0.56 % OM); July	12-18 inches	ND (--)	ND (90)
			Seven Springs, North Carolina (0.13-0.56 % OM); July	30-36 inches	ND (--)	ND (90)
			Seven Springs, North Carolina (0.13-0.56 % OM); July	3-6 inches	7.09 ppb (10)	ND (90)
			Seven Springs, North Carolina (0.13-0.56 % OM); July	6-12 inches	ND (--)	ND (90)

TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
M-73 Details **Molecular Structure:**  M-73 **Molecular Formula:** $C_{12}H_9ClF_4N_2O_5S$ **Molecular Weight:** 404.72						
M-73	**Aerobic soil**	2866091	CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	ph	4.8 (180)	**4.8 (180)**
			CA-SL (sand to loamy sand; pH 7.5; 20 ± 2 °C)	pyr	**10.4 (180)**	**10.4 (180)**
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	ph	8.1 (120)	2.4 (180)
			LAD-SCL-PF (light clay to clay; pH 8; 20 ± 2 °C)	pyr	2.5 (120)	**2.3 (180)**
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	ph	**13.8 (150)**	**13.6 (180)**
			MCL-PF (light clay to clay loam; pH 7.4; 20 ± 2 °C)	pyr	**11.6 (150)**	9.2 (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	ph	**14 (180)**	**14 (180)**
			MSL-PF (sandy clay loam to sandy loam; pH 6.8; 20 ± 2 °C)	pyr	**10.9 (180)**	**10.9 (180)**
M-73	Field studies (250 g a.i./ha bare ground)	2865977	Ephrata, Washington; sand (0.1-0.23 % OM); June	All depths when measured	-- (--)	-- (10)
M-73	Field studies (250 g a.i./ha bare ground)	2865976	Kerman, California; sandy loam (0.05-0.4 %OM); July	All depths when measured	-- (--)	-- (92)
M-73	Field studies (250 g a.i./ha bare ground)	2865978	Northwood, North Dakota; sandy loam (0.42-1.7% OM); June	All depths when measured	-- (--)	-- (366)

TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
M-73	Field studies (250 g a.i./ha bare ground)	2865979	Seven Springs, North Carolina (0.13-0.56 % OM); July	0-3 inches	ND (--)	ND (90)
			Seven Springs, North Carolina (0.13-0.56 % OM); July	12-18 inches	ND (--)	ND (90)
			Seven Springs, North Carolina (0.13-0.56 % OM); July	30-36 inches	6.98 ppb (90)	**6.98 ppb (90)**
			Seven Springs, North Carolina (0.13-0.56 % OM); July	3-6 inches	ND (--)	ND (90)
			Seven Springs, North Carolina (0.13-0.56 % OM); July	6-12 inches	11.9 ppb (29)	ND (90)
M-85 Details  M-85 **Molecular Structure:** **Molecular Formula:** $C_{24}H_{11}ClF_8N_4O_4S_2$ **Molecular Weight:** 670.94						
M-85	**Aqueous Photo-transformation**	2866089	Dark control	ph	ND	ND (15)
			Dark control	pyr	ND	ND (15)
			Irradiated	ph	**11.6 (15)**	**11.6 (15)**
			Irradiated	pyr	**10.8 (15)**	**10.8 (15)**

TP	Fate Process (Bold if Major)	Study PMRA No.	Study Characteristics	Label or Depth	Max %AR (d) or ppb[1]	%AR or ppb at Study End (Study Length, d)[2]
M-86 Details  **Molecular Structure:** M-86 **Molecular Formula:** C4 H5 F3 O2 **Molecular Weight:** 142.08						
M-86	**Anaerobic soil**	2866092	CA-SL (sand to loamy sand; pH 7.4; 20 ± 2 °C)	pyr	**16.5 (180)**	**16.5 (180)**
			LAD-SCL-PF (light clay to clay; pH 8.1; 20 ± 2 °C)	pyr	7.9 (180)	**7.9 (180)**
			MCL-PF (light clay to clay loam; pH 7.2; 20 ± 2 °C)	pyr	**13.5 (150)**	11.5 (180)
			MSL-PF (sandy clay loam to sandy loam; pH 6.3; 20 ± 2 °C)	pyr	8.6 (150)	7.7 (180)
M-86	Aerobic aquatic	2866093	Calwich Abbey Lake (silt loam; pH 7.9) Sediment	pyr	2.7 (28)	0.4 (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Total	pyr	7.6 (14)	1.4 (100)
			Calwich Abbey Lake (silt loam; pH 7.9) Water	pyr	7.5 (10)	1 (100)
			Swiss lake (sand; pH 6.7) Sediment	pyr	ND	ND (100)
			Swiss lake (sand; pH 6.7) Total	pyr	ND	ND (100)
			Swiss lake (sand; pH 6.7) Water	pyr	ND	ND (100)

[1]TP in **bold font** if reached ≥10% AR.
[2]TP in **bold font** if reached peak concentration at end of study.

Table 16 Effects of tiafenacil on terrestrial species

Organism	Exposure	Test substance	Endpoint Value[1]	Degree of toxicity[2]	PMRA #
Invertebrates					
Honey bee *Apis mellifera*	Adult contact (48-h)	Tiafenacil (97.3%)	**LD_{50} > 100.5 µg a.i./bee**	Practically nontoxic	2866057
	Adult oral (48-h)	Tiafenacil	**LD_{50} > 109.5 µg a.i./bee**	Practically	2866057

Organism	Exposure	Test substance	Endpoint Value[1]	Degree of toxicity[2]	PMRA #
		(97.3%)		nontoxic	
	Adult (10-d)	Tiafenacil (97.82%)	**NOEL (survival) = 49.8 µg a.i./bee/day**	N/A	2866058
	Larval (72-h)	Tiafenacil (98.6%)	**LD_{50} > 6.4 µg a.i./larva**[3]	Moderately toxic	2866059
	Larval (19-d)	Tiafenacil (98.6%)	**NOEL (survival, growth) ≥ 20.1 µg a.i./larva/day**[3]	N/A	2866061
Bumble bee *Bombus terrestris*	Adult contact (48-h)	Tiafenacil (97.82%)	LD_{50} > 400 µg a.i./bee	Practically nontoxic	2966979
	Adult oral (48-h)	Tiafenacil (97.82%)	LD_{50} > 388.7 µg a.i./bee	Practically nontoxic	2966979
Earthworm *Eisenia fetida*	Soil (14-d)	Tiafenacil (97.82%)	**LC_{50} > 1000 mg a.i./kg soil dw**[3]	N/A	2866071
	Soil (4-w)	Tiafenacil (97.82%)	**NOEC (number of juveniles) = 171.5 mg a.i./kg soil dw**	N/A	2866072
Springtail *Folsomia candida*	Reproduction test in soil (14-d)	Tiafenacil (97.82%)	**ER_{50} (survival, reproduction) > 250 mg a.i./kg soil dw**[3]	N/A	2866074
Predatory mite *Hypoaspis aculeifer*	Reproduction test in soil (14-d)	Tiafenacil (97.82%)	**ER_{50} (survival, reproduction) > 1000 mg a.i./kg soil dw**[3]	N/A	2866073
Predatory mite *Typhlodromus pyri*	Acute laboratory glass plate contact study	Tiafenacil (5.1%)	**LR_{50} = 64.9 g a.i./ha**	N/A	2866075
	Chronic laboratory glass plate contact study	Tiafenacil (5.1%)	**ER_{50} (eggs per female) = 13.15 g a.i./ha**	N/A	2866075
	Extended laboratory study	Tiafenacil (5.05%)	**ER_{50} (reproduction) = 211.28 g a.i./ha**	N/A	2866077
Parasitic wasp *Aphidius rhopalosiphi*	Acute laboratory glass plate contact study	Tiafenacil (5.1%)	**LR_{50} = 50 g a.i./ha**	N/A	2866076

