Proposed Registration Decision PRD2010-25

Flonicamid

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Overview

Proposed Registration Decision for Flonicamid

Health Canada's Pest Management Regulatory Agency (PMRA), under the authority of the *Pest Control Products Act* and Regulations, is proposing full registration for the sale and use of Flonicamid Technical Insecticide and Beleaf 50SG Insecticide, containing the technical grade active ingredient flonicamid, to control aphids on a variety of agricultural crops.

An evaluation of available scientific information found that, under the approved conditions of use, the product has value and does not present an unacceptable risk to human health or the environment.

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 flonicamid and Beleaf 50SG Insecticide.

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 (e.g. children) as well as organisms in the environment (e.g. those most sensitive to environmental contaminants). 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 the PMRA regulates pesticides, the assessment process and risk-reduction programs, please visit the Pesticide and Pest Management portion of Health Canada's website at healthcanada.gc.ca/pmra.

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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 flonicamid, the PMRA will consider all comments received from the public in response to this consultation document[3]. The PMRA will then publish a Registration Decision[4] on flonicamid, which will include the decision, the reasons for it, a summary of comments received on the proposed final registration decision and the PMRA'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 Flonicamid?

Flonicamid is an insecticide that controls aphids by stopping them from feeding. This anti-feeding effect eventually results in the death of the insect. Aphids must come into contact or ingest flonicamid in order for it to be effective.

Health Considerations

- **Can Approved Uses of Flonicamid Affect Human Health?**

Flonicamid is unlikely to affect your health when used according to label directions.

Potential exposure to flonicamid may occur through the diet (food and water) or when handling and applying the product. 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 (e.g., children and nursing mothers). 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 where no effects are observed. The health effects noted in animals occur at doses more than 100-times higher (and often much higher) than levels to which humans are normally exposed when flonicamid products are used according to label directions.

The technical grade active ingredient flonicamid is of moderate toxicity when administered as a single oral dose to rats; consequently, the hazard signal words "WARNING - POISON" are required on the label. It is of low acute toxicity when administered to rats dermally or through inhalation. Flonicamid is non-irritating to the eyes and minimally irritating to the skin of rabbits, and does not produce a skin sensitizing response in guinea pigs.

[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 Beleaf 50SG Insecticide is low via the oral, dermal and inhalation routes of exposure. It is non-irritating to the skin and is not considered a skin sensitizer. Beleaf 50SG Insecticide is mildly irritating to the eyes. Consequently, the hazard signal words "CAUTION – EYE IRRITANT" are required on the label.

Health effects in animals given daily doses of flonicamid over long periods of time included effects on the liver, kidney, spleen, bone marrow and lung. There was evidence of perturbations in reproductive hormones; however, there was no effect on the ability to reproduce. There was no indication that flonicamid caused damage to the nervous system, or evidence to suggest that flonicamid damaged genetic material. Flonicamid did however, cause the formation of lung tumours in mice.

When flonicamid was given to pregnant animals, minor effects on the developing foetus were observed at doses that were toxic to the mother, indicating that the foetus is not more sensitive to flonicamid than the adult animal.

The risk assessment protects against these effects by ensuring that the level of human exposure is well below the lowest dose at which these effects occurred in animal tests.

- **Residues in Water and Food**

Dietary risks from food and water are not of concern

Aggregate dietary intake estimates (food plus water) revealed that children 1-2 years old, the subpopulation which would ingest the most flonicamid relative to body weight, are expected to be exposed to less than 7.3 % of the acceptable daily intake. Based on these estimates, the chronic dietary risk from flonicamid is not of concern for all population sub-groups.

A single dose of flonicamid is not likely to cause acute health effects in the general population (including infants and children).

The *Food and Drugs Act (FDA)* 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 FDA purposes through the evaluation of scientific data under the *Pest Control Products Act (PCPA).* Food containing a pesticide residue that does not exceed the established MRL does not pose an unacceptable health risk.

Residue trials conducted throughout Canada and the United States using flonicamid on broccoli, cabbage, mustard greens, cantaloupe, cucumber, summer squash, tomato, pepper, celery, leaf lettuce, head lettuce, spinach, potato, radish, carrot, apple, pear, peach, cherry, plum, and hops were acceptable. The MRLs for this active ingredient can be found in the Science Evaluation section of this consultation document.

- **Risks in Residential and Other Non-Occupational Environments**

Entry by the public into treated commercial areas is considered acceptable.

No risk assessment was required for adults and children entering treated commercial areas for 'pick-your-own' harvest activities as there were no effects in the toxicology database that warranted the establishment of an acute reference dose.

- **Occupational Risks From Handling Beleaf 50SG Insecticide**

Occupational risks are not of concern when Beleaf 50SG Insecticide is used according to the proposed label directions, which include protective measures.

Farmers and custom applicators that mix, load or apply Beleaf 50SG Insecticide, as well as field workers re-entering treated fields can come in direct contact with flonicamid residues on the skin, or by inhalation. Therefore, the label specifies that anyone mixing or loading Beleaf 50SG Insecticide must wear a long-sleeved-shirt, long pants, chemical-resistant gloves and goggles; and that anyone applying the product must wear a long sleeve shirt and long pants. The label also requires that workers do not enter treated fields or other treated sites for at least 12 hours after application, or longer, depending on the crop and tasks to be performed. Taking into consideration these label statements, the number of applications and the expected exposure period for handlers and workers, the risks to these individuals are determined not to be of concern.

For bystanders, exposure is expected to be much less than that for workers and is considered negligible. Therefore, health risks to bystanders are not of concern.

Environmental Considerations

- **What Happens When Flonicamid Is Introduced Into the Environment?**

Environmental risks to non-target organisms are not of concern when Beleaf 50SG Insecticide is used according to label directions, which include precautionary label statements and buffer zones.

Flonicamid enters the environment when used as an insecticide on a variety of crops. Flonicamid is not persistent in soil and slightly to moderately persistent in water, while the environmentally relevant major transformation products, TFNA, TFNA-OH, TFNG, and TFNG-AM are all not persistent in soil and moderately persistent in water. The transformation products rapidly mineralize in aerobic soil. Flonicamid and its major transformation products are mobile and expected to leach. However, based on rapid dissipation in soil, the expected concentrations in groundwater are expected to be low. This is supported by water modelling which indicates that groundwater levels are low. Based on its low volatility, flonicamid residues are not expected in the air.

Flonicamid does not present a risk to wild mammals, birds, freshwater or marine invertebrates and fish, amphibians, algae, and aquatic plants. However, flonicamid does potentially affect terrestrial plants and predators and parasites. Therefore, to protect from the effects resulting from spray drift to non-target terrestrial plants, a ground buffer zone of one metre is required. Hazard based label statements for toxicity will be required for predators and parasites, and terrestrial plants.

Value Considerations

- **What Is the Value of Beleaf 50SG Insecticide?**

Beleaf 50SG Insecticide controls aphids on a wide variety of agricultural crops.

The active ingredient in Beleaf 50SG Insecticide will be useful in resistance management as it has a different mode of action compared to the currently registered pest control products in the same crops. It can also be used as an alternative to older chemistries registered for the same uses, such as organochlorines, organophosphates and carbamates.

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 Beleaf 50SG Insecticide to address the potential risks identified in this assessment are as follows.

Key Risk-Reduction Measures

Human Health

A 12-hour restricted-entry interval (REI) for agricultural products encompasses most post-application tasks; however, longer REIs are necessary for some tasks on several crops, including hops, pome fruits and stone fruits. For hops, a 31-day REI is required for stripping, training and hand harvest activities. For pome and stone fruits, a 2-day REI is required for thinning activities.

Environment

Beleaf 50SC Insecticide can not be sprayed within one metre of susceptible non-target plant species. Label statements for toxicity are required for predators and parasites, and terrestrial plants.

Next Steps

Before making a final registration decision on flonicamid, the PMRA will consider all comments received from the public in response to this consultation document. The PMRA 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). The PMRA will then publish a Registration Decision, which will include its decision, the reasons for it, a summary of comments received on the proposed final decision and the Agency's response to these comments.

Other Information

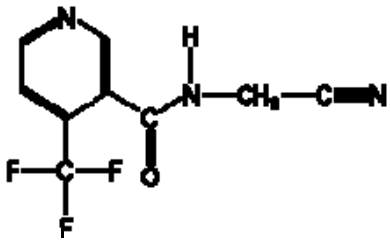
When the PMRA makes its registration decision, it will publish a Registration Decision on flonicamid (based on the Science Evaluation of this consultation document). In addition, the test data referenced in this consultation document will be available for public inspection, upon application, in the PMRA's Reading Room (located in Ottawa).

Science Evaluation

Flonicamid

1.0 The Active Ingredient, Its Properties and Uses

1.1 Identity of the Active Ingredient

Active substance	Flonicamid
Function	Insecticide
Chemical name	
1. International Union of Pure and Applied Chemistry (IUPAC)	*N*-cyanomethyl-4-(trifluoromethyl)nicotinamide
2. Chemical Abstracts Service (CAS)	*N*-(cyanomethyl)-4-(trifluoromethyl)-3-pyridinecarboxamide
CAS number	158062-67-0
Molecular formula	$C_9H_6F_3N_3O$
Molecular weight	229.16
Structural formula	
Purity of the active ingredient	98.4%

1.2 Physical and Chemical Properties of the Active Ingredients and End-Use Product

Technical Product—Flonicamid Technical

Property	Result
Colour and physical state	Light beige
Odour	Odourless
Melting range	157.5°C
Boiling point or range	N/A
Specific gravity	1.531

Property	Result
Vapour pressure at 20°C	9.43×10^{-4} mPa
Ultraviolet (UV)-visible spectrum	pH — λ_{max} (nm) neutral — 265 pH < 2 — 266 pH > 12 — 270
Solubility in water at 20°C	5.2 g/L
Solubility in organic solvents at 20°C (g/100 mL)	Solvent — Solubility Acetone — 17.32 Ethyl acetate — 3.57 Methanol — 9.76 Acetonitrile — 12.04 1-Propanol — 1.46
n-Octanol-water partition coefficient (K_{ow})	Log K_{ow} = 0.30
Dissociation constant (pK_a)	11.6
Stability (temperature, metal)	No change in appearance in the presence of temperature, metals and metal ions.

End-Use Product—Beleaf 50SG Insecticide

Property	Result
Colour	N/A
Odour	N/A
Physical state	Solid
Formulation type	Soluble granules (SG)
Guarantee	50% Flonicamid
Container material and description	High-density polyethylene (HDPE) bottles
Density	536.6-595.9 kg/m^3
pH of 1% dispersion in water	5.99

Property	Result
Oxidizing or reducing action	The product is not considered to be either a strong oxidizing or reducing agent.
Storage stability	Stable for at least 12 months when stored at ambient temperature in the commercial container.
Corrosion characteristics	The product is not corrosive.
Explodability	The product does not have any explosive ingredients.

1.3 Directions for Use

Beleaf 50SG Insecticide controls aphids on Brassica (cole) leafy vegetables, cucurbit vegetables, fruiting vegetables, leafy vegetables (excluding Brassica), hops, tuberous and corm vegetables, root vegetables (excluding sugar beets), pome fruit and stone fruit when applied by ground application equipment at a rate of 0.12 to 0.16 kg product/ha (0.06 to 0.08 kg a.i./ha). A maximum of 3 applications per year, applied 7 days apart, may be used to control aphids.

1.4 Mode of Action

Flonicamid is a feeding blocker belonging to the resistance classification group 9C. The exact mode of action for flonicamid is not known. Flonicamid suppresses the feeding of insects either through ingestion or contact.

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 the impurities in Flonicamid Technical 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

For residues in food stuffs and environmental media, high-performance liquid chromatography methods with tandem mass spectrometry (HPLC-MS/MS) were developed and proposed for data generation and enforcement purposes. These methods fulfilled the requirements with regards to selectivity/specificity, accuracy and precision at the respective method limit of quantitation. Acceptable recoveries (70–120%) were obtained in plant and animal matrices and environmental media. Adequate extraction efficiencies were demonstrated using the radiolabelled test substance

that was bioincurred in peaches, potato tubers, and wheat straw analyzed with the proposed enforcement method. Methods for residue analysis are summarized in Table 1, Appendix I.

3.0 Impact on Human and Animal Health

3.1 Toxicology Summary

A detailed review of the toxicological database for flonicamid 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. The scientific quality of the data is high and the database is considered adequate to define the majority of the toxic effects that may result from exposure to flonicamid.

Technical flonicamid was of moderate acute toxicity via the oral route of exposure and was of low acute toxicity via the dermal and inhalation routes of exposure when administered as a single dose to rats. It was non-irritating when applied to the skin and minimally irritating when instilled into the eyes of rabbits. Flonicamid was negative for skin sensitization in guinea pigs.

Beleaf 50SG Insecticide was of low acute toxicity via the oral, dermal, and inhalation routes of exposure when tested in rats. It was non-irritating to the skin and mildly irritating to the eyes of rabbits. Results of skin sensitization testing in guinea pigs were negative.

Five plant and/or animal metabolites (TFNA, TFNG, TFNA-OH, TFNG-AM, TFNA-AM) were found to be of low acute toxicity via the oral route in rats.

Following oral administration to rats, the toxicokinetic behaviour of flonicamid was characterized by rapid absorption and elimination from the plasma. High dose males exhibited a decreased rate of elimination relative to other dose groups with serum concentration reaching a plateau between 0.5-8.0 hours post-dose. In all dose groups, radiolabel concentration in the plasma decreased with time and in a manner consistent with first order kinetics. The predominant route of excretion was in the urine, accounting for 72-78% of the administered radiolabelled dose. Faecal and biliary excretions were minor (4-7%), and no residues were detected in the expired air. For all routes, excretion was rapid with 95% of the radioactivity excreted within the first 24-48 hours. Very little flonicamid was retained in the tissues and repeated dosing of rats did not indicate any potential for accumulation. Maximum plasma concentrations (C_{max}) and area under the curve (AUC) values were directly proportional to dose level in both sexes. Time to maximum plasma concentration (T_{max}) was similar in low dose males and females; however, T_{max} was increased in high dose males relative to females, probably in relation with the prolonged plateau observed in plasma concentrations in males at this dose. Tissue distribution of radiolabel was similar in all groups following single dosing. Radioactivity was rapidly and widely distributed throughout the tissues at levels similar to blood concentrations; however, slightly higher levels of radiolabel were noted in the liver, kidneys, adrenals, thyroid, and ovaries. Repeat dose males also had increased levels of radiolabel in the lungs. The metabolic profile in the urine was generally similar between the sexes after single and repeat dosing. In urine, the major residue was unchanged parent, followed by the metabolite TFNA-AM.

TFNA-AM was also the predominant metabolite in the faeces and bile. In the faeces, TFNA was found only in low dose animals, while TFNA-AM N-oxide conjugate was found only in high dose animals. Unchanged parent was the predominant residue in the bile and TFNG–AM was unique to the bile of high dose animals. In the liver, the predominant residue was unchanged parent, with TFNG and TFNA-AM noted as minor metabolites.

Flonicamid did not produce a toxic effect following short-term dermal administration in the rat.

Following repeated oral dosing in rats, the primary target organs were the liver and kidneys. In short-term studies, liver enlargement and hepatocellular hypertrophy, with changes in lipid metabolism, were noted in both sexes. Differences in kidney effects were noted between the sexes with respect to sensitivity and nature of response. In males, nephrotoxicity was characterized by hyaline product deposition in the proximal tubular epithelium at low dose levels, with associated degenerative changes, tubular basophilia and/or granular casts at higher dose levels. Immunohistochemical staining of kidneys from treated males confirmed the presence of α2μ-globulin in the hyaline droplets and granular casts of the tubules. Published literature indicates that these kidney effects in male rats are a species specific response, and therefore not relative to human risk. Kidney changes in the females were restricted to cytoplasmic vacuolation in proximal tubular cells at high dose levels only. Kidney weights were increased in both sexes. Following long-term administration of flonicamid, effects were similar to those seen following short-term dosing; however, female rats also developed signs of mild anaemia and accelerated expression of common age-related lesions, characterized by an increase in striated muscle fibre atrophy and eye effects.

In the mouse, the liver, spleen, bone marrow and lung were the primary target organs of toxicity following repeated dosing. Unlike rats, no adverse effects were noted in the kidneys of mice. An increased incidence of hepatocellular hypertrophy, along with increased liver weights, splenic extramedullary hematopoiesis with pigment deposition, and reduced bone marrow cellularity were noted in both sexes after 90 days of dosing with flonicamid. In addition to these findings, an increased incidence of lung hyperplasia/hypertrophy, lung masses/nodules and/or spots was observed in the mouse following 18 months of dosing. It is not known how early lung effects occur as lung tissue was not examined in the short-term study.