Organism	Exposure	Test substance	Endpoint Value[1]	Degree of toxicity[2]	PMRA #
	Chronic laboratory study (barley plants)	Tiafenacil (5.1%)	**ER_{50} (parisitisation) = 16.46 g a.i./ha**	N/A	2866076
	Extended laboratory study	Tiafenacil (5.05%)	**ER_{50} (survival, reproduction) > 345 g a.i./ha**[3]	N/A	2866078
Rove beetle *Aleochara bilineata*	Extended laboratory study	Tiafenacil (5.05%)	ER_{50} (reproduction) > 405 g a.i./ha[3]	N/A	2866079
Ladybird beetle *Coccinella septempunctata*	Extended laboratory study	Tiafenacil (5.09%)	ER_{50} (survival, reproduction) > 345 g a.i./ha[3]	N/A	2866080
Birds					
Zebra finch *Taeniopygia guttata*	Acute oral	Tiafenacil (98.04%)	**LD_{50} > 2000 mg a.i./kg bw/d**	Practically nontoxic	2866035
Bobwhite quail *Colinus virginianus*	Acute oral	Tiafenacil (97.3%)	LD_{50} > 2250 mg a.i./kg bw/d	Practically nontoxic	2866036
	Acute dietary (5-d)	Tiafenacil (97.3%)	**LC_{50} > 1119 mg a.i./kg bw/d**	Practically nontoxic	2866038
	Chronic dietary (23-w)	Tiafenacil (98.04%)	**NOEC (eggshell thickness) = 5.2 mg a.i./kg bw/d**	N/A	2866040
Mallard *Anas platyrhyncos*	Acute oral	Tiafenacil (96.63%)	LD_{50} > 2250 mg a.i./kg bw/d	Practically nontoxic	2866037
	Acute dietary (5-d)	Tiafenacil (97.3%)	LC_{50} > 1987 mg a.i./kg bw/d	Practically nontoxic	2866039
	Chronic dietary (20-w)	Tiafenacil (98.04%)	NOEC (viable embryos; hatchlings; 14-d survivors/eggs set) = 186 mg a.i./kg bw/d	N/A	2866041
Small wild mammals					
Laboratory Rat	Acute oral	Tiafenacil (97.3%)	**LD_{50} > 2000 mg a.i./kg bw/d**	Practically nontoxic	2865996
	Chronic dietary	Tiafenacil	**NOEL (reproductive toxicity;**	N/A	2866024

Organism	Exposure	Test substance	Endpoint Value[1]	Degree of toxicity[2]	PMRA #
		(97.82%)	**males) ≥ 8.0 mg a.i./kg bw/d[3]**		
Vascular plants					
Four monocot and six dicot species	Seedling Emergence	Tiafenacil 70WG (70%)	HR5 = 15.5 g a.i./ha	N/A	2865776
Four monocot and six dicot species	Vegetative Vigor	Tiafenacil 70WG (70%)	**HR5 = 0.440 g a.i./ha**	N/A	2865777

[1]Bolded values were carried forward to the risk assessment.
[2]Atkins et al. (1981) for bees and USEPA classification for others, where applicable.
[3]No toxic effects in any treatment.

Table 17 Effects of tiafenacil and transformation products on aquatic species

Organism	Exposure	Test substance	Endpoint value[1]	Degree of toxicity[2]	PMRA #
Freshwater Species					
Water flea *Daphnia magna*	48-h Acute	Tiafenacil (97.3%)	**EC_{50} (immobilization) > 80 mg a.i./L**	Slightly toxic	2866045
	48-h Acute	Tiafenacil 70WG (71.27%)	**EC_{50} (immobilization) > 78.3 mg a.i./L**	Slightly toxic	2865774
	48-h Acute	Tiafenacil 30% SC	**EC_{50} (immobilization) = 32 mg a.i./L**	Slightly toxic	2966973
	48-h Acute	M-36 (97.6%)	EC_{50} > 100.1 mg a.i./L	Practically nontoxic	2866046
	21-d Chronic	Tiafenacil (98.04%)	**NOEC (neonate reproduction) = 0.605 mg a.i./L**	N/A	2886817
Midge *Chironomus dilutus*	10-d Chronic (spiked sediment); sediment	Tiafenacil (98.6%)	NOEC (growth, survival, behaviour) ≥ 43 mg a.i/kg[3]	N/A	2866056
	10-d Chronic (spiked sediment); pore water	Tiafenacil (98.6%)	NOEC (growth, survival, behaviour) ≥ 5.1 mg a.i./L[3]	N/A	2866056
	10-d Chronic (spiked	Tiafenacil	NOEC (survival, growth, behaviour) ≥ 0.0257	N/A	2866056

Organism	Exposure	Test substance	Endpoint value[1]	Degree of toxicity[2]	PMRA #
	sediment); overlying water	(98.6%)	mg a.i./L[3]		
Freshwater amphipod *Hyalella azteca*	10-d Chronic (spiked sediment); sediment	Tiafenacil (98.6%)	NOEC (growth) = 8.1 mg a.i./kg	N/A	2866054
	10-d Chronic (spiked sediment); pore water	Tiafenacil (98.6%)	**NOEC (growth) = 2.5 mg a.i./L**	N/A	2866054
	10-d Chronic (spiked sediment); overlying water	Tiafenacil (98.6%)	**NOEC (growth) = 0.032 mg a.i./L**	N/A	2866054
Rainbow trout *Oncorhynchus mykiss*	96-h Acute	Tiafenacil (97.3%)	LC_{50} > 79 mg a.i./L	Slightly toxic	2866042
Common carp *Cyprinus carpio*	96-h Acute	Tiafenacil (97.3%)	LC_{50} > 80 mg a.i./L	Slightly toxic	2866044
	96-h Acute	Tiafenacil 70WG (71.27%)	**LC_{50} > 96.6 mg a.i./L**	Slightly toxic	2865773
	96-h Acute	Tiafenacil 30% SC	**LC_{50} = 31 mg a.i./L**	Slightly toxic	2966972
Japanese medaka *Oryzias latipes*	96-h Acute	Tiafenacil (97.3%)	LC_{50} > 106 mg a.i./L	Practically non-toxic	2966980
Fathead minnow *Pimephales promelas*	96-h Acute	Tiafenacil (98.6%)	**LC_{50} > 78.7 mg a.i./L**	Slightly toxic	2866043
	34-d Early Life Stage	Tiafenacil (98.6%)	**NOEC (growth) = 0.016 mg a.i./L**	N/A	2866050
	34-d Early Life Stage	Tiafenacil	**NOEC (growth) = 0.00102 mg a.i./L**	N/A	LDPH conversion (USEPA, 2016)
Green algae *Raphidocelis*	72-h Acute	Tiafenacil (97.3%)	E_yC_{50} = 0.0034 mg a.i./L	N/A	2966978

Organism	Exposure	Test substance	Endpoint value[1]	Degree of toxicity[2]	PMRA #
subcapitata (formerly *Pseudokirchneriella subcapitata*)	96-h Acute	Tiafenacil (97.82%)	**E_bC_{50} = 0.0038 mg a.i./L**	N/A	2866065
	96-h Acute	Tiafenacil 70WG (71.47%)	**E_bC_{50} = 0.0040 mg a.i./L**	N/A	2865775
	96-h Acute	Tiafenacil 30% SC	**$E_{b,y}C_{50}$ = 0.0029 mg a.i./L**	N/A	2966977
	96-h Acute	M-36	E_rC_{50} = 0.77 mg a.i./L	N/A	2866066
	96-h Acute	M-53	E_bC_{50} = 1.3 mg a.i./L	N/A	2866067
Blue-green algae *Anabaena flos-aquae*	96-h Acute	Tiafenacil (97.82%)	Ey,rC_{50} > 52 mg a.i./L	N/A	2866070
Diatom *Navicula pelliculosa*	96-h Acute	Tiafenacil (97.82%)	E_bC_{50} = 0.0040 mg a.i./L	N/A	2866068
Duckweed *Lemna gibba*	7-d	Tiafenacil (98.04%)	**E_yC_{50} (frond number) = 0.00573 mg a.i./L**	N/A	2866062
	7-d	Tiafenacil 70WG (71.47%)	**E_yC_{50} (frond number) = 0.00557 mg a.i./L**	N/A	2865778
	7-d	Tiafenacil 30% SC	**E_yC_{50} (frond number) = 0.00558 mg a.i./L**	N/A	2966976
	7-d	M-36	E_yC_{50} (frond number) = 0.35 mg a.i./L	N/A	2866063
	7-d	M-53	E_yC_{50} (biomass) = 1.1 mg a.i./L	N/A	2866064
Marine species					
Mysid shrimp *Americamysis bahia*	96-h Acute	Tiafenacil (98.04%)	**LC_{50} = 0.65 mg a.i./L**	Highly toxic	2866048
	30-d Chronic	Tiafenacil (98.6%)	**NOEC (reduced reproduction) = 0.086 mg a.i./L**	N/A	2886818
Eastern oyster *Crassostrea*	96-h Acute	Tiafenacil (97.82%)	**EC_{50} (shell deposition) > 10.7 mg a.i./L**	Slightly toxic	2866047

Organism	Exposure	Test substance	Endpoint value[1]	Degree of toxicity[2]	PMRA #
virginica					
Marine amphipod *Leptocheirus plumulosus*	10-d Chronic (spiked sediment); sediment	Tiafenacil (98.6%)	NOEC (survival, behaviour) ≥ 10 mg a.i./kg[3]	N/A	2866055
	10-d Chronic (spiked sediment); pore water	Tiafenacil (98.6%)	**NOEC (survival, behaviour) ≥ 23 mg a.i./L**[3]	N/A	2866055
	10-d Chronic (spiked sediment); overlying water	Tiafenacil (98.6%)	**NOEC (survival, behaviour) ≥ 1.78 mg a.i./L**[3]	N/A	2866055
Sheepshead minnow *Cyprinodon variegatus*	96-h Acute	Tiafenacil (98.04%)	**LC_{50} > 13.6 mg a.i./L**	Slightly toxic	2866049
	34-d Early Life Stage	Tiafenacil (98.6%)	**NOEC (survival) = 0.12 mg a.i./L**	N/A	2866051
Diatom *Skeletonema costatum*	96-h Acute	Tiafenacil (98.04%)	**E_bC_{50} = 0.0058 mg a.i./L**	N/A	2866069

[1]Bolded values were carried forward to the risk assessment. Transformation products M-36 and M-53 showed less toxicity than parent tiafenacil, therefore the risk assessment was conducted using parent-based effects metrics.
[2]USEPA classification, where applicable.
[3]No toxic effects in any treatment.
Subscript endpoints for algae and plant studies: b=biomass; r=rate; y=yield.

Table 18 Endpoints, uncertainty factors, and levels of concern used in the risk assessment for tiafenacil

Organism class	Organism	Test Substance	Exposure (scenario)[1]	Endpoint	Value	Study #	Uncertainty Factor	Level of Concern
Terrestrial Organisms								
Pollinators	Honey Bee (*Apis mellifera L.*)	Tiafenacil (97.3%)	Acute contact adult	48-h LD_{50}	> 100.5 µg a.i./bee	2866057	1	0.4
			Acute oral adult	48-h LD_{50}	> 109.5 µg a.i./bee	2866057	1	0.4
		Tiafenacil (97.82%)	Chronic oral adult	10-d NOEL (survival)	49.8 µg a.i./bee	2866058	1	1
		Tiafenacil	Acute oral	72-h LD_{50}	> 6.4 µg	2866059	1	0.4

Organism class	Organism	Test Substance	Exposure (scenario)[1]	Endpoint	Value	Study #	Uncertainty Factor	Level of Concern
		(98.6%)	larvae		a.i./larva			
		Tiafenacil (98.6%)	Chronic oral larvae	19-d NOEL (survival, growth)	≥ 20.1 µg a.i./larva/day	2866061	1	1
Soil-dwelling invertebrates	Earthworm (*Eisenia fetida*)	Tiafenacil (97.82%)	Acute	14-d LC_{50}	> 1000 mg a.i./kg soil dw	2866071	2	1
		Tiafenacil (97.82%)	Chronic	NOEC	171.5 mg a.i./kg soil dw	2866072	1	1
	Springtail (*Folsomia candida*)	Tiafenacil (97.82%)	Chronic	14-d ER_{50} (survival, reproduction)	> 250 mg a.i./kg soil dw	2866074	1	1
	Predatory mite (*Hypoaspis aculeifer)*	Tiafenacil (97.82%)	Chronic	14-d ER_{50} (survival, reproduction)	> 1000 mg a.i./kg soil dw	2866073	1	1
Foliar-dwelling invertebrates	Predatory mite (*Typhlodromus pyri)*	Tiafenacil (5.1%)	Acute contact (glass surface)	7-d LR_{50}	64.9 g a.i./ha	2866075	1	2
			Chronic contact (glass surface; screening)	14-d ER_{50} (reproduction)	13.15 g a.i./ha	2866075	1	1
		Tiafenacil (5.05%)	Chronic (extended laboratory study; refinement)	ER_{50} (reproduction)	211.28 g a.i./ha	2866077	1	1
	Parasitic wasp (*Aphidius rhopalosiphi*)	Tiafenacil (5.1%)	Acute contact (glass surface)	48-h LR_{50}	50 g a.i./ha	2866076	1	2
			Chronic (barley	13-d ER_{50} (reproduction and	16.46 g a.i./ha	2866076	1	1