In the dog, no specific target organs were identified. Clinical signs, including vomiting and ataxia, were noted as early as the first day of administration. Decreased body weight gain and haematological changes suggestive of mild anaemia were observed.

Flonicamid was non-genotoxic in both *in vitro* and *in vivo* studies. TFNA, TFNA-AM, TFNG, TFNG-AM and TFNA-OH were non-mutagenic in bacterial reverse mutation assays either with or without metabolic activation.

With respect to oncogenicity, tumours were observed in both the rat and the mouse. In rats, treatment with flonicamid was associated with an increased incidence of nasolacrimal duct tumours in high dose animals (36.5/219 mg/kg bw/day in M/F) of both sexes, relative to concurrent controls. Although the increase was not statistically significant, it was outside of the upper range of historical control values. The applicant proposed an association between

malocclusion of incisor teeth and inflammation as a contributing factor for the neoplasms noted in the nasolacrimal duct. Although results suggest malocclusion/inflammation may have been a contributing factor for squamous cell carcinoma of the nasolacrimal duct in high dose males, no clear association could be made in females due to the low incidence of both neoplastic and non-neoplastic lesions. In addition, no elevation in tumour incidence was noted in females at 44 mg/kg bw/day, the next lowest dose. Evidence that the nasolacrimal duct tumours were treatment-related in females was concluded to be equivocal. There was a slight increase in incidence of cerebellar granular cell tumours (GCT) in high dose females relative to concurrent controls. The incidence of this tumour was also slightly outside of the upper end of the range of historical control values. In light of these findings, a clear association to treatment with flonicamid could not be made; therefore, the increase in GCT in high dose females was considered equivocal.

Two 18-month oncogenicity studies were available in the mouse. An increased incidence of alveolar/bronchiolar adenomas and carcinomas were observed in both sexes; however, tumours were evident down to the lowest dose tested. For this reason, a second oncogenicity study, using lower doses (with an overlapping dose group), was performed to further investigate these neoplastic effects. On the basis of the combined results of both studies, it was concluded that flonicamid produced a statistically significant increase in alveolar/bronchiolar tumours in both sexes at doses of 29 mg/kg bw/day and above. An increased incidence of epithelial cell hyperplasia in terminal bronchioles was also evident in many of the terminal sacrifice animals at doses producing an increase in tumour response. A non-linear mitogenic mode of action (MOA) for lung tumours was proposed by the applicant. The applicant contended that these tumours were unique to the CD-1 mouse and were due to a mitogenic effect, which results in increased proliferation and structural changes in Clara cells. Over time, the increased cell turnover resulted in tumour development. A series of experiments using Bromodeoxyuridine (BrdU) labelling were designed to assess cell proliferation in CD-1 mice exposed to flonicamid. According to these supplemental studies, a dose-related increase in BrdU index, an indicator of cell proliferation, was evident. The effect was observed following 3 days of treatment, was reversible within 7 days after the cessation of treatment, and was not observed in mice treated with metabolites TFNG, TFNA and TFNA-AM. In addition, no change in BrdU index was evident in two other mouse strains tested or in the Wistar rat. Microscopic examination of lung tissue confirmed that the above changes occur in Clara cells. Although the data suggest that the proposed MOA is plausible, some residual uncertainties remain with respect to temporal considerations for pre- and neoplastic changes. Overall, however, the weight of evidence for the MOA was sufficient to conclude that a linear low dose extrapolation (q_1*) approach to the cancer risk assessment may be overly conservative. For these reasons, a threshold approach for lung tumours was applied for the cancer risk assessment.

In a 2-generation reproductive toxicity study in the rat, flonicamid did not affect fertility or fecundity in either sex. Effects suggestive of interference with normal sexual maturation in female progeny were seen at the highest dose (reduced uterine weights and slightly delayed vaginal opening in the F_1 generation), but all other aspects of F_1 development, including reproductive capacity, were unaffected by treatment with flonicamid. Sperm analysis did not reveal any treatment-related effect on sperm count or morphology. Further investigations of serum gonadotrophin and sex hormone concentrations were performed in F_1 progeny upon

maturity due to the delay in vaginal opening observed earlier. The duration of dosing required to elicit hormone perturbations is not known, as hormone measurements were not performed in the P-generation animals. There were no changes in luteinizing hormone (LH), follicle stimulating hormone (FSH) or testosterone concentrations in male F_1 offspring at any dose. In females, serum LH concentration was elevated at the mid-dose and above and was accompanied by an increase in serum FSH and a decrease in serum 17β-estradiol concentrations at the high dose. Serum progesterone was unaffected by treatment with flonicamid. Further investigation of estrogen receptor binding affinity showed that flonicamid has a very low affinity for both α- and β-receptors. Reproductive performance was unaffected in subsequent matings with F_1 animals, decreasing the level of concern for these effects. Kidney changes similar to those seen in the repeat dose toxicity studies were also observed. The F_1 males and females were no more susceptible than the P generation to these renal lesions. There was no evidence of sensitivity of the young to flonicamid in this study.

Flonicamid was not teratogenic in the rat or rabbit. Developmental effects were observed at maternally toxic doses only. An increased incidence of cervical rib was evident in rat foetuses at high dose levels in the presence of overt maternal toxicity, notably liver hypertrophy, vacuolation of renal tubular cells and increased placental weight. Effects were evident in the rabbit at much lower doses. A decrease in foetal body weight was observed at the high dose; however, this was accompanied by reduced food consumption, body weight gain and gravid uterine weight in the does. Therefore, there was no evidence suggesting sensitivity of the young in rats or rabbits treated with flonicamid.

Although effects indicative of neurotoxicity were observed in the acute and short-term rat studies (decreased locomotor activity in both sexes, as well as decreased motor activity, decreased rearing and increased landing foot splay in males only), these effects were seen at high doses and were considered to reflect systemic toxicity rather than neurotoxicity. The incidences of vomiting and ataxia observed early on in the dog studies were sporadic, did not follow a consistent pattern, and were attributed to systemic toxicity and general malaise rather than neurotoxicity. For these reasons, flonicamid was not considered to be neurotoxic in laboratory animals.

Results of the acute and chronic tests conducted on laboratory animals with Flonicamid Technical and its associated end-use products, along with the toxicology endpoints for use in the human health risk assessment, are summarized in Tables 2, 3 and 4 of Appendix I.

3.1.1 PCPA 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 data for the assessment of risk to infants and children, the database contains the full complement of required studies including developmental toxicity studies in rats and rabbits, and a reproductive toxicity study in rats. There was no trigger for the requirement of a developmental neurotoxicity study.

With respect to identified concerns relevant to the assessment of risk to infants and children, there was no indication of increased susceptibility of foetuses or offspring compared to parental animals in the reproductive and prenatal developmental toxicity studies. Minor developmental effects (increased incidence of a skeletal variation and decreased body weight) were observed in the rat and rabbit prenatal developmental toxicity studies; however, these effects occurred in the presence of maternal toxicity. In the 2-generation rat reproductive toxicity study, vaginal opening was delayed in F_1 pups at the high dose; however, this occurred in the presence of maternal toxicity (kidney effects and decreased ovary weights). Overall, endpoints in the young were well characterized and occurred at doses well above those used for regulatory purposes. On the basis of this information, the 10-fold factor required under the *Pest Control Products Act* was reduced to 1-fold.

3.2 Determination of Acute Reference Dose

There were no effects in the database warranting establishment of an acute reference dose.

3.3 Determination of Acceptable Daily Intake

The recommended acceptable daily intake (ADI) is 0.04 mg/kg bw/day, based on a NOAEL of 4.4 mg/kg bw/day in the 2-generation reproductive toxicity study for increased blood serum LH concentrations in F_1 females at the LOAEL of 27 mg/kg bw/day. The 2-generation reproductive toxicity study is the only study in which reproductive hormones were assessed. This study provides the lowest NOAEL in the database. The standard uncertainty factors of 10-fold for interspecies extrapolation and 10-fold for intraspecies variability were applied. For the reasons outlined in the PCPA Hazard Characterization Section, the PCPA factor was reduced to 1-fold resulting in a Composite Assessment Factor (CAF) of 100-fold. The selection of this endpoint is considered to be protective of all populations including women of child-bearing age and nursing infants.

The ADI is calculated according to the following formula:

$$\text{ADI} = \frac{\text{NOAEL}}{\text{CAF}} = \frac{4.4 \text{ mg/kg bw/day}}{100} = 0.04 \text{ mg/kg bw/day of flonicamid}$$

This ADI provides a margin of 725 to the dose at which lung tumours were observed in the mouse and a margin of 5475 to the high dose for female rats, at which an equivocal increase in nasolacrimal and cerebellar granular cell tumours was observed.

3.4 Occupational and Residential Risk Assessment

3.4.1 Toxicological Endpoints

Dermal and inhalation exposure to flonicamid is possible for chemical handlers mixing/loading and applying Beleaf 50SG Insecticide. Workers re-entering treated areas are potentially exposed mainly via the dermal route. Exposure scenarios for farmers are expected to be short- to intermediate-term in duration, based on the maximum number of applications per year (3 applications at 7-day intervals). Custom applicators may have more frequent exposure since they could apply sequential applications throughout the growing season, leading to intermediate-term exposure.

For exposures of all durations via the dermal and inhalation routes, the NOAEL of 4.4 mg/kg bw/day for the 2-generation reproductive toxicity study was selected. Blood serum LH concentrations were increased in F_1 females at the LOAEL of 27 mg/kg bw/day. Although one route specific study was available (28-day dermal), the reproduction study was the only study which addressed hormone perturbation. Measurements were made in the F_1 females prior to sacrifice. Since hormone measurements were not conducted in P-generation females, the duration required to elicit these changes is not known. Therefore, this endpoint is considered to be appropriate for all durations of dermal and inhalation exposure.

The target margin of exposure (MOE) for these scenarios is 100, which includes uncertainty factors of 10-fold for interspecies extrapolation and 10-fold for intraspecies variability. The selection of this endpoint and MOE is considered to be protective of all populations including women of child-bearing age and nursing infants.

3.4.1.1 Dermal Absorption

Chemical specific dermal penetration data were not available for flonicamid. A weight-of-evidence approach, using available data and information, was considered to refine the default dermal absorption value for risk assessment purposes. As a result of a comparison of the oral and dermal acute toxicity studies and evaluation of the physical and chemical properties of the product, the dermal absorption value was revised from 100% to 50% for flonicamid for risk assessment purposes.

3.4.2 Occupational Exposure and Risk

3.4.2.1 Mixer/loader/applicator Exposure and Risk Assessment

Individuals have potential for exposure to flonicamid during mixing, loading and application. Handlers are assumed to have potential short-term and intermediate-term dermal and inhalation exposure to flonicamid. Long term handler exposure is not expected due to the seasonal nature of anticipated applications and the limited frequency that may be applied per year. Both farmers and custom applicators were considered as handlers and it was assumed that the one person would perform both the mixing/loading and applying.

Appropriate unit exposure values were found in the Canadian PHED Tables to cover all potential exposure scenarios. It should be noted that some bridging of data was necessary as PHED does not contain water dispersible granule (WDG) unit exposure values for the proposed application methods. Therefore, according to PMRA protocol, PHED data for dry flowable formulations was used as a reasonable surrogate for the WDG formulation.

Exposure estimates, shown in Tables 3.4.1, and 3.4.2, were derived for mixers, loaders and applicators applying Beleaf 50SG Insecticide. Dermal exposure was estimated by coupling the unit exposure values with the amount of product handled per day and the dermal absorption factor. Dermal exposure estimates are based on mixers and loaders of Beleaf 50SG Insecticide wearing a long-sleeved shirt, long pants and chemical-resistant gloves and applicators wearing a long-sleeved shirt and long pants. 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 70 kg adult body weight. Exposure estimates were compared to the toxicological endpoint (the NOAEL) of 4.4 mg/kg bw/day, to obtain the MOE; the target MOE is 100. All uses exceed the target MOE and are considered acceptable based on the label directions.

Table 3.4.1 PHED unit exposure estimates for mixer/loader and applicators with proposed PPE while handling Beleaf™ 50SG Insecticide (µg/kg bw/day)

Scenario[1]		Dermal (µg/kg a.i. handled)	Inhalation[2] (µg/kg a.i. handled)	Total Absorbed[3] (µg/kg a.i. handled)
Mixer/loader PHED estimates				
A	Scenario 1a : Dry flowable, open mixing and loading (PPE = single layer, gloves)	163.77	1.02	82.66
Applicator PHED estimates				
B	Scenario 11: Groundboom open cab (PPE = single layer, no gloves)	32.98	0.96	17.45
C	Scenario 9: Airblast open cab (PPE = single layer, no gloves)	828.22	5.8	419.91
Mixer/loader and applicator PHED estimates				
Groundboom Application				
A+B	Single layer and gloves when open mixing/loading and single layer, no gloves when applying in open cab	196.75	1.98	100.11

Scenario[1]		Dermal (µg/kg a.i. handled)	Inhalation[2] (µg/kg a.i. handled)	Total Absorbed[3] (µg/kg a.i. handled)
Airblast Application				
A+C	**Mitigation Option #1:** Single layer and gloves when open mixing/loading and single layer, no gloves when applying with open cab	991.99	6.82	502.57

[1]Scenario dermal and inhalation unit exposures were used from the Pesticide Handlers Exposure Database, version 1.1
[2]Inhalation assumed to be LIGHT work for mixer/loader and applicator
[3]Total Absorbed Exposure = (dermal exposure x 50% dermal absorption) + (inhalation exposure x 100% inhalation absorption)

Table 3.4.2 Mixer/Loader/Applicator Risk Assessment

Crop Group	Application Method	Applicator	ATPD (ha)[1]	Total Daily Exposure (µg/kg-bw/day)[2]	MOE[3]
Brassica (cole) leafy, leafy, cucurbit, fruiting, root, tuberous and corm vegetables and hops	Groundboom	Farmer	26	2.97	1479
		Custom	360	41.19	107
Potato[4]	Groundboom	Farmer (Large)	107	12.24	359
Pome and stone fruit and hops	Airblast	Farmer/ Custom	20	11.49	383

[1]ATPD from PMRA ATPD Default Values (July, 2009)
[2]Total Daily Exposure (TDE) = ((Dermal Unit Exposure x DA factor) + Inhalation Unit Exposure) x ATPD x application rate ÷ Body Weight (where, BW = 70 kg)
[3]Occupational endpoints: Short- and intermediate-term exposure: Dermal and Inhalation, based on 2-generation oral reproduction study NOAEL of 4.4 mg/kg-bw/day; a target MOE of 100 (10x-interspecies extrapolation x 10x intraspecies variability)
Margin of Exposure (MOE) = NOAEL for route ÷ Daily Dose
Daily Dose = ((total route unit exposure x absorption) ÷ 1000) x ATPD x application rate ÷ Body weight
Where, Body weight = 70 kg
Dermal absorption (DA) value = 50% = 0.5; Inhalation absorption assumed to be 100% = 1
[4]Potato is considered a 'large field crop' for *farmer application*, but is captured within the general tuberous and corm crop group category for custom application.

3.4.2.2 Exposure and Risk Assessment for Workers Entering Treated Areas

There is potential for exposure to workers entering treated areas to perform cultural activities such as weeding, pruning, scouting and hand-harvesting. The duration of exposure is considered short- to intermediate-term in duration and the primary route of exposure for workers that enter treated crops would be dermal through contact with residues on leaves.

Dermal exposure to workers entering treated areas is estimated by coupling dislodgeable foliar residue values with activity-specific transfer coefficients. Activity transfer coefficients are based on reviewed Agricultural Re-Entry Task Force studies, of which ISK Biosciences is a member, and United States Environmental Protection Agency Policy 3.1 data. Chemical-specific dislodgeable foliar residue (DFR) studies were submitted on apples, cucumbers and potatoes.

The DFR study on apples was performed at one field site in North Rose, New York, in 2001 and applications of the test product were made at a rate of approximately 0.10 kg a.i./ha with a retreatment interval of 7-days and a total of 3 applications. DFR samples were collected up to 42 days following the final application. The application rate, intervals, formulation and application equipment are considered to be representative of the use of flonicamid on apples in Canada and the study was considered to be acceptable to determine the decline of flonicamid residues. The calculated half life of flonicamid on apple foliage was determined to be 10.9 days. Peak residues occurred immediately after the final application and were approximately 35% of the application rate (0.348 $\mu g/cm^2$). Since the dissipation of flonicamid followed first order kinetics with high R^2 values of 0.8775, it was considered appropriate to use the equation of the line from the linear regression of the natural log versus days after last application to estimate DFR values for flonicamid. This equation gave a post-application DFR value of 34.8% of the application rate and a daily dissipation rate of approximately 6.15% per day to be used for risk assessment purposes.