Organism class	Organism	Test Substance	Exposure (scenario)[1]	Endpoint	Value	Study #	Uncertainty Factor	Level of Concern
			plants; screening)	parisitisation)				
		Tiafenacil (5.05%)	Chronic (extended laboratory study; refinement)	ER_{50} (reproduction)	> 345 g a.i./ha	2866078	1	1
Birds	Zebra finch *(Taeniopygia guttata)*	Tiafenacil (98.04%)	Acute oral	LD_{50}	> 2000 mg a.i./kg bw	2866035	10	1
	Bobwhite quail *(Colinus virginianus)*	Tiafenacil (97.3%)	Acute dietary	5-d LD_{50}	> 1119 mg a.i./kg bw/d	2866038	10	1
		Tiafenacil (98.04%)	Chronic dietary	NOEC (reproduction)	5.2 mg a.i./kg bw/d	2866040	1	1
Wild Mammals	Mammals (Rat)	Tiafenacil (97.3%)	Acute oral	LD_{50}	> 2000 mg a.i./kg bw/d	2865996	10	1
		Tiafenacil (97.82%)	Chronic dietary	NOEC (reproduction)	≥ 8.01 mg a.i./kg bw/d	2866024	1	1
Terrestrial vascular plants	Standard terrestrial plant species	Tiafenacil 70WG (70%)	Vegetative vigor	HR5	0.440 g a.i./ha	2865777	1	1
Aquatic Organisms								
Freshwater pelagic invertebrates	Water flea *(Daphnia magna)*	Tiafenacil 339SC (30.7%)	Acute (overspray, drift)	48-h EC_{50} (immobilization)	32 mg a.i./L	2966973	2	1
		Tiafenacil 70WG (71.27%)	Acute (overspray, drift)	48-h EC_{50} (immobilization)	> 78.3 mg a.i./L	2865774	2	1
		Tiafenacil (97.3%)	Acute (overspray, runoff)	48-h EC_{50} (immobilization)	> 80 mg a.i./L	2866045	2	1
		Tiafenacil (98.04%)	Chronic (overspray,	21-d NOEC (reproduction)	0.605 mg a.i./L	2886817	1	1

Organism class	Organism	Test Substance	Exposure (scenario)[1]	Endpoint	Value	Study #	Uncertainty Factor	Level of Concern
			drift, runoff)					
Freshwater benthic invertebrates	Freshwater amphipod *(Hyalella azteca)*	Tiafenacil (98.6%)	Chronic (overlying water; overspray, drift, runoff)	10-d NOEC (growth)	0.032 mg a.i./L	2866054	1	1
			Chronic (pore water; runoff)	10-d NOEC (growth)	2.5 mg a.i./L	2866054	1	1
Freshwater fish	Carp *(Cyprinus carpio)*	Tiafenacil 339SC (30.7%)	Acute (overspray, drift)	96-h LC_{50}	31 mg a.i./L	2966972	10	1
	Carp *(Cyprinus carpio)*	Tiafenacil 70WG (71.27%)	Acute (overspray, drift)	96-h LC_{50}	> 96.6 mg a.i./L	2865773	10	1
	Fathead minnow *(Pimephales promelas)*	Tiafenacil (98.6%)	Acute (overspray, runoff)	96-h LC_{50}	> 78.7 mg a.i./L	2866043	10	1
	Fathead minnow *(Pimephales promelas)*	Tiafenacil (98.6%)	Chronic ELS – LDPH conversion (overspray, drift, runoff)	34-d NOEC (growth)	0.00102 mg a.i./L	2866050	1	1
Aquatic-phase amphibians	Amphibians (Carp and fathead minnow as surrogates)	Tiafenacil 339SC (30.7%)	Acute (overspray, drift)	96-h LC_{50}	31 mg a.i./L	2966972	10	1
		Tiafenacil 70WG (71.27%)	Acute (overspray, drift)	96-h LC_{50}	> 96.6 mg a.i./L	2865773	10	1
		Tiafenacil (98.6%)	Acute (overspray, runoff)	96-h LC_{50}	> 78.7 mg a.i./L	2866043	10	1

Organism class	Organism	Test Substance	Exposure (scenario)[1]	Endpoint	Value	Study #	Uncertainty Factor	Level of Concern
		Tiafenacil (98.6%)	Chronic ELS (overspray, drift, runoff)	34-d NOEC (growth)	0.016 mg a.i./L	2866050	1	1
Freshwater vascular plants	Aquatic vascular plant (*Lemna gibba*)	Tiafenacil 339SC (30.7%)	Acute (overspray, drift)	7-d EC_{50}	0.00558 mg a.i./L	2966976	2	1
		Tiafenacil 70WG (71.47%)	Acute (overspray, drift)	7-d EC_{50}	0.00557 mg a.i./L	2865778	2	1
		Tiafenacil (98.04%)	Acute (overspray, runoff)	7-d EC_{50}	0.00573 mg a.i./L	2866062	2	1
Freshwater algae	Green algae (*Raphidocelis subcapitata)*	Tiafenacil 339SC (30.7%)	Acute (overspray, drift)	96-h EC_{50}	0.0029 mg a.i./L	2966977	2	1
		Tiafenacil 70WG (71.47%)	Acute (overspray, drift)	96-h EC_{50}	0.0040 mg a.i./L	2865775	2	1
		Tiafenacil (97.82%)	Acute (overspray, runoff)	96-h EC_{50}	0.0038 mg a.i./L	2866065	2	1
Marine/ estuarine pelagic invertebrates	Mysid shrimp *(Americamysis bahia)*	Tiafenacil (98.04%)	Acute (overspray, drift, runoff)	96-h LC_{50}	0.65 mg a.i./L	2866048	2	1
		Tiafenacil (98.6%)	Chronic (overspray, drift, runoff)	30-d NOEC (reproduction)	0.086 mg a.i./L	2886818	1	1
Marine/ estuarine mollusc	Eastern oyster *(Crassostrea virginica)*	Tiafenacil (97.82%)	Acute (overspray, drift, runoff)	96-h EC_{50} (shell deposition)	> 10.7 mg a.i./L	2866047	2	1
Marine/ estuarine	Estuarine amphipod	Tiafenacil (98.6%)	Chronic (overlying	10-d NOEC (survival,	≥ 1.78 mg a.i./L	2866055	1	1

Organism class	Organism	Test Substance	Exposure (scenario)[1]	Endpoint	Value	Study #	Uncertainty Factor	Level of Concern
benthic invertebrates	*(Leptocheirus plumulosus)*		water; overspray, drift, runoff)	behaviour)				
			Chronic (pore water; runoff)	10-d NOEC (survival, behaviour)	≥ 23 mg a.i./L	2866055	1	1
Marine/ estuarine fish	Sheepshead minnow *(Cyprinodon variegatus)*	Tiafenacil (98.04%)	Acute (overspray, drift, runoff)	96-h LC_{50}	> 13.6 mg a.i./L	2866049	10	1
		Tiafenacil (98.6%)	Chronic (overspray, drift, runoff)	34-d NOEC (survival)	0.12 mg a.i./L	2866051	1	1
Marine/ estuarine algae	Saltwater diatom *(Skeletonema costatum)*	Tiafenacil (98.04%)	Acute (overspray, drift, runoff)	96-h EC_{50}	0.0058 mg a.i./L	2866069	2	1

[1]Exposure scenarios for the aquatic risk assessment include direct overspray, runoff, and spray drift. Where available, toxicity endpoints derived using end use products containing tiafenacil will be used for the direct overspray and spray drift exposure scenarios, whereas toxicity endpoints derived using the technical grade active ingredient will be used for the runoff exposure scenarios. For benthic invertebrates exposed via sediment-water systems, toxicity endpoints based on overlying water concentrations are used for EECs in the water column, whereas toxicity endpoints based on pore water concentrations are used for pore water EECs in the runoff scenario.

Table 19 Screening level risk from tiafenacil exposure to terrestrial invertebrates and non-target terrestrial plants (on-field exposure)

Organism Class (Species)	Exposure	Endpoint and Uncertainty Factor	Endpoint Value	On-field EEC[1]	Units (a.i.)	RQ[2]	LOC[3]	LOC Exceeded
Pollinators (Honey Bee)	Adult contact acute	LD_{50}	> 100.5	0.120	µg/bee/day	< 0.00119	0.4	No
	Adult oral acute	LD_{50}	> 109.5	1.43	µg/bee/day	< 0.0131	0.4	No
	Adult oral chronic	NOEL	49.8	1.43	µg/bee/day	0.0287	1	No
	Larvae oral acute	LD_{50}	> 6.4	0.606	µg/larva/day	< 0.0946	1	No

Organism Class (Species)	Exposure	Endpoint and Uncertainty Factor	Endpoint Value	On-field EEC[1]	Units (a.i.)	RQ[2]	LOC[3]	LOC Exceeded
	Larvae oral chronic	NOEL	≥ 20.1	0.606	µg/larva/day	≤ 0.0301	1	No
Soil-dwelling invertebrates (Earthworm)	Acute	$LC_{50}/2$	> 500	0.0222	mg/kg soil	$< 4.44x10^{-5}$	1	No
	Chronic	NOEC	171.5	0.0222	mg/kg soil	$1.30x10^{-4}$	1	No
Soil-dwelling invertebrates (Springtail)	Chronic	ER_{50}	> 250	0.0222	mg/kg soil	$< 8.87x10^{-5}$	1	No
Soil-dwelling invertebrates (Predatory mite)	Chronic	ER_{50}	> 1000	0.0222	mg/kg soil	$< 2.22x10^{-5}$	1	No
Foliar-dwelling invertebrates (Predatory mite)	Acute contact (glass plates)	LR_{50}	64.9	50	g/ha	0.770	2	No
	Chronic (glass plates)	ER_{50}	13.15	50	g/ha	**3.80**	1	**Yes**
Foliar-dwelling invertebrates (Parasitic wasp)	Acute contact (glass plates)	LR_{50}	50	50	g/ha	1.00	2	No
	Chronic (barley plants)	ER_{50}	16.46	50	g/ha	**3.04**	1	**Yes**
Vascular plants	Vegetative vigor	HC5	0.440	50	g/ha	**114**	1	**Yes**

[1]EEC = Estimated Environmental concentration.

- The soil EEC of 0.0222 mg a.i./kg was calculated based on the maximum proposed single application rate of 50 g a.i./ha and was used for soil-dwelling organisms. This concentration was calculated assuming that the product is evenly distributed in the top 0 to 15 cm depth of soil with a bulk density of 1.5 g/cm^3.
- The foliar EEC of 50 g a.i./ha was calculated based on the maximum proposed single application rate of 50 g a.i./ha and was used for foliar-dwelling organisms and vegetative vigour effects metrics.
- The pollinator EECs were calculated using the single maximum application rate of 50 g a.i./ha as follows:
  Estimated contact exposure = 2.4 µg a.i./bee × 0.050 kg a.i./ha;
  Estimated dietary exposure = 98 µg a.i./g × 0.292 g/day × 0.050 kg a.i./ha; and
  Estimated brood exposure = 98 µg a.i./g × 0.124 g/day × 0.050 kg a.i./ha.

[2]RQ = Risk Quotient. The RQ is calculated by dividing the EEC by the endpoint value (RQ = EEC/endpoint value)

[3]LOC = Level of Concern. The RQ is compared to the LOC.

Table 20 Further characterization of risk from tiafenacil to terrestrial invertebrates and non-target terrestrial plants (off-field exposure)

Organism Class (Representative Species)	Exposure	Endpoint	Endpoint Value	Off-field EEC[1]	Units (a.i.)	RQ[2]	LOC[3]	LOC Exceeded
Foliar-dwelling invertebrates (Predatory mite)	Chronic (extended laboratory study)	ER_{50}	211.28	3	g/ha	0.0142	1	No
Foliar-dwelling invertebrates (Parasitic wasp)	Chronic (extended laboratory study)	ER_{50}	> 345	3	g/ha	< 0.00870	1	No
Vascular plants	Vegetative vigor	HR5	0.440	3	g/ha	**7.00**	1	**Yes**

[1]EEC = Estimated Environmental Concentration, which is calculated as 6% of the maximum application rate for off-field exposure.

- The further characterized EECs for off-field exposure to non-target terrestrial plants accounted for a 6% drift factor for groundboom applications at 50 g a.i./ha using an ASAE medium spray quality.

[2]RQ = Risk Quotient. The RQ is calculated by dividing the EEC by the endpoint value (RQ = EEC/endpoint value)

[3]LOC = Level of Concern. The RQ is compared to the LOC. The LOC = 2 for predatory mites and parasitic wasp tested on glass plates (otherwise LOC = 1). The LOC =1.0 for earthworms, chronic exposure in bees and vascular plants. The LOC = 0.4 for acute exposure in bees. If the screening level risk quotient is below the level of concern, the risk is considered negligible and no further risk characterization is necessary.

Table 21 Screening level risks to birds exposed to tiafenacil (on-field exposure)

Bird Size / Endpoint	Toxicity (mg a.i./kg bw/d)	Food Guild (Food Item)[1]	EDE (mg a.i./kg bw)[2]	RQ[3]	LOC[4]	LOC Exceeded
Small Bird (0.02 kg)						
Acute	200.00	Insectivore	4.07	0.0203	1	No
Reproduction	5.20	Insectivore	4.07	0.783	1	No
Medium-Sized Bird (0.1 kg)						
Acute	200.00	Insectivore	3.18	0.0159	1	No
Reproduction	5.20	Insectivore	3.18	0.611	1	No

Bird Size / Endpoint	Toxicity (mg a.i./kg bw/d)	Food Guild (Food Item)[1]	EDE (mg a.i./kg bw)[2]	RQ[3]	LOC[4]	LOC Exceeded
Large-Sized Bird (1 kg)						
Acute	200.00	Herbivore (short grass)	2.05	0.0103	1	No
Reproduction	5.20	Herbivore (short grass)	2.05	0.395	1	No

[1]Specialized feeding guilds are considered for each category of animal weights to help determine exposure (herbivore, frugivore, insectivore and granivore).
[2]EDE = Estimated dietary exposure; is calculated using the following formula: (FIR/BW) × EEC, where: FIR: Food Ingestion Rate, BW: Body Weight, EEC: Estimated Environmental Concentration. For generic birds with body weight less than or equal to 200 g, the "passerine" equation was used; for generic birds with body weight greater than 200 g, the "all birds" equation was used: Passerine Equation (BW < or = 200 g): FIR (g dry weight/day) = $0.398(\text{BW in g})^{0.850}$
All birds Equation (body weight > 200 g): FIR (g dry weight/day) = $0.648(\text{BW in g})^{0.651}$.
[3]RQ = Risk Quotient. The RQ is calculated by dividing the EDE by the endpoint value (RQ = EDE/endpoint value).
[4]LOC = Level of Concern. The RQ is then compared to the level of concern (LOC = 1).