The second DFR study on cucumbers and potatoes was carried out in 2000 at two field sites; the cucumber site was in North Carolina and the potato site was in North Dakota. The test product was applied at a rate of approximately 0.10 kg a.i./ha for a total of 3 applications with an interval of 5 or 9-days (North Carolina site) and 7-days (North Dakota site) between applications. DFR samples were collected for each crop up to 42 days following the final application. The application rate, intervals, formulation and application equipment are considered to be representative of the use pattern of flonicamid in Canada and the study was considered to be acceptable to determine the decline of flonicamid residues. The calculated half life of flonicamid on cucumber foliage is 1.29 days and on potato foliage is 1.22 days. For cucumbers, the residue levels immediately after the third and final application were approximately 14% of the application rate (0.140 $\mu g/cm^2$). For potatoes, the residue levels immediately after the third and final application were approximately 24% of the application rate (0.243 $\mu g/cm^2$). Since the dissipation of flonicamid followed first order kinetics with high R^2 values of 0.8738 and 0.9212 for cucumbers and potatoes, respectively, it was considered appropriate to use the equation of the line from the linear regression of the natural log versus days after last application to estimate DFR values for flonicamid. For cucumbers, this gave a post-application DFR value of 14.0% of the application rate and a daily dissipation rate of approximately 41.5% per day for risk assessment purposes. For potatoes, this gave a post-application DFR value of 24.3% of the application rate and a daily dissipation rate of approximately 43.4 % per day for risk assessment purposes.

In the absence of DFR data specific to each proposed crop, the results from the apple, cucumber and potato studies were used to estimate flonicamid residues on the other crops. Data from the DFR study on apples was used for all orchard crops (pome and stone fruit) as well as airblast-applied hops. Data from the DFR study on cucumber was used as a surrogate for the brassica,

cucurbit, fruiting, leafy, and hops applied by groundboom equipment. Finally, the data from the DFR study on potatoes were used to estimate the exposure on root, tuberous and corm vegetable crops. These designations were considered appropriate based on the application method, minimum spray volumes, leaf texture, and plant morphology.

Post-application exposure was calculated for the day of the proposed PHI for hand harvest activities and on the day of the last application for non-hand harvest activities. Exposure estimates were compared to the toxicological endpoint of 4.4 mg/kg bw/day to obtain the calculated MOE; the target MOE being 100. Exposure and risk assessments are shown in Tables 3.4.3 and 3.4.4. For the hand harvest activities, most crops had MOEs that exceeded the target MOE of 100 given the proposed PHIs, except for hops, which requires a pre-harvest interval of 31 days in order to meet the target MOE. For non-hand harvest activities the exposure risk met the target MOE for most crops and cultural activities except: hops (stripping and training), pome and stone fruit (thinning). For these crops and specific cultural activities, the REIs that are required to meet the target MOE are two days for pome and stone fruit and 31 days for hops.

Table 3.4.3 Post-Application Risk Assessment of Hand-Harvest Activities on the day of the PHI[1]

Crop Group	DFR Study used as surrogate	TC[1] (cm^2/h)	PHI (days)	Dermal MOE[2]	PHI required to achieve MOE ≥100
Brassica	Cucumber	5000	0	138	/
Cucurbit Vegetables	Cucumber	2500	0	275	/
Fruiting Vegetables	Cucumber	1000	0	688	/
Leafy Vegetables	Cucumber	2500	0	275	/
Hops (groundboom applied)	Cucumber	19300	10	7589	/
Hops (airblast applied)	Apple	19300	10	**27**	***31 days***
Tuberous/Corm Vegetables	Potato	2500	7	8514	/
Root Vegetables	Potato	2500	3	874	/
Pome Fruit	Apple	1500	21	699	/
Stone Fruit	Apple	1500	14	448	/

[1] EPA Policy 3.1: *Science Advisory Council for Exposure Agricultural Transfer Coefficient* (Revised - August 7, 2000); Transfer coefficients from PMRA memo - *Transfer Coefficients for Grapes, Trellis Crops and Caneberries* (PMRA, 2005); Transfer coefficient from PMRA memo – *Transfer Coefficients for Orchard Tree Crops and Christmas Trees* (PMRA, 2004)

[2] Target MOE = 100. Actual MOE = NOAEL (4.4 mg/kg bw/day) / Total Daily Exposure; Total Daily Exposure calculated using values of 24.3%, 34.8% and 14.0% of residues retained on foliage for root, tuberous and corm; airblast-applied crops; and all other groundboom applied crops, respectively, with accompanying daily decline rates of 43.4 %, 6.15% and 41.5%, respectively.

Table 3.4.4 Post-Application Risk Assessment of Non-Hand Harvest Activities on Day of Last Application

Crop Group	Activity	TC1 (cm2/h)	Label REI	Dermal MOE2	REI required to achieve MOE ≥100
Brassica (cole) leafy vegetables	Irrigation, Pruning, Tying (cauliflower only	5000	0	138	/
	Scouting	4000	0	172	/
Cucurbit vegetables	Hand Pruning, Thinning, Turning (watermelon only)	2500	0	275	/
	Irrigation, Scouting, Hand Weeding	1500	0	458	/
Fruiting vegetables	Tying, Staking, Hand Pruning, Training (tomato), Thinning (tomato)	1000	0	688	/
Leafy vegetables	Thinning	2500	0	275	/
	Irrigation, Scouting	1500	0	458	/
Hops (groundboom applied)	Stripping, Training	19300	0	***36***	***2***
	Scouting	1300	0	529	/
Hops (airblast applied)	Stripping, Training	19300	0	***14***	***31***
	Scouting	1300	0	215	/
Tuberous and corm vegetables	Green onions: Thinning	2500	0	275	/
	Irrigation, Scouting	1500	0	458	/
Root vegetables	Irrigation, Scouting, Hand Weeding	300	0	2292	/
Pome fruit	Thinning	3000	0	***92***	***2***
	Handline Irrigation	1100	0	251	/
	Scouting, Hand Pruning, Training, Tying (pears only)	500	0	559	/
Stone fruit	Thinning,:	3000	0	***92***	***2***
	Handline Irrigation	1100	0	251	/
	Scouting, Hand Pruning, Training, Tying (plums only)	500	0	559	/

[1] EPA Policy 3.1: *Science Advisory Council for Exposure Agricultural Transfer Coefficient* (Revised - August 7, 2000); Transfer coefficients from PMRA memo - *Transfer Coefficients for Grapes, Trellis Crops and Caneberries* (PMRA, 2005); Transfer coefficient from PMRA memo – *Transfer Coefficients for Orchard Tree Crops and Christmas Trees* (PMRA, 2004)

[2] Target MOE =-100. Actual MOE = NOAEL (4.4 mg/kg bw/day) / Total Daily Exposure; Total Daily Exposure calculated using values of 24.3%, 34.8% and 14.0% of residues retained on foliage for root, tuberous and corm; airblast-applied crops; and all other groundboom applied crops, respectively, with accompanying daily decline rates of 43.4 %, 6.15% and 41.5%, respectively.

3.4.2.3 Bystander Exposure and Risk

Bystander exposure should be negligible since the potential for drift is expected to be minimal. Application is limited to agricultural crops only when there is low risk of drift to areas of human habitation or activity such as houses, cottages, schools and recreational areas, taking into consideration wind speed, wind direction, temperature, application equipment and sprayer settings.

3.4.3 Residential Exposure and Risk Assessment

3.4.3.1 Post-application Exposure and Risk

Non-worker adults and children have potential for post-application exposure to those crops available for 'pick-your-own' (PYO) harvesting. PYO farms are those that allow the public to harvest their own fruits and vegetables. No PYO assessment was required for flonicamid as there were no effects in the toxicology database that warranted establishment of an acute reference dose.

3.5 Food Residues Exposure Assessment

3.5.1 Residues in Plant and Animal Foodstuffs

The residue definition for risk assessment and enforcement in plant products is flonicamid, TFNA, TFNG, and TFNA-AM and in animal commodities is flonicamid, TFNA, and TFNA-AM. The data gathering/enforcement analytical methods are valid for the quantification of flonicamid residues in the various crops (broccoli, cabbage, mustard greens, cantaloupe, cucumber, summer squash, tomato, pepper, celery, leaf lettuce, head lettuce, spinach, potato, radish, carrot, apple, pear, peach, cherry, plum, and hops) and livestock matrices. The residues of flonicamid, TFNA, TFNG, and TFNA-AM are stable when stored in a freezer at -18°C for 23 months. Raw agricultural commodities were processed, and flonicamid processing factors were determined for tomato (6.9x paste, 11.7x for puree), plum (1.0x for prune), and potato (0.3x for wet peel, 1.5x for chips, 2.9x flakes). Residues of flonicamid are not expected at quantifiable levels in any animal commodity. Supervised residue trials were conducted at exaggerated rates throughout the United States and Canada using end-use products containing flonicamid. The trials on broccoli, cabbage, mustard greens, cantaloupe, cucumber, summer squash, tomato, pepper, celery, leaf lettuce, head lettuce, spinach, potato, radish, carrot, apple, pear, peach, cherry, plum, and hops are sufficient to support the proposed maximum residue limits.

3.5.2 Dietary Risk Assessment

A chronic dietary risk assessment was conducted using the Dietary Exposure Evaluation Model (DEEM–FCID™, Version 2.16), which uses updated food consumption data from the United States Department of Agriculture's Continuing Surveys of Food Intakes by Individuals, 1994–1996 and 1998.

3.5.2.1 Chronic Dietary Exposure Results and Characterization

The following assumptions were made in the refined chronic analysis: median values from crop field trials were used for most crops, United States monitoring data were used for some crops (potato, spinach, collards, kale, peaches, tomato, apple juice, nectarines, and summer squash), and experimental processing factors (plums and potatoes) were used. The refined chronic dietary exposure from all supported flonicamid food uses (alone) for the total population, including infants and children, and all representative population subgroups is 2.5% of the acceptable daily intake (ADI). Aggregate exposure from food and water is considered acceptable. The PMRA estimates that chronic dietary exposure to flonicamid from food and water is 2.6% (0.001 mg/kg bw/day) of the ADI for the total population. The highest exposure and risk estimate is children aged 1-2 years at 7.3% (0.003 mg/kg bw/day) of the ADI.

3.5.2.2 Acute Dietary Exposure Results and Characterization

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

3.5.3 Aggregate Exposure and Risk

The aggregate risk for flonicamid consists of exposure from food and drinking water sources only; there are no residential uses. Aggregate risks were calculated based on chronic endpoints. There was no acute endpoint identified for the general population, including infants and children.

3.5.4 Maximum Residue Limits

Table 3.5.1 Proposed Maximum Residue Limits

Commodity	Recommended MRL (ppm)
Stone Fruit Crop Group 12	0.60
Pome Fruit Crop Group 11	0.20
Cucurbit Vegetables Crop Group 9	0.40
Fruiting Vegetables Crop Group 8	0.40
Head and Stem Brassica subgroup 5A	1.5
Leafy Brassica greens subgroup 5B	16
Leafy Vegetable (except *Brassica*), excluding spinach, Crop Group 4	4.0
Root Vegetable (except sugarbeets) subgroup 1B	0.60
Tuberous and Corm Vegetable subgroup 1C	0.20
Spinach	9.0
Radish tops	16
Hops	7.0

Commodity	Recommended MRL (ppm)
Potato granular flakes	0.40
Tomato paste	2.0
Tomato puree	0.50
Fat of Cattle, Goat, Sheep, and Horse, and Milk	0.03
Meat and meatbyproducts of Cattle, Goat, Sheep, and Horse	0.08

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

The nature of the residues in animal and plant matrices, analytical methodology, field trial data, and the chronic dietary risk estimates are summarized in Table 1, 5, and 6 in Appendix I.

4.0 Impact on the Environment

4.1 Fate and Behaviour in the Environment

Flonicamid enters the soil in its use as an insecticide on a variety of crops. Under field conditions relevant to Canada, the half life ranges from 3.4 to 9.6 days. Under laboratory conditions, flonicamid transforms quickly in soil with half lives ranging from 0.6 to 1.9 days. The half lives of major transformation products, TFNA-OH, TFNA and TFNG-AM, range from 0.1 to 4.57 days. The phototransformation half life of flonicamid on soil is 22 days. Field and laboratory data indicate that flonicamid and its major transformation products are not strongly bound to soil particles (K_{oc} values ranging from 7.9 to 42.1 L/kg for parent and 0 to 13.2 L/kg for the transformation products), and are thus expected to leach through the soil profile and enter groundwater. However, based on the short half lives of flonicamid and its transformation products on soil, it is expected that concentrations in groundwater will be low. This is supported by water modelling which indicates that groundwater levels are expected to be low.

Flonicamid could reach water systems by spray drift or runoff. It is very soluble in water, therefore, transport is likely to occur via runoff events. Abiotic transformation in water is not an important route of transformation. Flonicamid is stable to hydrolysis and photolysis (extrapolated half life of 265 days for phototransformation). In the aerobic water/sediment system, the half life of flonicamid ranges from 35.7 to 44.6 days. Two major transformation products were formed, TFNA-OH and TFNA, which reached maximums of 13% and 18% throughout the study, and then declining by study termination, indicating they were transient. The majority of the radioactivity at study termination was associated with non-extractable residues (up to 38.4% in the river water sandy loam system and 75.4% in the pond water silty clay system). In the anaerobic water/sediment system, the half life of flonicamid is 129 days. One major transformation product, TFNA, was formed at a maximum of 76% in the entire system at study termination. From the available data it can be concluded that soils or sediments with higher organic carbon content resulted in higher bound and non-extractable residues.

Because there were no major transformation products for the TFNA-AM study, just bound residues (comparable to the other studies with the parent and other predecessor transformation products) and CO_2, it was concluded that the bound residues were likely not parent. In addition, there were less bound residues in the phototransformation study utilizing sterile soil compared to the biologically active studies, indicating that the bound residues were the result of microbial degradation.

Based on low values for vapour pressure (2.55×10^{-6} Pa) and Henry's law constant (4.2×10^{-8} Pa m^3/mol), flonicamid is considered to be non-volatile in the environment. Therefore, flonicamid residues are not expected in the air, and long-range transport is not expected.

Data on the fate and behaviour of flonicamid and its major transformation products are summarized in Tables 8 to 10 and Figure 1 of Appendix I.

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. Estimated environmental exposure concentrations (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 (i.e. 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 (e.g. 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 = 1, for all species except for screening level studies conducted with the predatory mite and/or aphid parasitoid, where the LOC is 2). 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.

4.2.1 Risks to Terrestrial Organisms

Risk of flonicamid to terrestrial organisms (see Table 11, Appendix I) was based upon evaluation of toxicity data for the following:

- one mammal and two bird species representing vertebrates (acute gavage, short- and long term (reproduction), dietary exposure);
- one bee species, four other arthropods and one earthworm species representing invertebrates (acute, short term and long term exposure);
- ten crop species representing non-target plants.

For terrestrial vertebrates flonicamid caused 40% mortality in Northern Bobwhite quail and 60% in mallards at a concentration of 2000 mg/kg bw when exposed on an acute oral basis (LD_{50}> 2000 mg/kg bw and 1591 mg/kg bw for the quail and mallard, respectively). Some sublethal effects including uncoordinated movement and inactivity were also observed in the mallard ducks at concentrations of 432 mg/kg bw (NOEC of 260 mg/kg bw). In contrast, no mortality was observed in either species of bird when exposed on a dietary basis (LC_{50}>4613 mg/kg diet and > 5037 mg/kg diet for the quail and mallard, respectively). Observable reproductive effects were reported following long-term exposure to mallards (viability and hatchability at 1000 mg/kg diet; NOEC of 415 mg/kg diet). No reproductive impairment was observed for the Northern Bobwhite quail. Screening level risk quotients did not exceed the trigger value of one for birds exposed to food contaminated with flonicamid on and off the field of application (Table 15, Appendix I).

Following acute exposure of rats to flonicamid, mortality was observed in male and female rats with a higher sensitivity in response seen in the males (LD_{50} males: 884 mg/kg bw**;** females: 1768 mg/kg bw). Additional symptoms of toxicity included decreased activity, convulsions and tremors. Typical effects of flonicamid administered in the diet for 90 days to the rat included change in kidney weight (NOAEL: 72.3 mg/kg bw/day). Observable effects on lutenizing hormone were reported following long-term exposure to rats (NOAEL of 3.7 mg/kg bw). Despite changes in hormone levels no definitive reproductive effects were seen in F1 and F2 rats, and thus, the NOAEL of 133 mg/kg bw/day was chosen for the risk assessment. Risk quotients did not exceed the trigger value of one for mammals exposed to food contaminated with flonicamid on and off the field of application (Tables 15 and 16, Appendix I). Overall, it can be concluded that the reproductive capacity of mammals will not be impacted by Beleaf 50SG Insecticide when visiting vegetable fields or orchards treated with the insecticide, or when visiting habitats adjacent to orchards where spray drift is anticipated at either 59% drift for late season exposure (with leaves present on the trees) and 74% drift for early season exposure (with no leaves present on the trees) based on airblast application with an ASAE fine.

For terrestrial invertebrates, flonicamid was not toxic in acute dose response studies with LC_{50} values exceeding the highest dose tested for earthworms (LC_{50} and NOEC >1000 and 1000 mg/kg soil, respectively). Acute oral and contact exposure of honeybees to flonicamid and its end-use product, Beleaf 50SG Insecticide resulted in mortality and behavioural effects including uncoordinated movement and apathy. The oral exposure for both the active ingredient and the end-use product resulted in higher mortality (up to 53%) compared to contact exposure

(up to 10%) indicating toxicity through ingestion. Significant mortality was also observed in two of the four predator and parasite species tested (*C. carnea* and *Typhlodormus pyri*). An exposure rate of 170 g end-use product/ha caused 18.8% and 23.3% mortality for the green lacewing and predacious mite, respectively. Screening level risk quotients did not exceed the trigger value of one for honeybees from either contact or oral exposure to food contaminated with flonicamid on the field of application. However, based on the effects observed at the rates tested for flonicamid (at less than the proposed label rate) for predators and parasites, risk quotients did exceed the trigger value of one and there was potential risk from exposure to food contaminated with flonicamid on and off the field (Table 13, Appendix I). For the refined risk assessment, additional exposure considerations were incorporated to further evaluate risk for predators and parasites. Using the 80th percentile of laboratory soil data (half life of 1.38 days) for soil EECs, the exposure for the carabid beetle decreased (Table 18, Appendix I). As an additional consideration, foliar interception and soil deposition factors were applied to the EECs to determine the amount of active remaining on the foliage or soil after crop interception (Linders et al., 2000). Beleaf 50SC Insecticide is applied to a number of crops including stone and pome fruit, potatoes, tomatoes, and cabbage. According to Linders et al., 2000, foliar interception for the above listed crops would be 0.8 for on field foliar assessment and 0.2 for on field soil assessment. For on field assessment, foliar interception factors were applied for foliar dwelling predators and parasites, and soil deposition factors were applied for soil dwelling arthropods. For off field assessment, EEC values were multiplied by a vegetation distribution factor of x 0.1. Incorporating foliar interception reduced the in field exposure when considering 0.8 percent interception (late stage of foliage development for pome fruit), however, the RQ still exceeded the LOC (RQ = <1.6) for aphid parasitoid, predacious mite and green lacewing (Table 19, Appendix I). Since leaves and flowers are larger in later stages of growth, the EECs would be expected to higher, and thus exposure is higher. For carabid beetles, exposed to soil concentrations of flonicamid, soil deposition factors of 0.1 reduced in field exposure (RQ=0.4). Off-field exposure was also reduced for beneficial arthropods for late and early season application of Beleaf 50SC Insecticide (factor of 0.1; RQ=0.11 to 0.15). Since the study rates were conducted below Canadian label rates, there is some uncertainty in the potential risk to these organisms and thus, a precautionary label statement of toxicity to predators and parasites will be required on the label.

For terrestrial plants, seedling emergence and vegetative vigour were examined, however, Beleaf 50SG Insecticide affected only vegetative vigour. Between the three endpoints used to assess vegetative vigour (height, dry weight and phytotoxicity), dry weight was the most sensitive endpoint. Based on the effects observed at the rates tested for flonicamid, risk quotients did exceed the trigger value of one and there was potential risk (Table 18, Appendix I). For the refined risk assessment, additional exposure considerations were incorporated to further evaluate risk to non-target terrestrial plants. Risks to non-target plants were assessed using refined EECs for foliage surfaces (12.5 day half life). The risk was still present and thus, non-target plants inside the treated areas are potentially at risk from exposure to Beleaf 50SG Insecticide (RQs ≤1.1; Table 18, Appendix I). Using drift deposition data from Canadian field trials, a ground buffer zone of 1 metre was calculated to protect sensitive non-target plant species in adjacent habitats. The buffer zone is also a function of the EC_{25} of the most sensitive plant tested. In addition to the buffer zone, a precautionary label statement of toxicity to non-target plants will be required on the label.

4.2.2 Risks to Aquatic Organisms

Risk of flonicamid to freshwater aquatic organisms (see Table 12, Appendix I) was based upon evaluation of toxicity data for the following:

- two invertebrates; daphnid (acute and long term exposure)
- three freshwater fish species (acute and long term exposure);
- amphibian species using fish as a surrogate;
- two algae and one vascular plant.

Risk of flonicamid to marine aquatic organisms (see Table 12, Appendix I) was based upon evaluation of toxicity data for the following:

- two invertebrates; mysid (acute and long term exposure) and eastern oyster (acute exposure);
- one fish species (acute exposure).

For freshwater invertebrates flonicamid did not cause acute mortality. Observable reproductive effects were reported for daphnid following long term exposure at concentrations of 6.3 mg/L (NOEC: 3.01 mg/L). For freshwater and marine aquatic vertebrates (rainbow trout, bluegill sunfish and sheepshead minnow), flonicamid did not cause acute mortality to fish at concentrations up to 98 and 120 mg/L, respectively. Chronic exposure of fathead minnow to flonicamid at concentrations up to 20 mg/L resulted in slightly reduced fish weight at the highest concentration. No other effects were observed for hatching success or length. For algae (*Pseudokirchneriella subcapitata,* and *Selenastrum capricornutum)* and the aquatic vascular plant, duckweed, flonicamid did not cause adverse effects on cell density at concentrations up to 119 mg/L. Using the most sensitive fish species as a surrogate for amphibians, effects on reproduction may occur at concentrations of 20 mg/L. For marine invertebrates flonicamid did not cause mortality to mysid at concentrations up to 121 mg/L. Toxic effects, including 44% decline in shell deposition, were observed in the eastern oystern at concentrations of 48 mg/L. There are no concerns about the use of flonicamid affecting amphibians. Screening level risk quotients did not exceed the trigger value of one for freshwater and marine invertebrates and vertebrates, algae, amphibians and vascular plants exposed to flonicamid (Table 17, Appendix I).

4.2.3 Incident Reports, or Special Use Pattern

Since April 26, 2007, registrants have been required by law to report incidents, including adverse effects to health and the environment, to the PMRA within a set time frame. Information on the reporting of incidents can be found on the PMRA website http://www.hc-sc.gc.ca/cps-spc/pest/part/protect-proteger/incident/index-eng.php. Incidents from Canada and the United States were searched and reviewed for products containing the active ingredient flonicamid. As of June 02, 2010, the PMRA concluded that there were no environmental incident reports found for flonicamid.

5.0 Value

5.1 Effectiveness Against Pests

5.1.1 Acceptable Efficacy Claims

Data from efficacy studies conducted between 2001 and 2004 in the United States (e.g., Florida, California, Oregon, Washington and New York) were submitted. Of those trials submitted, 57 trials had an acceptable experimental design and adequate pest pressure to generate meaningful results. These trials investigated the efficacy of Beleaf 50SG Insecticide or an equivalent formulation against 15 aphid species in 22 crops. The application rate of 0.06 to 0.08 kg flonicamid/ha (equivalent to 0.12 to 0.16 kg Beleaf 50SG Insecticide/ha) provided control of aphids in all crop groups. Therefore, the use of Beleaf 50SG Insecticide at a rate of 0.12 to 0.16 kg product/ha (0.06 to 0.08 kg a.i./ha) to control aphids on Brassica (cole) leafy vegetables, cucurbit vegetables, fruiting vegetables and leafy vegetables (excluding Brassica), hops, tuberous and corm vegetables, root vegetables (excluding sugar beets), pome fruit and stone fruit is supported.

5.2 Phytotoxicity to Host Plants

5.2.1 Acceptable Claims for Host Plants

Phytotoxicity observations were made and recorded in most of the submitted efficacy trials. In addition, nine trials conducted from 2003 to 2004 across five crop groups were submitted. No phytotoxicity was observed in any of the field trials. Therefore, all crops in the following crop groups are acceptable: Brassica (cole) leafy vegetables, cucurbit vegetables, fruiting vegetables and leafy vegetables (excluding Brassica), hops, tuberous and corm vegetables, root vegetables (excluding sugar beets), pome fruit and stone fruit.

5.3 Sustainability

The different mode of action of flonicamid will be useful for resistance management. Prudent use of insecticides in this class should be observed to prevent the development of resistance.

5.3.1 Survey of Alternatives

There are alternatives for the control of aphids in each of the crop groups. The alternatives include several older chemistries such as organophosphates, organochlorines and carbamates. Some of these compounds are in the process of being removed from the Canadian market and will no longer be available for use in the future.

<u>Brassica (cole) leafy vegetables (Crop group 5)</u>
Active ingredients in pest control products registered to aphids in brassica leafy vegetables include acephate, acetamiprid, diazinon, dimethoate, endosulfan, imidacloprid, malathion, naled, pyrethrins and spirotetramat.

Cucurbit vegetables (Crop group 9)
Active ingredients in pest control products registered to control aphids in cucurbit vegetables include diazinon, endosulfan, malathion, pyrethrins, and spirotetramat.

Fruiting vegetables (Crop group 8)
Active ingredients in pest control products registered to control aphids in fruiting vegetables include acephate, diazinon, dimethoate, endosulfan, malathion, pyrethrins, and spirotetramat. Thiamethoxam.

Leafy vegetables (excluding Brassica) (Crop group 4)
Active ingredients in pest control products registered to control aphids in leafy vegetables include diazinon, malathion, endosulfan, pyrethrins, naled, acephate, dimethoate, imidacloprid and spirotetramat.

Hops
Active ingredients in pest control products registered to control aphids in hops include diazinon and spirotetramat.

Tuberous and corm vegetables (Crop group 1A)
Active ingredients in pest control products registered to control aphids in tuberous and corm vegetables include diazinon, endosulfan, pyrethrins, deltamethrin, acephate, dimethoate, imidacloprid, phosmet, oxamyl, spirotetramat and thiamethoxam.

Root vegetables (excluding sugar beets) (Crop group 1B)
Active ingredients in pest control products registered to control aphids in root vegetables include diazinon, endosulfan and malathion.

Pome fruit (Crop group 11)
Active ingredients in pest control products registered to control aphids in pome fruit include diazinon, endosulfan, phosmet, phosalone, deltamethrin, lambda-cyhalothrin, imidacloprid, malathion, thiamethoxam and spirotetramat.

Stone fruit (Crop group 12)
Active ingredients in pest control products registered to control aphids in stone fruit include diazinon, endosulfan, malathion, dimethoate, phosalone, imidacloprid, lambda-cyhalothrin and spirotetramat.

5.3.2 Compatibility with Current Management Practices Including Integrated Pest Management

Beleaf 50SG Insecticide may be used in an Integrated Pest Management (IPM) program that includes monitoring and good cultural practices. Flonicamid may impact some arthropod predators and parasitic arthropods used in an IPM program. However, the impacts on beneficials may be less severe compared to some of the older chemistries registered for the same use (Refer to Section 4.2).

5.3.3 Information on the Occurrence or Possible Occurrence of the Development of Resistance

Aphids are known to rapidly develop resistance to insecticides. Repeated use of insecticides with the same mode of action increases the probability of naturally selecting resistant biotypes within an insect population. Therefore, Beleaf 50SG Insecticide should be used in rotation with insecticides that have different modes of action. The Beleaf 50SG Insecticide labels include the resistance management statements, as per Regulatory Directive DIR99-06, *Voluntary Pesticide Resistance- Management Labelling Based on Target Site/Mode of Action*.

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 (those that meet all four criteria outlined in the policy, i.e., CEPA-toxic or equivalent, predominantly anthropogenic, persistent and bio-accumulative).

During the review process, flonicamid, 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 following conclusions:

- Flonicamid does not meet the criteria for persistence. Its values for half-life in soil (maximum half life of 1.9 days (lab), 9.6 days (field)), and sediment (maximum DT_{50} of 50 days) are below the TSMP Track-1 cut-off criteria for soil (≥ 182 days), and sediment (≥ 365 days).

- Flonicamid is not bioaccumulative. The octanol-water partition coefficient (log K_{ow}) is (0.3), which is below the TSMP Track-1 cut-off criterion of ≥5.0.

- Flonicamid does not meet the criteria for toxicity.

- Flonicamid does not form any major transformation products that meet the TSMP Track-1 criteria.

- Flonicamid (technical grade) does not contain any by-products or microcontaminants that meet the TSMP Track-1 criteria. Impurities of toxicological concern are not expected to be present in the raw materials nor are they expected to be generated during the manufacturing process.

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

The formulated product does not contain any formulants that are known to contain TSMP Track-1 substances.

6.2 Formulants and Contaminants of Health or Environmental Concern

During the review process, contaminants in the technical are compared against the list in the *Canada Gazette.* The list is used as described in the PMRA Notice of Intent NOI2005-01[6] and is based on existing policies and regulations including: DIR99-03; and DIR2006-02[7], and taking into consideration the Ozone-depleting Substance Regulations, 1998, of the *Canadian Environmental Protection Act* (substances designated under the Montreal Protocol). The PMRA has reached the following conclusions:

Technical grade flonicamid does not contain any contaminants of health or environmental concern identified in the *Canada Gazette.*

7.0 Summary

7.1 Human Health and Safety

The toxicology database submitted for flonicamid is adequate to define the majority of toxic effects that may result from exposure to flonicamid. In short-term and long-term studies in laboratory animals, the primary targets of toxicity were the liver, kidney, spleen, bone marrow and lung. There was no evidence of increased susceptibility of the young in the reproduction or developmental toxicity studies. Flonicamid is not considered to be a neurotoxicant. Flonicamid is considered to be carcinogenic in mice, as lung tumours were noted in both sexes. A mode of action for the development of these tumours was supported, and consequently, a threshold approach was applied for the cancer risk assessment. There was equivocal evidence for nasolacrimal and cerebellar tumours in rats. The risk assessment protects against the toxic effects noted above by establishing that the level of human exposure is well below the lowest dose at which these effects occurred in animal tests.

Mixer, loader, applicators and workers entering treated orchards and fields are not expected to be exposed to levels of flonicamid that will result in unacceptable risk when the Beleaf 50SG Insecticide is used according to label directions. The personal protective equipment on the product label is adequate to protect workers.

Risk to workers re-entering treated areas is not of concern as long as the specified restricted entry intervals are observed.

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6 NOI2005-01, List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern under the New Pest Control Products Act.

7 DIR2006-02, PMRA Formulants Policy.

The nature of the residue in plants and animals is adequately understood. The residue definition for risk assessment and enforcement in plant commodities is flonicamid, TFNA, TFNG, and TFNA-AM and for animal commodities is flonicamid, TFNA, and TFNA-AM. The proposed use of flonicamid on broccoli, cabbage, mustard greens, cantaloupe, cucumber, summer squash, tomato, pepper, celery, leaf lettuce, head lettuce, spinach, potato, radish, carrot, apple, pear, peach, cherry, plum, and hops does not constitute an unacceptable chronic dietary risk (food and drinking water) to any segment of the population, including infants, children, adults and seniors. Sufficient crop residue data have been reviewed to recommend maximum residue limits to protect human health. The PMRA recommends that maximum residue limits (see previous Table 3.5.1) be specified for: residues of flonicamid in and on broccoli, cabbage, mustard greens, cantaloupe, cucumber, summer squash, tomato, pepper, celery, leaf lettuce, head lettuce, spinach, potato, radish, carrot, apple, pear, peach, cherry, plum, and hops.

7.2 Environmental Risk

Flonicamid does not present a risk to wild mammals, birds, freshwater or marine invertebrates and fish, amphibians, algae, and aquatic plants. However, flonicamid does potentially affect terrestrial plants and predators and parasites. Therefore, to protect from the effects of spray drift to non-target terrestrial plants, a ground buffer zone of one metre is required. Label statements for toxicity will be required for predators and parasites, and terrestrial plants.

7.3 Value

Beleaf 50SG Insecticide controls aphids on a variety of crops when applied by ground application equipment at a rate of 0.12 to 0.16 kg product/ha (0.06 to 0.08 kg a.i./ha). Flonicamid has a different mode of action compared to many of the active ingredients registered to control aphids in the supported crops which will help in resistance management. In addition, flonicamid provides an alternative to older chemistries registered for these uses, such as organochlorines, organophosphates and carbamates.

7.4 Unsupported Uses

The use of Beleaf 50SG Insecticide to control *Lygus* bug on all the crop groups and aerial application were not supported because there was insufficient efficacy data.

8.0 Proposed Regulatory Decision

Health Canada's PMRA, under the authority of the *Pest Control Products Act* and Regulations, is proposing full registration for the sale and use of Flonicamid Technical Insecticide and Beleaf 50SG Insecticide, containing the technical grade active ingredient flonicamid, to control aphids on a variety of agricultural crops.