Table 22 Screening level risks to mammals exposed to tiafenacil (on-field exposure)

Mammal Size / Endpoint	Toxicity (mg a.i./kg bw/d)	Feeding Guild (food item)[1]	EDE (mg a.i./kg bw)[2]	RQ[3]	LOC[4]	LOC Exceeded
Small Mammal (0.015 kg)						
Acute	200.00	Insectivore	2.34	0.0117	1	No
Reproduction	≥ 8.01	Insectivore	2.34	≤ 0.292	1	No
Medium-Sized Mammal (0.035 kg)						
Acute	200.00	Herbivore (short grass)	4.54	0.0227	1	No
Reproduction	≥ 8.01	Herbivore (short grass)	4.54	≤ 0.567	1	No
Large-Sized Mammal (1 kg)						
Acute	200.00	Herbivore (short grass)	2.43	0.0121	1	No
Reproduction	≥ 8.01	Herbivore (short grass)	2.43	≤ 0.303	1	No

[1]Specialized feeding guilds are considered for each category of animal weights to help determine exposure (herbivore, frugivore, insectivore and granivore).
[2]EDE = Estimated dietary exposure; is calculated using the following formula: (FIR/BW) × EEC, where: FIR: Food Ingestion Rate, BW: Body Weight, EEC: Estimated Environmental Concentration. For mammals, the "all mammals" equation was used: FIR (g dry weight/day) = $0.235(\text{BW in g})^{0.822}$
[3]RQ = Risk Quotient. The RQ is calculated by dividing the EDE by the endpoint value (RQ = EDE/endpoint value).
[4]LOC = Level of Concern. The RQ is then compared to the level of concern (LOC = 1).

Table 23 Screening level risk from tiafenacil to aquatic organisms exposed to tiafenacil from direct overspray

Organism Class (Species)	Exposure	Endpoint and Uncertainty Factor Applied	Endpoint Value (mg a.i./L)	Direct Overspray EEC[1] (mg a.i./L)	RQ[2]	LOC[3]	LOC Exceeded
Freshwater species							
Pelagic invertebrates (Water flea)	Acute (339SC)	LC_{50}/2	16	0.00625	$3.91x10^{-4}$	1	No
	Acute (70WG)	LC_{50}/2	> 39.2	0.00625	$< 1.60x10^{-4}$	1	No
	Acute (Technical Grade Active Ingredient)	LC_{50}/2	> 40	0.00625	$< 1.56x10^{-4}$	1	No
	Chronic (Technical Grade Active Ingredient)	NOEC	0.605	0.00625	0.0103	1	No
Benthic invertebrates (Freshwater amphipod)	Chronic (Technical Grade Active Ingredient)	NOEC (overlying water)	0.032	0.00625	0.195	1	No
Fish (Carp, fathead minnow)	Acute (339SC)	LC_{50}/10	3.1	0.00625	0.00202	1	No
	Acute (70WG)	LC_{50}/10	> 9.66	0.00625	$< 6.47x10^{-4}$	1	No
	Acute (Technical Grade Active Ingredient)	LC_{50}/10	> 7.87	0.00625	$< 7.94x10^{-4}$	1	No
	Chronic (Technical Grade Active Ingredient)	NOEC (LDPH)	0.00102	0.00625	**6.10**	1	**Yes**
Aquatic-phase amphibians (Fathead minnow as surrogate)	Acute (339SC)	LC_{50}/10	3.1	0.0333	0.0107	1	No
	Acute (70WG)	LC_{50}/10	> 9.66	0.0333	0.00345	1	No
	Acute (Technical	LC_{50}/10	> 7.87	0.0333	0.00424	1	No

Organism Class (Species)	Exposure	Endpoint and Uncertainty Factor Applied	Endpoint Value	Direct Overspray EEC[1] (mg a.i./L)	RQ[2]	LOC[3]	LOC Exceeded
	Grade Active Ingredient)						
	Chronic (Technical Grade Active Ingredient)	NOEC	0.016	0.0333	**2.08**	1	**Yes**
Vascular plants (Duckweed)	Acute (339SC)	$EC_{50}/2$	0.00279	0.00625	**2.24**	1	**Yes**
	Acute (70WG)	$EC_{50}/2$	0.00279	0.00625	**2.24**	1	**Yes**
	Acute (Technical Grade Active Ingredient)	$EC_{50}/2$	0.00287	0.00625	**2.18**	1	**Yes**
Algae (Green algae)	Acute (339SC)	$EC_{50}/2$	0.00145	0.00625	**4.31**	1	**Yes**
	Acute (70WG)	$EC_{50}/2$	0.0020	0.00625	**3.13**	1	**Yes**
	Acute (Technical Grade Active Ingredient)	$EC_{50}/2$	0.0019	0.00625	**3.29**	1	**Yes**
Marine/Estuarine species							
Pelagic invertebrates (Mysid shrimp)	Acute	$LC_{50}/2$	0.325	0.00625	0.0192	1	No
	Chronic	NOEC	0.086	0.00625	0.0727	1	No
Mollusc (Eastern oyster)	Acute	$EC_{50}/2$	> 5.35	0.00625	< 0.00117	1	No
Benthic invertebrates (Estuarine amphipod)	Chronic	NOEC (overlying water)	≥ 1.78	0.00625	≤ 0.00351	1	No
Fish (Sheepshead minnow)	Acute	$LC_{50}/10$	> 1.36	0.00625	< 0.00459	1	No
	Chronic	NOEC	0.12	0.00625	0.0521	1	No
Algae (Saltwater	Acute	$EC_{50}/2$	0.0029	0.00625	**2.15**	1	**Yes**

Organism Class (Species)	Exposure	Endpoint and Uncertainty Factor Applied	Endpoint Value	Direct Overspray EEC[1]	RQ[2]	LOC[3]	LOC Exceeded
			(mg a.i./L)				
diatom)							

[1]EEC = Estimated Environmental Concentration. Calculated assuming a maximum application rate of 50 g a.i./ha to water bodies of 80 cm depth (fish) and 15 cm depth (amphibian).
[2]RQ = Risk quotient. The RQ is calculated by dividing the EEC by the endpoint value (RQ = EEC/endpoint value).
[3]LOC = Level of concern. The RQ is compared to the 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.

Table 24 Further characterization of risk from tiafenacil to aquatic organisms exposed to tiafenacil from spray drift

Organism Class	Exposure	Endpoint and Uncertainty Factor Applied	Endpoint Value	Spray Drift EEC[1]	RQ[2]	LOC[3]	LOC exceeded
			(mg a.i./L)				
Freshwater species							
Fish	Chronic	NOEC (LDPH)[4]	0.00102	0.000375	0.366	1	No
Aquatic-phase amphibians	Chronic	NOEC	0.016	0.00200	0.125	1	No
Vascular plants	Acute (339SC)	$EC_{50}/2$	0.00279	0.000375	0.135	1	No
	Acute (70WG)	$EC_{50}/2$	0.00279	0.000375	0.134	1	No
Algae	Acute (339SC)	$EC_{50}/2$	0.00145	0.000375	0.259	1	No
	Acute (70WG)	$EC_{50}/2$	0.0020	0.000375	0.188	1	No
Marine species							
Algae	Acute	$EC_{50}/2$	0.0029	0.000375	0.129	1	No

[1]EEC = Estimated Environmental Concentration, which is calculated as 6% of the maximum application rate for spray drift exposure. Calculated assuming a maximum application rate of 50 g a.i./ha to water bodies of 80 cm depth (fish) and 15 cm depth (amphibian).
[2]RQ = Risk quotient. The RQ is calculated by dividing the EEC from spray drift by the endpoint value (RQ = EEC/endpoint value).
[3]LOC = Level of concern. The RQ is compared to the LOC.