An evaluation of available scientific information found that, under the approved conditions of use, the product has value and does not present an unacceptable risk to human health or the environment.

List of Abbreviations

µg	microgram(s)
a.i.	active ingredient
AD	administered dose
ADI	acceptable daily intake
AR	applied radioactivity
ASAE	American Society of Agricultural Engineers
ATPD	area treated per day
AUC	area under the curve
BAF	Bioaccumulation Factor
BCF	Bioconcentration Factor
BrdU	Bromodeoxyuridine
bw	body weight
CAF	Composite Assessment Factor
CAS	Chemical Abstracts Service
CDN	Canadian
CEPA	Canadian Evironmental Protection Act
cm	centimetre(s)
cm^2	centimetre(s) squared
Cmax	maximum plasma concentration
CO2	carbon dioxide
d	day
DFR	dislodgeable foliar residue
DNA	deoxyribonucleic acid
DT_{50}	dissipation time 50% (the dose required to observe a 50% decline in concentration)
DT_{90}	dissipation time 90% (the dose required to observe a 90% decline in concentration)
E%	beneficial capacity
EC_{25}	effective concentration on 25% of the population
EC_{50}	effective concentration on 50% of the population
EDE	estimated daily exposure
EEC	estimated environmental exposure concentration
EP	end-use product
EPA	Environmental Protection Agency
ER_{50}	effective rate for 50% of the population
F	female(s)
F1/F2	generation of offspring (first or second)
FDA	*Food and Drugs Act*
FIR	food ingestion rate
FSH	follicle stimulating hormone
g	gram(s)
GAP	Good Agricultural Practices (registered)
GCT	cerebellar granular cell tumour
GD	gestational day
h	hour

ha	hectare(s)
HAFT	highest average field trial
HDPE	high-density polyethylene
HPLC	high performance liquid chromatography
ILV	Independent Laboratory Validation
IMP	Integrated Pest Management
IOBC	International Organization for Biological Control
IUPAC	International Union of Pure and Applied Chemistry
kg	kilogram(s)
K_d	soil-water partition coefficient
K_{oc}	organic-carbon partition coefficient
K_{ow}	*n*–octanol-water partition coefficient
L	litre(s)
LC	liquid chromatography
LC_{50}	lethal concentration 50%
LD_{50}	lethal dose 50%
LH	luteinizing hormone
LOAEL	lowest observed adverse effect level
LOC	level of concern
LOQ	limit of quantitation
LR_{50}	lethal rate 50%
M	male(s)
m^3	metre(s) cubed
mg	milligram(s)
mL	millilitre(s)
MAS	maximum average score
MIS	maximum irritation score
MOA	mode of action
MOE	margin of exposure
MRL	maximum residue limit
MS	mass spectrometry
N/A	not applicable
nm	nanometre(s)
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
NOEL	no observed effect level
OH-TFNA-AM	6-hydroxy-4-trifluoromethylnicotinamide
P	parental generation
Pa	Pascal
PBI	plantback interval
PCPA	*Pest Control Product Act*
PHED	Pesticide Handlers Exposure Database
PHI	preharvest interval
p*K*a	dissociation constant
PMRA	Pest Management Regulatory Agency
ppb	parts per billion
PPE	personal protective equipment

ppm	parts per million
PYO	pick-your-own
R^2	square of the multiple correlation coefficient
REI	restricted-entry interval
RQ	risk quotient
SG	soluble granules
STMdR	supervised trial median residue
STMR	supervised trail mean residue
TC	transfer coefficient
TDE	total daily exposure
TFNA	4-trifluoromethylnicotinic acid
TFNA-AM	4-trifluoromethylnicotinamide
TFNA-OH	6-hydroxy-4-trifluoromethylnicotinic acid
TFNG	*N*-(4-trifluoromethylnicotinoyl)glycine
TFNG-AM	*N*-(4-trifluoromethylnicotinoyl)glycinamide
Tmax	time to maximum plasma concentration
TRR	total radioactive residue
TSMP	Toxic Substances Management Policy
U.S.	United States
UV	ultraviolet
v/v	volume per volume dilution
WDG	water dispersible granule
wk	week(s)

Appendix I Tables and Figures

Table 1 Residue Analysis

Matrix	Method ID	Analyte	Method Type	LOQ		Reference
Plant	F1785	Flonicamid	HPLC-MS/MS[1] ESI +	10 ppb	Peach, potato	1588376
		TFNA		20 ppb	Wheat straw	
		TFNA-AM				
		TFNG				
	FMC P-3561 M	Flonicamid	LC/MS/MS	0.01 ppm for each analyte	All plant commodities except cotton matrices and wheat straw	1582306
		TFNA				
		TFNA-AM		0.02 ppm for each analyte	Cotton matrices and wheat straw	
		TFNG				
Animal	N/A	Flonicamid	HPLC-MS/MS[2] APCI + ESI -	0.01 ppm	Bovine muscle, liver, kidney and fat/ Poultry muscle, liver and fat.	1588378
		TFNA				
		TFNA-AM				
		OH-TFNA-AM				
		TFNG				
	RCC 844743	Flonicamid	LC/MS/MS	0.01 ppm for each analyte	Eggs and poultry tissues	1582312
		OH-TFNA-AM				
		TFNA-AM				
		TFNG				
		TFNA				
	RCC 842993	Flonicamid	LC/MS	0.01 ppm for each analyte	Milk	1582316
		OH-TFNA-AM				
		TFNA-AM				
		TFNG				
		TFNA				
	FMC P-3580	Flonicamid	LC/MS/MS	0.025 ppm for each analyte	Cattle muscle, liver and kidney	1582311
		OH-TFNA-AM				
		TFNA-AM				
		TFNG				

Matrix	Method ID	Analyte	Method Type	LOQ	Reference
		TFNA			
Soil	N/A	Flonicamid	HPLC-MS/MS[3] Turbo ion spray, + and - mode	5.0 ppb	1581999, 1582000
		TFNA			
		TFNA-OH			
		TFNA-AM			
		TFNG			
		TFNG-AM			
Sediment	N/A	The method used for soil was extended to sediment.			
Water	N/A	Flonicamid	HPLC-MS/MS[4] APCI +	0.1 ppb	1582001
		TFNA			
		TFNA-OH			
		TFNA-AM			
		TFNG			
		TFNG-AM			

[1] MS-MS transitions: Flonicamid 229.8 to 202.8 m/z, TFNA 191.8 to 147.8 m/z, TFNA-AM 190.8 to 147.8 m/z, TFNG 248.8 to 202.8 m/z.

[2] MS-MS transitions: APCI +: Flonicamid 229.8 to 203.1 m/z, TFNA 192.1 to 147.9 m/z, TFNA-AM 191.2 to 148.1 m/z, OH-TFNA-AM 207.1 to 146.0 m/z; ESI -: TFNA 190.4 to 146.1 m/z, OH-TFNA-AM 205.3 to 161.9 m/z, TFNG 247.3 to 183.0 m/z.

[3] MS-MS transitions: + mode: Flonicamid 230.0 to 202.9 m/z, TFNA-AM 191.0 to 148.0 m/z; - mode: TFNA 190.3 to 145.8 m/z, TFNA-OH 206.1 to 162.0 m/z, TFNG 247.3 to 183.0 m/z, TFNG-AM 246.3 to 99.0 m/z.

[4] MS-MS transitions: Flonicamid 229.8 to 203.1 m/z, TFNA 192.1 to 147.9 m/z, TFNA-AM 191.2 to 148.1 m/z, TFNA-OH 208.1 to 145.9 m/z, TFNG 249.0 to 202.9 m/z, TFNG-AM 248.0 to 174.0 m/z.

Table 2 Acute Toxicity of Flonicamid and Its Associated End-use Product (Beleaf 50SG Insecticide)

Study Type	Species	Result	Comment	Reference
Acute Toxicity of Flonicamid (Technical)				
Oral	Rat	LD_{50} (M) = 884 mg/kg bw LD_{50} (F) = 1768 mg/kg bw	Moderate Toxicity	1581882
Dermal	Rat	LD_{50} > 5000 mg/kg bw	Low Toxicity	1581893
Inhalation	Rat	LC_{50} > 4.90 mg/L	Low Toxicity	1581897
Skin irritation	Rabbit	MAS = 0 MIS = 0	Non Irritating	1581901
Eye irritation	Rabbit	MAS = 0.9 MIS = 2 at 24 hours	Minimally Irritating	1581899
Skin sensitization	Guinea pig	No sensitization response	Not a skin sensitizer	1581903

Study Type	Species	Result	Comment	Reference
Oral - TFNA	Rat	LD_{50} > 5000 mg/kg bw	Low Toxicity	1581886
Oral – TFNG	Rat	LD_{50} > 5000 mg/kg bw	Low Toxicity	1581889
Oral – TFNA-OH	Rat	LD_{50} > 5000 mg/kg bw	Low Toxicity	1581892
Oral – TFNG-AM	Rat	LD_{50} > 5000 mg/kg bw	Low Toxicity	1581890
Oral – TFNA-AM	Rat	LD_{50} > 5000 mg/kg bw	Low Toxicity	1581888
Acute Toxicity of End-Use Product – Beleaf 50SG Insecticide				
Oral	Rat	LD_{50} > 2000 mg/kg bw	Low Toxicity	1582274
Dermal	Rat	LD_{50} > 2000 mg/kg bw	Low Toxicity	1582276
Inhalation	Rat	LC_{50} > 5.36 mg/L	Low Toxicity	1582278
Skin irritation	Rabbit	MAS = 0 MIS = 0	Non Irritating	1582284
Eye irritation	Rabbit	MAS = 5.56 MIS = 14.67 at 24 hours	Mildly Irritating	1582281 1582283
Skin sensitization	Guinea pig	No sensitization response	Not a skin sensitizer	1582288 1582289

a MAS = maximum average score for 24, 48 and 72 hours

b MIS = maximum irritation score

Table 3 Toxicity Profile of Flonicamid Technical

Study Type	Species	Results[a] (mg/kg/day in M/F)	Reference
28-day dermal irritation	Rat	NOAEL = 1000 mg/kg bw/day LOAEL not established since no adverse effects were noted up to the highest dose tested.	1581913
28-day dietary	Rat	Effects were not established since this was a dose range-finding study. Hyaline droplet deposition of proximal tubular cells of the kidney were observed in males at 7.47 mg/kg bw/day	1630629
90-day dietary	Rat	NOAEL (♂): 12.11 mg/kg bw/day LOAEL (♂): 60 mg/kg bw/day, based on increased kidney weights, granular casts in tubules and tubular basophilic changes. NOAEL (♀): 72.3 mg/kg bw/day LOAEL (♀): 340 mg/kg bw/day, based on decreased food consumption, decreased hematocrit, increased liver and kidney weights, increased incidence of cytoplasmic vacuolization of proximal tubules and increased incidence of hepatocellular hypertrophy.	1581907
90-day dietary	Mouse	A NOAEL and LOAEL were not established as this study was deemed unacceptable; the majority of organs/tissues were not examined histopathologically. No effects were noted at 15/20 mg/kg bw/day in ♂/♀. Effects at the next highest dose of 154/192 mg/kg bw/day included an increased incidence of centrilobular hepatocellular hypertrophy and extramedullary haematopoiesis of the spleen.	1581905
90-day dietary/capsule	Dog	NOAEL: 8 mg/kg bw/day LOAEL: 20 mg/kg bw/day, based on vomiting, ataxia, decreased activity, laboured breathing, prostration, diarrhea, as well as decreased bodyweights, bodyweight gain and food consumption and decreased thymus weights. Onset of clinical signs was noted as early as the 1st day of treatment and were sporadic with no identifiable pattern.	1581909
1-year dietary/capsule	Dog	NOAEL: 8 mg/kg bw/day LOAEL: 20 mg/kg bw/day, based on an increased incidence of vomiting, increased reticulocyte count and decreased bodyweight gain.	1581911

Study Type	Species	Results[a] (mg/kg/day in M/F)	Reference
Carcinogenicity (18-month dietary)	Mouse	NOAEL: not determined as effects observed at lowest dose tested LOAEL: 29/38 mg/kg bw/day, based on increased incidence of extramedullary haematopoiesis of the spleen, decreased cellularity and increased pigment deposition in bone marrow, increased centrilobular hepatocellular hypertrophy, hyperplasia/hypertrophy of epithelial cells of the terminal bronchioles and an increase in masses/nodules in the lung. An increased incidence of alveolar/bronchiolar tumours were noted in both sexes in all dose groups	1581915
Carcinogenicity (18-month dietary)	Mouse	NOAEL: 10.0/11.8 mg/kg bw/day LOAEL: 30.3/36.3 mg/kg bw/day, based on increased lung masses and lung spots (♂), increased incidence of hyperplasia/hypertrophy of the epithelial cells of the terminal bronchioles, and increased hyperplasia of alveolar epithelial cells (♀) An increased incidence of alveolar/bronchiolar tumours were noted in both sexes at 30.3/36.3 mg/kg bw/day	1581919 1581920 1581921 1581922 1581923
Chronic/ Carcinogenicity (2-year dietary)	Rat	NOAEL:7.32/8.92 mg/kg bw/day LOAEL: 36.5/44.1 mg/kg bw/day, based on increased red adhesive substance in the periocular region, decreased triglycerides and increased incidence of striated muscles atrophy in females. Males exhibited decreased rearing, decreased bodyweights and bodyweight gains, increased incidence of keratitis, increased forestomach erosion/ulcer, hyaline droplet deposition in renal proximal tubular cells, kidney pelvic dilatation and increased lung masses; equivocal increase in nasolacrimal duct and cerebellar granular cell tumours in females.	1581925 1581926 1581927 1581928 1581929 1581930 1581931 1581932
Two-generation reproduction	Rat	NOAELs and LOAELs were not established since this was a dose range-finding study. No effects were noted at 3.3/3.8 mg/kg bw/day. Effects at the next highest dose of 13.3/14.1 included increased incidence of hyaline droplet deposition in proximal tubules of kidney (♂).	1581934

Study Type	Species	Results[a] (mg/kg/day in M/F)	Reference
Two-generation reproduction	Rat	**Parental toxicity**: NOAEL (♂): 3.7 mg/kg bw/day LOAEL (♂): 22 mg/kg bw/day, based on increased relative kidney weight (F_1♂) and hyaline droplet deposition (P/F_1 ♂). NOAEL (♀): 153 mg/kg bw/day LOAEL (♀): Not determined, as no parental toxicity in ♀ at highest dose tested **Offspring toxicity:** NOAEL (♀): 27 mg/kg /day LOAEL (♀): 153 mg/kg bw/day, based on delayed vaginal opening. NOAEL (♂): 133 mg/kg bw LOAEL (♂): Not determined as no offspring toxicity in ♂ at highest dose tested **Reproductive toxicity:** NOAEL (♀):4.4 mg/kg bw/day LOAEL (♀): 27 mg/kg bw/day, based on increased concentrations of blood serum luteinizing hormone (F_1 ♀). NOAEL (♂):133 mg/kg bw LOAEL (♂): Not determined as no reproductive toxicity in ♂ at highest dose tested	1581935
Developmental toxicity	Rat	NOAELs and LOAELs were not established since this was a dose range-finding study. No effects were noted at 300 mg/kg bw/day. Treatment-related maternal effects at the next highest dose of 1000 mg/kg bw/day included forelimb wounds, loss of abdominal fur, soiling around external genital area, vaginal haemorrhage, white discharge, death (GD 9-13), decreased food consumption and bodyweight gain.	1630638
Developmental toxicity	Rat	**Maternal:** NOAEL: 100 mg/kg bw/day LOAEL: 500 mg/kg bw/day, based on increased liver weights, centrilobular hepatocellular hypertrophy, cytoplasmic vacuolization of proximal tubules in kidney. **Developmental:** NOAEL: 100 mg/kg bw/day LOAEL: 500 mg/kg bw/day, based on increased incidence of cervical rib (skeletal variation).	1581937

Study Type	Species	Results[a] (mg/kg/day in M/F)	Reference
Developmental toxicity	Rabbit	NOAELs and LOAELs were not established since this was a dose range-finding study. Effects noted at 30 mg/kg bw/day, the lowest dose tested, included decreased bodyweight gain and food consumption, decreased mean gravid uterine weight, decreased number of live foetuses, decreased foetal bodyweight, and decreased % male foetuses.	1581939
Developmental toxicity	Rabbit	**Maternal:** NOAEL: 7.5 mg/kg bw/day LOAEL: 25 mg/kg bw/day, based on decreased bodyweight gain, decreased food consumption and decreased gravid uterine weight. **Developmental:** NOAEL: 7.5 mg/kg bw/day LOAEL: 25 mg/kg bw/day, based on decreased bodyweights	1581940
Acute neurotoxicity	Rat	**Systemic Toxicity:** NOAEL (♂): 600 mg/kg/bw LOAEL (♂): 1000 mg/kg bw, based on one death with clinical signs of toxicity in that animal. NOAEL (♀): 300 mg/kg bw, LOAEL(♀): 1000 mg/kg bw, based on increased forelimb grip strength and landing foot splay	1581982 1630631 1630632 1630633
28-Day neurotoxicity	Rat	NOAELs and LOAELs were not established since this was a dose range-finding study. Effects noted at 712/807 mg/kg bw/day and above were decreased food consumption, body weight and body weight gain. In females, at the highest dose tested (1012 mg/kg bw/day), mortality was observed along with clinical signs of toxicity.	1581983
90-day neurotoxicity	Rat	NOAEL(♂/♀): 67/81 mg/kg bw/day LOAEL(♂/♀): 625/722 mg/kg bw/day, based on decreased body weight, body weight gain, food consumption, and decreased locomotor activity in both sexes, with a decreased in total motor activity and rearing and increased landing foot splay observed in males only.	1581984 1630635 1630636
Bacterial reverse gene mutation assay	*S. typhimurium* and *E. coli* strains	Negative	1581942
Gene mutations in mammalian cells *in vitro*	Mouse lymphoma L5178Y $TK^{+/-}$ Cells	Negative	1581957

Study Type	Species	Results[a] (mg/kg/day in M/F)	Reference
In vivo unscheduled DNA synthesis	Sprague-Dawley Rat	Negative	1581970
In vitro mammalian chromosomal aberration	Chinese hamster lung cells	Negative	1581961
In vivo micronucleus test	CD-1 mice	Negative	1581966
In vivo comet assay	Male ddY mice	Negative	1581971
Gene mutations in mammalian cells *in vitro* (TFNA)	*S. typhimurium* and *E. coli* strains	Negative	1581945
Gene mutations in mammalian cells *in vitro* (TFNA-AM)	*S. typhimurium* and *E. coli* strains	Negative	1581947
Gene mutations in mammalian cells *in vitro* (TFNG-AM)	*S. typhimurium* and *E. coli* strains	Negative	1581950
Gene mutations in mammalian cells *in vitro* (TFNA-OH)	*S. typhimurium* and *E. coli* strains	Negative	1581952
Gene mutations in mammalian cells *in vitro* (TFNG)	*S. typhimurium* and *E. coli* strains	Negative	1581954
Special Studies			
3 day dietary administration followed by BrdU analysis of terminal bronchioles	Mice	Supplemental; the purpose of this study was to determine a threshold for BrdU uptake in the terminal bronchioles of the lung. A threshold for this effect was identified between 80 and 250 ppm (12.3 and 40.9 mg/kg bw/day)	1630637
Comparative study with mice and rats	Mice/Rat	Supplemental; the purpose of this study was to assess differences in BrdU uptake in the terminal bronchioles of the lung in mice and rats. BrdU index was significantly increased for day 3 and day 7 days measurements in mice only.	1630637

Study Type	Species	Results[a] (mg/kg/day in M/F)	Reference
28 day dietary with 28 day recovery	Mice	Supplemental; the purpose of this study was to assess if changes in BrdU uptake and cell morphology in the terminal bronchioles of the lung were reversible following a 28-day dosing and a 7-, 14- or 28- day recovery period. Cells appeared normal after 7 days recovery	1630637
3 or 7 day dietary with IKI-220 and metabolites	Mice	Supplemental; the purpose of this study was to determine differences in BrdU uptake in the terminal bronchioles of the lung associated with a 3- or 7- day dietary dosing with the unchanged parent and metabolites. BrdU index was significantly increased for mice treated with unchanged parent only	1630637
Comparative study with IKI-220 and isoniazid	Mice, 3 strains	Supplemental; the purpose of this study was to determine if BrdU uptake in the terminal bronchioles of the lung differs between mouse strains following 3 days of dietary dosing with flonicamid. An additional group of each strain was dosed with isoniazid, known to cause mouse tumours in mice. In mice treated with flonicamid, BrdU index was significantly increased in the CD-1 strain only. BrdU was significantly increased in all three mouse strains treated with isoniazid. Clara cell numbers were similar among mouse strains.	1630637

Study Type	Species	Results[a] (mg/kg/day in M/F)	Reference
Metabolism		**Absorption** Rapid and extensive following either a single low dose, in males or females, or high dose in females only. A plateau was observed between 0.5-8.0 hours following a single high dose administration to males. **Distribution** Maximum plasma concentration was attained within 20 minutes of administration for low dose animals, 20-60 minutes for high dose females and 2-4 hours for high dose males. The majority of the radiolabel was contained in the carcass. Highest levels in tissue included adrenals, thyroid, liver kidneys, ovaries (low dose only), lung (high dose males only). After 168 hours, tissue burden was low for all animals. There was no evidence of tissue sequestration following repeated dosing. **Excretion** Elimination was 4.5-7.0 hours for low dose groups and high dose females and almost 12 hours for high dose males. The primary route of elimination was urinary accounting for 72-78% of administered dose (AD). Faecal route accounted for 4-7% (AD), and biliary excretion accounted for 4% of AD. Excretion via expired air was considered negligible. Approximately 95% of radioactivity was eliminated within the first 24 hours. **Metabolism** In urine, the primary residue was unchanged flonicamid (46-72%). TFNA-AM (16-25%) was the primary metabolite in urine, faeces, and bile. TFNA was found only in low dose animals and TFNG-AM was found only in the bile of high dose animals. TFNG was found only in liver tissue. Flonicamid is metabolized by several routes, including nitrile hydrolysis, amide hydrolysis, N-oxidation, and hydroxylation of the pyridine ring.	1581972 1581973 1581975 1581977 1581979 1581980 1581981

a Effects observed in males as well as females unless otherwise reported

Table 4 Toxicology Endpoints for Use in Health Risk Assessment for Flonicamid

Exposure Scenario	Dose (mg/kg bw/day)	Study	Endpoint	CAF or Target MOE and Rationale[1]
Acute dietary,	Not required			
Chronic Dietary	NOAEL = 4.4	2- generation rat reproduction toxicity study	Increased blood serum luteinizing hormone in F1 females	100 PCPA = 1-fold
	ADI = 0.04 mg/kg bw/day			
Dermal and Inhalation (all durations)	NOAEL = 4.4	2- generation reproduction toxicity study	Increased blood serum luteinizing hormone in F_1 females	100

[1] CAF (Composite assessment factor) refers to the total of uncertainty and PCPA factors for dietary and residential risk assessments, MOE refers to target margin of exposure for occupational assessments.

Table 5 Integrated Food Residue Chemistry Summary

NATURE OF THE RESIDUE IN POTATO			**PMRA # 1582299**	
Radiolabel Position	**[^{14}C-pyridyl] Flonicamid**			
Test Site	Outdoors			
Treatment	Foliar			
Rate	200 or 1000 g a.i./ha			
End-use product	Water dispersible granular			
Preharvest interval	14 days			
Matrix	**200 g a.i./ha**		**1000 g a.i./ha**	
	TRR (ppm)		**TRR (ppm)**	
Unwashed Potato Tubers	0.106		0.200	
Washed Potato Tubers	0.144		0.531	
Surface Wash	<0.001		0.002	
Foliage	1.533		7.666	
Matrix	**200 g a.i./ha**		**1000 g a.i./ha**	
	Major Metabolites (> 10% TRR)	**Minor Metabolites (< 10% TRR)**	**Major Metabolites (> 10% TRR)**	**Minor Metabolites (< 10% TRR)**
Potato Tubers (unwashed)	TFNG, TFNA	Flonicamid, TFNG-AM, TFNA-AM, TFNA-conjugate	Flonicamid, TFNG, TFNA	TFNG-AM, TFNA-AM, TFNA-conjugate
Foliage	TFNG, TFNA	Flonicamid, TFNG-AM, TFNA-AM, TFNA-conjugate	Flonicamid, TFNG, TFNA	TFNG-AM, TFNA-AM, TFNA-conjugate

NATURE OF THE RESIDUE IN PEACH			**PMRA # 1582297**	
Radiolabel Position	**[^{14}C-pyridyl] Flonicamid**			
Test Site	Outdoors			
Treatment	Foliar			
Rate	200 or 1000 g a.i./ha			
End-use product	Water dispersible granular			
Preharvest interval	21 days			
Matrix	**200 g a.i./ha**		**1000 g a.i./ha**	
	TRR (ppm)		**TRR (ppm)**	
Surface Wash	0.006		0.049	
Whole Fruit (unwashed)	0.100		0.322	
Foliage	6.247		24.213	
Matrix	**200 g a.i./ha**		**1000 g a.i./ha**	
	Major Metabolites (> 10% TRR)	**Minor Metabolites (< 10% TRR)**	**Major Metabolites (> 10% TRR)**	**Minor Metabolites (< 10% TRR)**
Whole Fruit (unwashed)	Flonicamid, TFNA	TFNG, TFNG-AM, TFNA-AM	Flonicamid, TFNA	TFNG, TFNG-AM, TFNA-AM
Foliage	Flonicamid, TFNG, TFNA	TFNG-AM, TFNA-AM	Flonicamid	TFNA, TFNG-AM, TFNA-AM
NATURE OF THE RESIDUE IN MATURE WHEAT			**PMRA # 1582298**	
Radiolabel Position	**[^{14}C-pyridyl] Flonicamid**			
Test Site	Outdoors			
Treatment	Foliar			
Rate	100 or 500 g a.i./ha			
End-use product	Water dispersible granular			
Preharvest interval	21 days			
Matrix	**100 g a.i./ha**		**500 g a.i./ha**	
	TRR (ppm)		**TRR (ppm)**	
Wheat straw	2.033		9.282	
Wheat Chaff	3.603		18.879	
Wheat Grain	0.277		1.467	
Matrix	**100 g a.i./ha**		**500 g a.i./ha**	
	Major Metabolites (> 10% TRR)	**Minor Metabolites (< 10% TRR)**	**Major Metabolites (> 10% TRR)**	**Minor Metabolites (< 10% TRR)**

Wheat straw	Flonicamid, TFNG	TFNA, TFNG-AM, TFNA-AM	Flonicamid, TFNG	TFNA, TFNA-AM
Wheat Chaff	Flonicamid, TFNG	TFNA, TFNG-AM, TFNA-AM	Flonicamid, TFNG	TFNA, TFNA-AM
Wheat Grain	Flonicamid, TFNG	TFNA, TFNG-AM, TFNA-AM	Flonicamid, TFNG	TFNA, TFNA-AM, N-oxide of TFNA-AM

NATURE OF THE RESIDUE IN IMMATURE WHEAT			**PMRA # 1582300**
Radiolabel Position	**[^{14}C-pyridyl] Flonicamid**		
Test Site	Outdoors		
Treatment	Foliar		
Rate	100 or 500 g a.i./ha		
End-use product	Water dispersible granular		
Preharvest interval	7 days (immature hay); 14 days (immature forage)		
Matrix	**PHI (days)**	**TRR (ppm)**	
Wheat Foliage	14	0.648	
Wheat Hay	7	0.951	
Matrix	**PHI (days)**	**Major Metabolites (>10 % TRR)**	**Minor Metabolites (<10 % TRR)**
Wheat Foliage	14	Flonicamid, TFNG, TFNG-AM	TFNA, TFNA-AM, TFNA conjugate, N-oxide of Flonicamid
Wheat Hay	7	Flonicamid, TFNG, TFNG-AM	TFNA, TFNA-AM
The major metabolic pathway of flonicamid in plants involves hydrolysis of the –CN and –$CONH_2$ groups.			

CONFINED ACCUMULATION IN ROTATIONAL CROPS	**PMRA # 1582340**
Radiolabel Position	**[^{14}C-pyridyl] Flonicamid**
Test site	Green House
Formulation used for trial	Water dispersible granular
Application rate and timing	Two applications at 100 g a.i./ha to bare soil (total of 200 g a.i./ha) at 30, 120, and 361 day PBIs

Rotational Crop Matrices	TRR (ppm)		
	30-day PBI	**120-day PBI**	**361-day PBI**
Immature carrot	0.011	0.006	0.003
Mature carrot roots	0.004	0.003	<0.001
Mature carrot tops	0.019	0.005	0.002
Immature lettuce	0.006	0.004	0.002
Mature lettuce	0.004	0.004	0.001
Wheat forage	0.077	0.009	0.007
Wheat straw	0.140	0.031	0.017
Wheat chaff	0.078	0.023	0.013
Wheat grain	0.029	0.010	0.005

Metabolites Identified		**Major Metabolites (> 10% TRR)**	**Minor Metabolites (< 10% TRR)**
Matrix	**PBI (days)**		
Wheat Forage	30	TFNG, TFNA, TFNA-AM, TFNA-OH	Flonicamid, TFNA-AM
Wheat Straw	30	TFNG, TFNG-AM	Flonicamid, TFNA, TFNA-AM, TFNA-OH
Wheat Chaff	30	TFNG, TFNG-AM	Flonicamid, TFNA, TFNA-AM, TFNA-OH
Wheat Grain	30	TFNG, TFNA	Flonicamid, TFNG-AM, TFNA-AM, TFNA-OH
Mature carrot roots	30	TFNG-AM, TFNA-A	Flonicamid, TFNG, TFNA, TFNA-OH
Mature carrot tops	30	TFNG-AM	Flonicamid, TFNG, TFNA, TFNA-AM, TFNA-OH
Immature lettuce	30	TFNG	Flonicamid, TFNA, TFNG-AM, TFNA-AM, TFNA-OH
Mature lettuce	30	TFNG-AM	Flonicamid, TFNG, TFNA, TFNA-AM, TFNA-OH
Immature Carrot	120	-	TFNA-OH
Mature Carrot Tops	120	-	TFNA-OH

Proposed metabolic scheme in rotational crops
The major metabolic reactions of flonicamid in rotational crops are the same as in primary crops (hydrolysis of the -CN and $–CONH_2$ groups).

NATURE OF THE RESIDUE IN LAYING HEN		**PMRA # 1588325, 1588329**	
Hens were fed [C^{14}-pyridyl]flonicamid at 10 ppm in the diet for 5 days. Eggs were collected twice daily, and tissues (liver, kidney, muscle, skin, and fat) were collected at sacrifice.			
Matrices		**% of Administered Dose**	**TRR (ppm)**
Excreta & cage wash		72.34	-
Thigh Muscle		1.08	0.94
Breast Muscle		1.13	0.99
Fat		0.33	0.15
Skin		2.31	0.70
Liver		0.79	1.18
Kidney		0.22	1.42
Egg yolk (day 3)		0.15	0.50
Egg white (day 3)		0.46	0.74
Matrices	**Major Metabolites (> 10% TRR)**	**Minor Metabolites (< 10% TRR)**	
Skin	TFNA-AM	Flonicamid, OH-TFNA-AM, TFNG-AM	
Fat	TFNA-AM	Flonicamid, OH-TFNA-AM, TFNG-AM	
Muscle	TFNA-AM	Flonicamid, OH-TFNA-AM, TFNG-AM	
Liver	TFNA-AM	Flonicamid, OH-TFNA-AM, TFNA-AM conjugate	
Egg	TFNA-AM	Flonicamid	
NATURE OF THE RESIDUE IN LACTATING GOAT		**PMRA # 1588323, 1588324**	
Lactating goats were fed [C^{14}-pyridyl]flonicamid at 10 ppm in the diet for 5 days. Milk was collected twice daily, and tissues (liver, kidney, muscle, and fat) were collected at sacrifice.			
Matrices		**% of Administered Dose**	**TRR (ppm)**
Urine and feces		70.04	-
Loin Muscle		3.97	0.39
Rear Leg Muscle		3.48	0.34
Perirenal Fat		0.05	0.07
Omental Fat		0.03	0.05
Kidney		0.15	0.66
Liver		1.71	1.22
Milk (day 3)		0.21	0.09

Matrices	Major Metabolites (> 10% TRR)	Minor Metabolites (< 10% TRR)
Milk	TFNA-AM	Flonicamid, GT-1, OH-TFNA-AM, TFNA
Kidney	TFNA-AM	Flonicamid, GT-1, OH-TFNA-AM, TFNA
Liver	TFNA-AM	Flonicamid, GT-1, OH-TFNA-AM, TFNA
Fat	TFNA-AM	Flonicamid, GT-1, OH-TFNA-AM, TFNA
Muscle	TFNA-AM	Flonicamid

Proposed Metabolic Scheme in Livestock
Flonicamid is mainly metabolized by hydrolysis of the cyano functional group to amide or carboxyl groups, and ring hydroxylation.