Table 25 Further characterization of risk from to aquatic organisms exposed to tiafenacil from runoff

Organism Class	Exposure	Uncertainty Factor Applied to Endpoint	Endpoint value (mg a.i./L)	Runoff EEC[1] (mg a.i./L)	RQ[2]	LOC[3]	LOC exceeded
Freshwater species							
Fish	Chronic	NOEC (LDPH)[4]	0.00102	0.0039	**3.82**	1	**Yes**
Aquatic-phase amphibians	Chronic	NOEC	0.016	0.019	**1.19**	1	**Yes**
Vascular plants	Acute	$EC_{50}/2$	0.00287	0.0040	**1.39**	1	**Yes**
Algae	Acute	$EC_{50}/2$	0.0019	0.0040	**2.11**	1	**Yes**
Marine species							
Algae	Acute	$EC_{50}/2$	0.0029	0.0040	**1.38**	1	**Yes**

[1]EEC = Estimated Environmental Concentration. Calculated assuming a maximum application rate of 50 g a.i./ha to water bodies of 80 cm depth (fish) and 15 cm depth (amphibian).
[2]RQ = Risk quotient. The RQ is calculated by dividing the EEC from spray drift by the endpoint value (RQ = EEC/endpoint value).
[3]LOC = Level of concern. The RQ is compared to the LOC.

Table 26 *Toxic Substances Management Policy* Considerations - Comparison to TSMP Track 1 Criteria

TSMP Track 1 Criteria	TSMP Track 1 Criterion value		Tiafenacil Endpoints
Toxic or toxic equivalent as defined by the *Canadian Environmental Protection Act*[1]	Yes		Yes
Predominantly anthropogenic[2]	Yes		Yes
Persistence[3]	Soil	Half-life ≥ 182 days	No: DT_{50} 0.6 to 1 hour
	Water	Half-life ≥ 182 days	No: DT_{50} 3.16 to 7.79 days (whole system)
	Sediment	Half-life ≥ 365 days	
	Air	Half-life ≥ 2 days or evidence of long range transport	Not determined. The AOPWIN model is not suited for predicting the atmospheric half-life of tiafenacil given the large fraction expected to be sorbed to airborne particles.
Bioaccumulation[4]	Log K_{ow} ≥ 5		No: 1.95 to 2
	BCF ≥ 5000		Not available
	BAF ≥ 5000		Not available
Is the chemical a TSMP Track 1 substance (all four criteria must be met)?			No, does not meet TSMP Track 1 criteria.

[1]All pesticides will be considered toxic or toxic equivalent for the purpose of initially assessing a pesticide against the TSMP criteria. Assessment of the CEPA toxicity criteria may be refined if required (in other words, all other TSMP criteria are met).
[2]The policy considers a substance "predominantly anthropogenic" if, based on expert judgement, its concentration in the environment medium is largely due to human activity, rather than to natural sources or releases.
[3] If the pesticide and/or the transformation product(s) meet one persistence criterion identified for one media (soil, water, sediment or air) than the criterion for persistence is considered to be met.
[4]Field data (for example, BAFs) are preferred over laboratory data (for example, BCFs) which, in turn, are preferred over chemical properties (for example, log K_{ow}).

Table 27 List of Supported Uses

Items	Label claims that are supported
Active application rate range	All host crops and use sites: 25-50 g a.i./ha. Higher rates within the rate range may be used when there are dense and/or mature weed infestations.
Product application rate range	Tiafenacil 70WG: 36 to 72 g product/ha. Tiafenacil 339SC: 74 to 148 mL product/ha.
Adjuvant	Methylated seed oil (MSO) must be added to the spray solution at 1% v/v.
Efficacy claims	Early-season suppression: redroot pigweed, tall waterhemp, common lamb's-quarters, prickly lettuce and wild buckwheat. Early-season control: velvetleaf, kochia and Russian thistle.
Host crops, use sites and timing	Preplant and/or pre-emergence (to crop; postemergence to weeds), as a broadcast spray, in field corn, soybean and spring wheat; postemergence (to crop and weed) as a directed spray in grape; and, postemergence (to weed) as a broadcast spray when a crop is not present (in other words, non-crop areas and summerfallow).
Application method	Apply in a minimum of 140 L water/ha using ground application equipment. When targeting dense weed populations and/or larger weeds, use higher spray volumes.
Sequential applications	For field corn, soybean and spring wheat, a preplant application may be followed with a second application at the pre-emergence timing (2 applications total; to a maximum of 50 g a.i./ha per year) provided the applications are made at least 2 weeks apart; for grapes, up to two applications may be made (to a maximum of 50 g a.i./ha per year) provided the applications are made at least 3 weeks apart; and, for summerfallow and non-crop areas, up to two applications may be made (to a maximum of 50 g a.i./ha per year) provided the applications are made at least 2 weeks apart.
Rotational restrictions	Field corn, soybeans and spring wheat: Immediate. All other rotational crops: 9 months.

Appendix II Supplemental Maximum Residue Limit Information—International Situation and Trade Implications

Tiafenacil is an active ingredient that is concurrently being registered in Canada and the United States for use on corn, wheat and soybeans as a preplant and/or pre-emergence application, and on grapes as a directed spray postemergence to the crop. In the United States only, tiafenacil is being registered for use on cotton and popcorn as preplant and pre-emergent application and cotton for postemergent desiccant use.

Once established, the American tolerances for tiafenacil will be listed in the Electronic Code of Federal Regulations, 40 CFR Part 180, by pesticide.

Currently, there are no Codex MRLs[10] listed for tiafenacil in or on any commodity on the Codex Alimentarius Pesticide Index website.

Table 1 compares the MRLs proposed for tiafenacil in Canada with corresponding American tolerances.

Table 1 Comparison of Canadian MRLs and American Tolerances (where different)

Food Commodity	Canadian MRL (ppm)	American Tolerance (ppm)
Fat, meat and meat byproducts of goats, hogs, horses, poultry and sheep	0.01	Not established
Milk	0.01	Not established
Eggs	0.01	Not established

MRLs may vary from one country to another for a number of reasons, including differences in pesticide use patterns and the locations of the field crop trials used to generate residue chemistry data. For animal commodities, differences in MRLs can be due to different livestock feed items and practices.

[10] The Codex Alimentarius Commission is an international organization under the auspices of the United Nations that develops international food standards, including MRLs.