STORAGE STABILITY — **PMRA # 1582318, 1582344, 1582343**

Samples of untreated homogenized cotton seed (oilseed crop), potatoes (root or tuber crop), spinach (leafy vegetable), tomatoes (fruiting vegetable), wheat grain, forage, and straw (non-oily grain), as well as processed apple juice, cotton seed hulls, meal, and refined oil, and wheat bran, middlings, and germ were fortified with flonicamid, TFNA-AM, TFNA, and TFNG at 0.5 ppm each and stored frozen for up to 23 months. Samples were analyzed after ~ 0, 3, 6, 9, 15, and 23 months of storage. The results indicate that residues of flonicamid and its metabolites TFNG, TFNA, and TFNA-AM are relatively stable in/on frozen cotton seed, potato tubers, spinach, tomatoes, and wheat grain, forage, and straw, as well as in the processed commodities apple juice, cotton seed hulls, meal, and refined oil, and wheat bran, middlings, and germ for up to ~23 months.

The stability of flonicamid and its metabolites OH-TFNA-AM, TFNA-AM, TFNG, and TFNA in egg and livestock tissues during frozen storage. Under these conditions residues of flonicamid and its metabolites OH-TFNA-AM, TFNA-AM, TFNG, and TFNA were shown to be stable in frozen eggs for up to 299 days, in frozen poultry muscle and liver for up to 251-254 days, in frozen poultry fat for up to 243 days, in frozen cattle muscle, liver, and kidney for up to 374 days, and in frozen cattle fat for up to 315 days. There were no freezer storage stability data provided for milk. Milk samples were analyzed within 28 days of collection in the dairy cattle feeding study (PMRA # 1582343). Therefore, freezer storage stability data are not required.

CROP FIELD TRIALS STONE FRUIT (CDN GAP: 240 g a.i./ha, 14 day PHI) — **PMRA # 1582333**

Commodity	Total Applic. Rate (g a.i./ha)	PHI (days)	Residue Levels (ppm)						
			n	Min.	Max.	HAFT	Median (STMdR)	Mean (STMR)	Std. Dev.
Flonicamid, TFNA-AM, TFNA, TFNG									
Peach	305-316	10-14	18	<0.089	<0.492	0.468	0.195	0.225	0.119
Cherry		14	12	<0.306	<0.524	0.505	0.370	0.395	0.082
Plum		14	12	<0.053	<0.093	0.089	0.077	0.074	0.014

CROP FIELD TRIALS POME FRUIT (CDN GAP: 240 g a.i./ha, 21 day PHI)									**PMRA # 1582331**
Commodity	Total Applic. Rate (g a.i./ha)	PHI (days)	Residue Levels (ppm)						
			n	Min.	Max.	HAFT	Median (STMdR)	Mean (STMR)	Std. Dev.
Flonicamid, TFNA-AM, TFNA, TFNG									
Apple	305-315	20-21	22	<0.058	<0.157	<0.155	0.079	0.079	0.025
	309	14	2	<0.161	<0.181	<0.171	0.171	0.171	-
Pear	296-307	21	8	<0.050	<0.074	<0.071	0.039	0.044	0.011
	308-310	14	4	<0.064	<0.085	<0.083	0.071	0.068	0.009
CROP FIELD TRIALS CUCURBITS (CDN GAP: 240 g a.i./ha, 0 day PHI)									**PMRA # 1582324**
Commodity	Total Applic. Rate (g a.i./ha)	PHI (days)	Residue Levels (ppm)						
			n	Min.	Max.	HAFT	Median (STMdR)	Mean (STMR)	Std. Dev.
Flonicamid, TFNA-AM, TFNA, TFNG									
Cucumber	298-307	0	12	<0.135	<0.343	0.324	0.165	0.202	0.072
Cantaloupe	298-307	0	12	<0.119	<0.252	0.297	0.153	0.161	0.042
Summer Squash	304-309	0	10	<0.040	<0.174	0.164	0.132	0.115	0.053
CROP FIELD TRIALS FRUITING VEGETABLES (CDN GAP: 240 g a.i./ha, 0 day PHI)									**PMRA # 1582325**
Commodity	Total Applic. Rate (g a.i./ha)	PHI (days)	Residue Levels (ppm)						
			n	Min.	Max.	HAFT	Median (STMdR)	Mean (STMR)	Std. Dev.
Flonicamid, TFNA-AM, TFNA, TFNG									
Tomato	304-309	0	24	<0.049	<0.304	0.263	0.102	0.121	0.063
Bell Pepper	300-308	0	12	<0.141	<0.205	0.197	0.167	0.167	0.020
Non-Bell Pepper	302-311	0	6	<0.282	<0.300	0.298	0.285	0.284	0.008
CROP FIELD TRIALS BRASSICA LEAFY VEGETABLES (CDN GAP: 240 g a.i./ha, 0 day PHI)									**PMRA # 1582323**
Commodity	Total Applic. Rate (g a.i./ha)	PHI (days)	Residue Levels (ppm)						
			n	Min.	Max.	HAFT	Median (STMdR)	Mean (STMR)	Std. Dev.
Flonicamid, TFNA-AM, TFNA, TFNG									
Broccoli	297-314	0	12	<0.307	<0.805	<0.777	<0.564	<0.559	0.158
Cabbage with wrapper leaves	298-301	0	12	<0.106	<1.418	<1.401	<0.275	<0.430	0.462
Cabbage without wrapper leaves	298-301	0	12	<0.125	<1.333	<1.260	<0.261	<0.392	0.412
Mustard Greens	293-305	0	10	<2.132	10.113	9.855	4.595	5.537	3.192

CROP FIELD TRIALS LEAFY VEGETABLE, except BRASSICA (CDN GAP: 240 g a.i./ha, 0 day PHI)									**PMRA # 1582329**
Commodity	Total Applic. Rate (g a.i./ha)	PHI (days)	Residue Levels (ppm)						
			n	Min.	Max.	HAFT	Median (STMdR)	Mean (STMR)	Std. Dev.
Flonicamid, TFNA-AM, TFNA, TFNG									
Head Lettuce with wrapper leaves	299-304	0	12	<0.403	0.795	0.647	0.544	0.563	0.120
Head Lettuce without wrapper leaves	299-304	0	12	<0.049	<0.069	0.066	0.051	0.050	0.005
Leaf Lettuce	299-304	0	12	1.709	3.283	3.185	2.804	2.663	0.534
Celery	299-307	0	12	<0.367	<0.527	0.513	0.482	0.462	0.053
Spinach	299-300	0	12	4.757	7.978	7.758	6.461	6.450	1.047
CROP FIELD TRIALS ROOT VEGETABLES, except SUGARBEETS (CDN GAP: 240 g a.i./ha, 3 day PHI); Tuberous and Corm (CDN GAP 240 g a.i./ha, 7 day PHI)									**PMRA # 1582330, 1582334, 1582339**
Commodity	Total Applic. Rate (g a.i./ha)	PHI (days)	Residue Levels (ppm)						
			n	Min.	Max.	HAFT	Median (STMdR)	Mean (STMR)	Std. Dev.
Flonicamid, TFNA-AM, TFNA, TFNG									
Potato Tubers	302-313	7	34	0.050	0.139	0.123	0.056	0.061	0.022
Carrot Roots	296-310	6-8	16	<0.170	<0.298	<0.283	0.185	0.201	0.039
Carrot Roots	306	3	4	<0.181	<0.224	<0.222	0.212	0.207	0.019
Radish Roots	295-307	2-4	10	<0.080	<0.400	<0.360	0.180	0.200	0.100
OTHER CROPS (CDN GAP: 240 g a.i./ha 10 day PHI hops, 240 g a.i./ha, 3 day PHI radish tops)									**PMRA # 1582339, 1582336**
Commodity	Total Applic. Rate (g a.i./ha)	PHI (days)	Residue Levels (ppm)						
			n	Min.	Max.	HAFT	Median (STMdR)	Mean (STMR)	Std. Dev.
Flonicamid, TFNA-AM, TFNA, TFNG									
Radish Tops	295-307	2-4	10	0.343	10.1	9.8	5.7	5.1	3.3
Dried hop cones	292-305	9-11	6	1.09	3.45	3.40	1.96	2.15	1.04

FIELD ACCUMULATION IN ROTATIONAL CROPS — **PMRA # 1582341**

Six limited field rotational crop trials on turnip (2) and wheat (4) were conducted (leafy vegetables were not included since TRRs were <0.01 ppm in lettuce in the confined rotational crop study). A primary cover crop of cotton received three broadcast foliar applications of a 50% water-dispersible granular (WDG) formulation at ~ 100 g a.i./ha/application for total seasonal rates of ~ 300 g a.i./ha. Cotton was harvested 29-30 days after the last application, and turnips and wheat were planted 30-32 and 58-63 days after the last application. Individual residues of flonicamid and its metabolites TFNA-AM, TFNA, and TFNG were each below the method LOQ (<0.01 ppm for turnip roots and tops and wheat forage and grain.

PROCESSED FOOD AND FEED TOMATO	**PMRA # 1582325**
Test Site	Outdoors
Treatment	Foliar
Rate	711 g a.i./ha
End-use product	Water Dispersible Granular
Preharvest interval	0 days
Processed Commodity	**Processing Factor (Flonicamid, TFNA-AM, TFNA, TFNG)**
Tomato Paste	11.7x
Tomato Puree	6.9x
PROCESSED FOOD AND FEED POTATO	**PMRA # 1582330**
Test Site	Outdoors
Treatment	Foliar
Rate	1224 g a.i./ha
End-use product	Water Dispersible Granular
Preharvest interval	7 days
Processed Commodity	**Processing Factor (Flonicamid, TFNA-AM, TFNA, TFNG)**
Potato Chips	1.6x
Potato Flakes	2.9x
PROCESSED FOOD AND FEED PLUM	**PMRA # 1582333**
Test Site	Outdoors
Treatment	Foliar
Rate	720 g a.i./ha
End-use product	Water Dispersible Granular
Preharvest interval	14 days
Processed Commodity	**Processing Factor (Flonicamid, TFNA-AM, TFNA, TFNG)**
Plum	1.0x
PROCESSED FOOD AND FEED APPLE	**PMRA # 1582331**
Test Site	Outdoors
Treatment	Foliar
Rate	721 g a.i./ha
End-use product	Water Dispersible Granular
Preharvest interval	21 days
Processed Commodity	**Processing Factor**
Apple Juice	3.4x

LIVESTOCK FEEDING – Dairy cattle	**PMRA #1582343**

Dairy cattle were dosed orally with a 1:1 mixture of flonicamid and TFNG at levels equivalent to 2.50, 6.89, and 23.69 ppm (flonicamid and TFNG combined) in the diet. Cattle were dosed twice per day for 28 consecutive days. Milk samples were collected for analysis on study days 1 through 8, 10, 14, 17, 21, 24, 27, and 29. Cattle were sacrificed within 24 hours of the final dose, and samples of muscle, liver, kidney, and fat were collected for analysis.

Matrix	**Feeding Level (ppm/day)**	**n**	**Ranges (3 cows), ppm (Flonicamid, TFNA-AM, TFNA)**
Milk	2.50 6.84 23.69	45 45 45	<0.03 <0.03-0.062 <0.0386-<0.1313
Muscle	2.50 6.84 23.69	3 3 3	<0.075 <0.075-<0.0796 <0.1216-<0.1552
Liver	2.50 6.84 23.69	3 3 3	<0.075 <0.0844-<0.0917 <0.1411-<0.1742
Kidney	2.50 6.84 23.69	3 3 3	<0.075 <0.0912-<0.1055 <0.2247-<0.3212
Fat	2.50 6.84 23.69	3 3 3	<0.03 <0.03 <0.03-<0.0410

Matrix	**Feeding level (ppm)**	**Anticipated Residue (ppm) (Beef/Dairy)**
Milk	2.50	<0.03
Fat	2.50	<0.03
Kidney	2.50	<0.08
Liver	2.50	<0.08
Muscle	2.50	<0.08

The only feeding item treated with flonicamid for both beef and dairy cattle are potato culls. The highest residue for potato tubers from the potato crop field trials is 0.14 ppm. Based a 20 % moisture content and a 30 % contribution to the diet of beef cattle and a 10 % contribution to the diet of dairy cattle, it is anticipated that the dietary contribution (0.20 ppm and 0.07 ppm, respectively) would result in anticipated residues in livestock commodities that are below quantifiable limits.

There are no feeding items for hog, hence there is no expectation of residues in this commodity.

LIVESTOCK FEEDING – Laying hens			PMRA #1582344
A poultry feeding study with flonicamid and its metabolite TFNG was conducted with a 1:1 feeding ratio at levels equivalent to 0.2593, 2.514, 7.473, and 25.83 ppm (flonicamid and TFNG combined) in the diet. Hens were dosed once per day for 28 consecutive days. Egg samples were collected twice per day and tissue at sacrifice.			
Matrix	**Feeding Level**	**N (composite samples)**	**Ranges, ppm (Flonicamid, TFNA-AM, TFNA)**
Muscle	0.2593 2.514 7.473 25.83	3 3 3 3	<0.03 <0.0705-<0.0815 <0.1686-<0.2066 <0.6097-<0.7381
Liver	0.2593 2.514 7.473 25.83	3 3 3 3	<0.03 <0.0596-<0.0849 <0.1536-<0.2071 <0.6262-<0.8057
Fat	0.2593 2.514 7.473 25.83	3 3 3 3	<0.03 <0.0357-<0.0511 <0.0560-<0.0996 <0.2617-<0.3726
Egg	0.2593 2.514 7.473 25.83	3 3 3 3	<0.03-<0.0343 <0.03-<0.1441 <0.03-<0.3902 <0.03-<1.3163
There are currently no poultry feed items treated with flonicamid, hence there is no expectation of residues.			

Table 6 Food Residue Chemistry Overview of Metabolism Studies and Risk Assessment

PLANT STUDIES	
RESIDUE DEFINITION FOR ENFORCEMENT **Primary and Rotational crops**	Flonicamid, TFNA, TFNG, and TFNA-AM
RESIDUE DEFINITION FOR RISK ASSESSMENT **Primary and Rotational crops**	Flonicamid, TFNA, TFNG, and TFNA-AM
METABOLIC PROFILE IN DIVERSE CROPS	The metabolic profile in diverse crops is understood.
ANIMAL STUDIES	
ANIMALS	**Ruminant**
RESIDUE DEFINITION FOR ENFORCEMENT	Flonicamid, TFNA, and TFNA-AM
RESIDUE DEFINITION FOR RISK ASSESSMENT	Flonicamid, TFNA, and TFNA-AM
METABOLIC PROFILE IN ANIMALS **(goat, hen, rat)**	The metabolic profile in livestock is understood.
FAT SOLUBLE RESIDUE	No

DIETARY RISK FROM FOOD AND WATER			
	POPULATION	**ESTIMATED RISK % of ACCEPTABLE DAILY INTAKE (ADI)**	
		Food Only	**Food and Water**
Refined chronic dietary risk **ADI =0.04 mg/kg bw** **Estimated chronic drinking water concentration = 1.48 μg/L**	**All infants < 1 year**	3.5	3.7
	Children 1–2 years	7.2	7.3
	Children 3 to 5 years	5.5	5.6
	Children 6–12 years	3.4	3.5
	Youth 13–19 years	2.0	2.1
	Adults 20–49 years	2.0	2.1
	Adults 50+ years	2.0	2.1
	Total population	2.5	2.6

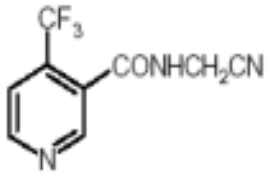
Table 7 Toxic Substances Management Policy Considerations-Comparison to TSMP Track 1 Criteria

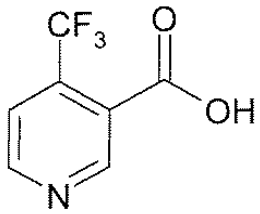
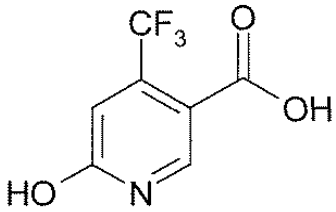
TSMP Track 1 Criteria	TSMP Track 1 Criterion value		Active Ingredient Endpoints	Transformation Products Endpoints
CEPA toxic or CEPA toxic equivalent[1]	yes		yes	yes
Predominantly anthropogenic[2]	yes		yes	yes
Persistence[3]:	Soil	Half-life ≥ 182 days	Half-life: 0.6 to 1.9 days for flonicamid (aerobic soil) and up to 9.6 days for flonicamid under field conditions; half-life for transformation products were less than 4.57 days.	no
	Water	Half-life ≥ 182 days	Half-life: Stable to hydrolysis; half-life from photolysis: 265 days	
	Sediment	Half-life ≥ 365 days	Half-life: Entire system half life ranged from 35.7 to 44.6 days in aerobic system and 129 days in anaerobic system	no
	Air	Half-life ≥ 2 days or evidence of long range transport	Half-life or volatilisation is not an important route of dissipation and long-range atmospheric transport is unlikely to occur based on the vapour pressure (9.43 x 10^{-7} Pa) and Henry's Law	

TSMP Track 1 Criteria	TSMP Track 1 Criterion value	Active Ingredient Endpoints	Transformation Products Endpoints
		Constant (4.2×10^{-8} Pa m^3/mol).	
Bioaccumulation[4]	Log $K_{OW} \geq 5$	0.3	no
	BCF $\geq$ 5000	not available	
	BAF $\geq$ 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.	No, does not meet TSMP Track 1 criteria.