References

A. List of Studies/Information Submitted by Registrant

1.0 Chemistry

PMRA Document Number	Reference
2865993	2018, Product Chemistry Studies for Technical Tiafenacil (DCC-3825) - Series 61 -, DACO: 2.11.1,2.11.2,2.11.3,2.11.4,2.13.2,IIA 1.8.1,IIA 1.8.2,IIA 2.5.2.1,IIA 2.5.2.3,IIA 2.5.2.4 CBI
2865994	2017, Product Chemistry Studies for Technical Tiafenacil (DCC-3825) - Series 62 -, DACO: 2.12.1,2.12.2,2.13.1,2.13.3,IIA 1.11.1,IIA 1.11.2,IIA 1.9.2,IIA 4.2.1 CBI
2865995	2010, Product Chemistry Studies for Technical Tiafenacil (DCC-3825) - Series 63 -, DACO: 2.14.1,2.14.10,2.14.11,2.14.12,2.14.13, 2.14.14, 2.14.2,2.14.3,2.14.4,2.14.5,2.14.6,2.14.7,2.14.8,2.14.9,2.16,8.2.3.2,IIA 2.1.1,IIA 2.1.2,IIA 2.11.1,IIA 2.12,IIA 2.13,IIA 2.15,IIA 2.16,IIA 2.17.1,IIA 2.17.2,IIA 2.2,IIA 2.3.1,IIA 2.4.1,IIA 2.4.2,IIA 2.5.1.1,IIA 2.6,IIA 2.7,IIA 2.8.1,IIA 2.9.5
2866123	2017, DCC-3825-M-36: Octanol/Water Partition Coefficient Test, DACO: 2.14.11,IIA 2.8.1
2866124	2017, DCC3825-M-53 : Octanol/Water Partition Coefficient Test, DACO: 2.14.11,IIA 2.8.1
2866143	2018, Part 2 Chemistry Requirements for Registration of a Technical Grade of Active Ingredient, DACO: 2.1,2.10,2.2,2 .3,2.3.1,2.4,2.5,2.6,2.7,2.8,2.9,IIA 1.1,IIA 1.2,IIA 1.3,IIA 1.4,IIA 1.5.1,IIA 1.5.2,IIA 1.5.3,IIA 1.6,IIA 1.7 CBI
2866081	2016, Residue Analytical Method of Tiafenacil and Its Metabolites in Soil, DACO: 8.2.2.1,IIA 4.4
2866082	2018, Independent Laboratory Validation of Dongbu Farm Hannong Co., Ltd.'s Residue Analytical Method for the Determination of Tiafenacil and Metabolites in Soil, DACO: 8.2.2.1,IIA 4.4
2866083	2017, Validation of an analytical method for the determination of DCC-3825 and its metabolites (M-01, M-12, M-13, M-36, M-53) in Surface water and Drinking water, DACO: 8.2.2.3,IIA 4.5
2866084	2018, Independent Laboratory Validation of Method MFT03717E: "Validation of an analytical method for the determination of DCC-3825 and its metabolites (M-01, M-12, M-13, M-36, M-53) in surface water and drinking water", DACO: 8.2.2.3,IIA 4.5
2866085	2017, Validation of an analytical method for the determination of DCC-3825 and its metabolites (M-01, M-12, M-13, M-36, M-53) in Sediment, DACO: 8.2.2.2,IIA 4.6

PMRA Document Number	Reference
2866086	2017, Independent Laboratory Validation of Method MFT03817E: "Validation of an analytical method for the determination of DCC-3825 and its metabolites (M-01, M-12, M-13, M-36, M-53) in Sediment", DACO: 8.2.2.2,IIA 4.6
2865771	2018, Tiafenacil 70WG Herbicide PART 3.1 Product Identification, DACO: 3.1.1,3.1.2,3.1.3,3.1.4,IIIA 1.1,IIIA 1.2.1,IIIA 1.3
2865772	2017, Product Chemistry Studies for Tiafenacil 70 WG - Series 61 -, DACO: 3.2.1,3.2.2,3.2.3,IIIA 1.2.3,IIIA 1.4.5.1,IIIA 1.4.5.2 CBI
2865779	2017, Product Chemistry Studies for Tiafenacil (DCC-3825) 70WG Herbicide - Series 63 -, DACO: 3.5.1,3.5.10,3.5.11,3.5.12,3.5.13, 3.5.14, 3.5.15,3.5.2,3.5.3,3.5.6,3.5.7,3.5.8,3.5.9,IIIA 2.1,IIIA 2.11,IIIA 2.12,IIIA 2.13,IIIA 2.2.1,IIIA 2.2.2,IIIA 2.3.2,IIIA 2.4.1,IIIA 2.5.2,IIIA 2.6.1,IIIA 2.7.5
2865781	2018, Product Chemistry Studies for Tiafenacil 70WG Herbicide - Series 62, DACO: 3.3.1,3.3.2,3.4.1,IIIA 1.4.2,IIIA 5.2.1 CBI
2866782	2018, Tiafenacil 339SC Herbicide PART 3.1 Product Identification, DACO: 3.1.1,3.1.2,3.1.3,3.1.4,IIIA 1.1,IIIA 1.2.1,IIIA 1.3
2866783	2017, Product Chemistry Studies for Tiafenacil 339SC - Series 61 -, DACO: 3.2.1,3.2.2,3.2.3 CBI
2866784	2018, Product Chemistry Studies for Tiafenacil 339SC Herbicide (DCC-3825 30%SC) - SERIES 62 -, DACO: 3.3.1,3.4,3.4.1 CBI
2866785	2017, Product Chemistry Studies for Tiafenacil 339SC (DCC-3825 30%SC) Herbicide (Test material identified as DCC-3825 30%SC) - Series 63 -, DACO: 3.5.1,3.5.10,3.5.11,3.5.12,3.5.13,3.5.14,3.5.15,3.5.2,3.5.3, 3.5.6,3.5.7,3.5.8,3.5.9

2.0 Human and Animal Health

PMRA Document Number	Reference
2865960	2017, DCC-3825 70 WG (DCC-3825 70%WG): Single Oral Dose Toxicity Study in Sprague-Dawley Rats, DACO: 4.6.1, IIIA 7.1.1
2865961	2017, DCC-3825 70 WG (DCC-3825 70%WG): Single Dermal Dose Toxicity Study in Sprague-Dawley Rats Amended Final Report, DACO: 4.6.2, IIIA 7.1.2
2865962	2017, DCC-3825 70% WG: Acute Inhalation Toxicity Study in Sprague-Dawley Rats, DACO: 4.6.3, IIIA 7.1.3
2865963	2016, DCC-3825 70 WG (DCC-3825 70%WG): Acute Dermal Irritation/Corrosion Study in New Zealand White Rabbits, DACO: 4.6.5, IIIA 7.1.4

PMRA Document Number	Reference
2865964	2016, DCC-3825 70 WG (DCC-3825 70%WG): Acute Eye Irritation/Corrosion Study in New Zealand White Rabbits, DACO: 4.6.4, IIIA 7.1.5
2865965	2017, A Skin Sensitisation Test of DCC-3825 70% WG Using the Local Lymph Node Assay in Mice, DACO: 4.6.6, IIIA 7.1.6
2865996	2017, DCC 3825: Acute Oral Toxicity to the Rat (Acute Toxic Class Method) Amended Final Report, DACO: 4.2.1, IIA 5.2.1
2865997	2017, DCC 3825: Dermal Toxicity to the Rat Amended Final Report, DACO: 4.2.2, IIA 5.2.2
2865998	2017, DCC-3825: Acute Inhalation Toxicity Study in Wistar Rats Amended Final Report, DACO: 4.2.3, IIA 5.2.3
2865999	2017, DCC-3825: Eye Irritation to the Rabbit Amended Final Report, DACO: 4.2.4, IIA 5.2.5
2866000	2017, DCC-3825: Skin Irritation to the Rabbit Amended Final Report, DACO: 4.2.5, IIA 5.2.4
2866001	2017, DCC-3825: Contact Hypersensitivity in Albino Guinea Pigs, Maximization-Test Amended Final Report, DACO: 4.2.6, IIA 5.2.6
2866002	2017, A Skin Sensitisation Test of DCC-3825 Using the Local Lymph Node Assay in Mice, DACO: 4.2.6, IIA 5.2.6
2866003	2016, Acute Neurotoxicity Study of DCC-3825 by Oral (Gavage) Administration in Rats, DACO: 4.5.12, IIA 5.7.1
2866004	2016, A 14 Day Dose Range Finding Study of DCC-3825 by Oral (Dietary) Administration in Rats, DACO: 4.3.3, IIA 5.3.1
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B. Additional Information Considered

i) Published Information

1.0 Human and Animal Health

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