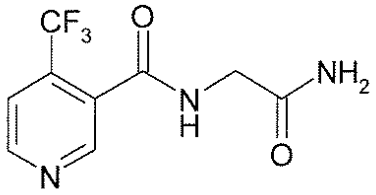
[1]All pesticides will be considered CEPA-toxic or CEPA toxic equivalent for the purpose of initially assessing a pesticide against the TSMP criteria. Assessment of the CEPA toxicity criteria may be refined if required (i.e., all other TSMP criteria are met).
[2]The policy considers a substance "predominantly 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 (e.g., BAFs) are preferred over laboratory data (e.g., BCFs) which, in turn, are preferred over chemical properties (e.g., log K_{OW}).

Table 8 Major transformation products in environmental media

Code	Chemical name	Chemical structure	Study	max %AR (day)	%AR at Study End (study length)
PARENT					
IKI-220	Flonicamid N-(cyanomethyl)-4-(trifluoromethyl)-3-pyridinecarboxamide				

Code	Chemical name	Chemical structure	Study	max %AR (day)	%AR at Study End (study length)
MAJOR (>10%) TRANSFORMATION PRODUCTS					
TFNA	4-trifluoromethylnicotinic acid		Aerobic soil	30.6% on day 1	<1% by day 7
			Anaerobic soil	--	--
			Soil photolysis	--	
			Aqueous photolysis	--	
			Hydrolysis	--	
			Aerobic aquatic	TFNA was detected at maximums of 9.6% (30 days), 9.2% (42 days) and 17.9% (30 days) in the water, sediment and total system, respectively, and was 2.4%, 3% and 5.4%, respectively at study termination	
			Anaerobic aquatic	57.5%, 20.1% and 76.4% of the applied in the water layer, soil, and total systems, respectively, at study termination.	
			Field studies	10.1 ppb (Washington)	
TFNA-OH	6-hydroxy-4-trifluoromethylnicotinic acid		Aerobic soil	21.3% day 3	<1% by day 7

Code	Chemical name	Chemical structure	Study	max %AR (day)	%AR at Study End (study length)
			Anaerobic soil	--	--
			Soil photolysis	--	
			Aqueous photolysis	--	
			Hydrolysis	--	
			Aerobic aquatic	12.5% (42 days), 2.2% (30 days) and 13.2% (42 days) in the water, sediment and total system, respectivley, and was 2.7%, 1.8% and 4.5%, respectively, at study termination	
			Anaerobic aquatic	--	
			Field studies	<15 ppb in 0-15 cm depth (North Dakota)	

Code	Chemical name	Chemical structure	Study	max %AR (day)	%AR at Study End (study length)
TFNG-AM	*N*-(4 trifluoromethyl nicotinoyl)-glycinamide		Aerobic soil	9.7% on day 0.33 10.2% at day 2 (Speyer 2.1 sand)	<1% by day 7
			Anaerobic soil	--	--
			Soil photolysis	29.5% day 15	
			Aq. photolysis	--	--
			Hydrolysis - pH7 Hydrolysis - pH9	30.5% day 120 (25ºC) 65.1% day 20 (50ºC)	30.5% (day 120) (25ºC) 11.4% day 120 (50ºC)
			Aerobic aquatic	--	--
			Anaerobic aquatic	--	--
			Field studies	<15 ppb in 0-15 cm depth (North Dakota)	

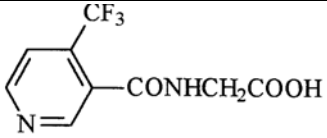
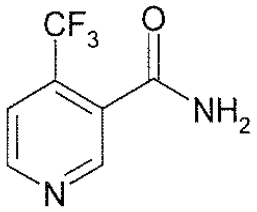
Code	Chemical name	Chemical structure	Study	max %AR (day)	%AR at Study End (study length)
TFNG	N-(4-trifluoromethylnicotinoyl)-glycine		Aerobic soil	3.9%	--
			Anaerobic soil	--	--
			Soil photolysis	2% (day 15)	2% (day 15)
			Aq. photolysis	--	--
			Hydrolysis - pH7 Hydrolysis - pH9	1% at day 77 (25ºC) 85.7% at day 120 (50ºC)	2.2% at day 120 (25ºC) 85.7% at day 120 (50ºC)
			Aerobic water	--	--
			Anaerobic water	--	--
			Field studies	<15 ppb in 0-15 cm depth (North Dakota)	
MINOR (<10%) TRANSFORMATION PRODUCTS					
TFNA-AM	4-trifluoromethylnicotinamide		Aerobic soil	7.6%	--
			Anaerobic soil	3.6%	--
			Soil photolysis	2.8%	2.8%
			Aq. Photolysis	2.9% (day 15)	--
			Hydrolysis - pH7 Hydrolysis - pH9	--	--
			Aerobic water	<1.1%	--
			Anaerobic water	--	--
			Field studies	--	--

Table 9 Fate and Behaviour in the Terrestrial Environment

Property	Test substance	Value	Comments
Abiotic transformation			
Hydrolysis	flonicamid	half life pH 4: stable (25°C) half life pH 7: stable (25°C) half life pH 7: 580 days (50°C) half life pH 9: 203 days (25°C) half life pH 9: 7.02 days (50°C)	Hydrolysis is not an important route of transformation
Phototransformation on soil	flonicamid	half life: 22 days (continuous illumination) half life: 53 days (dark control)	Not an important route of transformation (> 3 days)
Biotransformation			
Biotransformation in aerobic soil	flonicamid	Speyer 2.1 sand: half life: 1.9 days; DT_{90}: 6.37 days UK #39 sandy loam: half life: 0.6 days; DT_{90}: 2.1 days UK #21 loamy sand: half life: 0.6 days; DT_{90}: 2.1 days half life: 2.4 days (10ºC)	Non persistent
	TFNA (maximum of 76.4% in anaerobic system)	Speyer 2.1 sand: half life: 0.52 days; DT_{90}: 1.71 days UK #39 sandy loam: half life: 0.3 days; DT_{90}: 0.98 days UK #21 loamy sand: half life: 0.59 days; DT_{90}: 1.97 days	Non persistent
	TFNG-AM (maximum of 30.5% in hydrolysis)	Speyer 2.1 sand: half life: 1 days; DT_{90}: 3.4 days UK #39 sandy loam: half life: 0.3 days; DT_{90}: 1 day UK #21 loamy sand: half life: 0.1 days; DT_{90}: 0.5 days	Non persistent
	TFNA-OH (maximum of 21.3% in aerobic soil)	Speyer 2.1 sand: half life: 4.57 days; DT_{90}: 15.2 days UK #39 sandy loam: half life: 1.51 days; DT_{90}: 5.03 days UK #21 loamy sand: half life: 1.93 days; DT_{90}: 6.42 days	Non persistent
	TFNA-AM	Speyer 2.1 sand: half life: 3.91 days; DT_{90}: 13 days	Non persistent

Property	Test substance	Value	Comments
		UK #39 sandy loam: half life: 1.12 days; DT_{90}: 3.73 days UK #21 loamy sand: half life: 1.4 days; DT_{90}: 4.64 days	
	TFNG	Speyer 2.1 sand: half life: 1.32 days; DT_{90}: 4.4 days UK #39 sandy loam: half life: 0.31 days; DT_{90}: 1 day UK #21 loamy sand: half life: 0.18 days; DT_{90}: 0.61 days	Non persistent
Mobility			
Adsorption / desorption in soil	flonicamid	5 mg/kg dose (with 0.01% mercuric chloride): loamy sand: Kd: 0.1941, Koc: 16.2; sandy loam: Kd: 0.399, Koc: 13.3; German sandy loam: Kd: 0.2441, Koc: 18.8; OH loamy sand: Kd: 0.295, Koc: 42.1. 5 mg/kg dose (without 0.01% mercuric chloride): loamy sand: Kd: 0.1451, Koc: 12.1; sandy loam: Kd: 0.4539, Koc: 15.1; German sandy loam: Kd: 0.2950, Koc: 22.7; OH loamy sand: Kd: 0.2441, Koc: 34.9. 12 mg/kg dose (with 0.01% mercuric chloride): loamy sand: Kd: 0.0944, Koc: 7.9; sandy loam: Kd: 0.3349, Koc: 11.2; German sandy loam: Kd: 0.1737, Koc: 13.4; OH loamy sand: Kd: 0.1454, Koc: 20.7.	Very highly mobile
	TFNA	Kd: 0-0.02 for all soils. Koc: 2.67 for loamy sand, 3.05 for German sand, 0.35 for UK loamy sand, and 0 for UK sandy loam.	Very highly mobile

Property	Test substance	Value	Comments
	TFNG	Kd values were 0-0.03 for all soils. Koc values were 4.1 for loamy sand, 1.3 for german sand, 0.2 for UK loamy sand and 1.1 for UK sandy loam. A definitive study was not conducted.	Very highly mobile
	TFNA-OH	Kd values were 0.01 to 0.06 for all soils. Koc values were 4.39 for loamy sand, 4.19 for German sand, 1.6 for UK loamy sand and 0.192 for UK sandy loam.	Very highly mobile
	TFNA-AM	Kd values were 0.03-0.09 for all soils. Koc values were 4.8 for loamy sand, 5.16 for German sand, 5.52 for UK loamy sand and 2.76 for UK sandy loam. A definitive study was not conducted.	Very highly mobile
	TFNG-AM	Kd values were 0-0.08 for all soils. Koc values were 13.16 for loamy sand, 0 for German sand, 2.51 for UK loamy sand and 5.50 for UK sandy loam. A definitive study was not conducted.	Very highly mobile
Field studies			
Field dissipation	floniamid	Washington: DT_{50}: 3.42 days, DT_{90}: 11.4 days North Dakota: DT_{50}: 9.6 days, DT_{90}: 31.8 days	Non-persistent

Persistence of pesticide in soil (Goring et al. 1975) or water (McEwen and Stephenson 1979)
Adsorption/Desorption and Mobility (McCall et al. 1981)

Table 10 Fate and Behaviour in the Aquatic Environment

Property	Test material	Value	Comments
Abiotic transformation			
Hydrolysis	flonicamid	half life pH 4: stable (25°C) half life pH 7: stable (25°C) half life pH 7: 580 days (50°C) half life pH 9: 203 days (25°C) half life pH 9: 7.02 days (50°C)	Hydrolysis is not an important route of transformation

Property	Test material	Value	Comments
Phototransformation in water	flonicamid	half life: 265 days	phototransformation in water is not an important route of transformation (> 1 week)
Biotransformation			
Biotransformation in aerobic water systems	flonicamid	EFS-163 water phase: DT_{50}: 39 days DT_{90}: 130 days entire system: DT_{50}: 44.6 days DT_{90}: 148 days EFS-164 water phase: DT_{50}: 29.1 days DT_{90}: 96.7 days entire system: DT_{50}: 35.7 days DT_{90}: 118 days	Slightly to moderately persistent, depending on system
Biotransformation in anaerobic water systems	flonicamid	water phase: DT_{50}: 98.3 days DT_{90}: 502 days entire system: DT_{50}: 129 days DT_{90}: 565 days	Moderately persistent

Table 11 Toxicity to Non-Target Terrestrial Organisms

Organism	Exposure [Reference]	Test Substance	Endpoint Value	Degree of Toxicity[a]
Invertebrates				
Earthworm	Acute (14 d) [1582053]	Flonicamid	LC_{50}> 1000 mg/kg NOEC: 1000 mg/kg	Relatively non-toxic
Bee	Oral (96 h) [1582055]	Flonicamid	LD_{50}: >60.5 µg a.i./bee (up to 36.7% mortality and sublethal effects (e.g. nervousness) NOEC (mortality): 6.4 µg a.i./bee	Relatively non-toxic
	Contact (96 h) [1582055]	Flonicamid	LD_{50}: >100 µg a.i./bee (<10% mortality. sublethal effects in 82% of treated bees) NOEC (sublethal effects): <100 µg a.i./bee	Relatively non-toxic
	Oral (96 h) [152367]	Flonicamid 50% (Beleaf insecticide)	LD_{50}: 13.6 µg/bee (up to 53% mortality) NOEC: <6.8 µg/bee	Relatively non-toxic
	Contact (96 h) [1582367]	Flonicamid 50% (Beleaf insecticide)	LD_{50}: >100 µg/bee (up to 10% mortaltiy) NOEC (sublethal effects): <100 µg/bee	Relatively non-toxic
Green lacewing (*C. carnea*)	Contact (4 wk) [1582371]	Flonicamid 50% (Beleaf insecticide)	LR_{50}: >85 g a.i./ha (170 g product/ha). Reduction in E%: 3.65% Mortality (corrected): 18.8% ER_{50}>85 g a.i./ha	Harmless
Aphid parasitoid (*Aphidius rhopalosiphi*)	Contact (13 d) [1582369]	Flonicamid 50% (Beleaf insecticide)	LR_{50}: >85 g a.i./ha. Reduction in E%: 13.6% ER_{50}>85 g a.i./ha	Harmless
Carabid beetle (*Poecilus cupreus*)	Contact (14 d) [1582373]	Flonicamid 50% (Beleaf insecticide)	LR_{50}: >45 g a.i./ha (90 g product/ha). Mortality: 3.3% ER_{50}>85 g a.i./ha	Harmless
Predacious mite (*T. pyri*)	Contact (7 d) [1582375]	Flonicamid 50% (Beleaf insecticide)	LR_{50}: >85 g a.i./ha (170 g product/ha). Reduction in E%: 18.8% Mortality (corrected): 23.3% ER_{50}>85 g a.i./ha	Harmless

Organism	Exposure [Reference]	Test Substance	Endpoint Value	Degree of Toxicity[a]
Birds				
Bobwhite quail	Acute (14 d) [1582075]	Flonicamid	LD_{50}> 2000 mg/kg bw (40% mortality at highest test concentration) NOEL (mortality, body weight and food consumption): females: 1200 mg/kg males: 2000 mg/kg	Practically non-toxic
	Dietary (5 d) [1582079]	Flonicamid	**LC_{50}> 4613 mg/kg**, NOEC: <4613 mg/kg (based on food consumption and body weight)	Slightly toxic
	Reproduction (21 wk) [1582083]	Flonicamid	NOEC (adult and offspring parameters): 1030 mg a.i./kg.	--
Mallard duck	Acute (14 d) [1582077]	Flonicamid	LD_{50}: male ducks: 2621 mg/kg, **LD_{50}: female ducks: 1591 mg/kg** (60% mortality). NOEL (sublethal effects): male ducks: 260 mg/kg female: 432 mg/kg.	Slightly toxic
	Dietary (5 d) [1582081]	Flonicamid	LD_{50} >5037 mg/kg; NOEC: <5037 mg/kg (based on food consumption and body weight)	Practically non toxic
	Reproduction (21 wk) [1582085]	Flonicamid	**NOEC: 415 mg/kg** (based on viable embryos set (most sensitive))	--
Mammals				
Rat	Acute	Flonicamid	LD_{50} males: **884 mg a.i./kg bw** LD_{50} females: 1768 mg a.i./kg bw	Moderately toxic
Rat	Dietary (90 day)	Flonicamid	NOAEL: 72.3 mg a.i./kg bw	--
Rat	Reproduction	Flonicamid	NOAEL (reproductive): 3.7 mg a.i./kg bw (increase in lutenizing hormone) NOAEL (parental): 3.7 mg a.i./kg bw (increase kidney weight and droplet deposition in kidney) **No further effects upon F1 generation pups or adults** (NOAEL: 133 mg/kg bw/d).	--

Organism	Exposure [Reference]	Test Substance	Endpoint Value	Degree of Toxicity[a]
Vascular plants				
Vascular plant	Seedling emergence [1582094]	Flonicamid 50% (Beleaf insecticide)	NOEC: 150 g ai/ha EC_{25}: >150 g ai/ha. (300 g product/ha),	--
	Vegetative vigour [1582096]	Flonicamid 50% (Beleaf insecticide)	NOEC: 150 g ai/ha EC_{25}: >150 g ai/ha (300 g product/ha),	--

[a]Atkins et al. (1981) for bees and US EPA classification for others, where applicable
Beneficial capacity (E%)= 100-(100-M(%))*R (fecundity in treatment (7.36)/fecundity in control (8.14)). IOBC categories are as follows: 1. harmless (E<25%); 2. slightly harmful (25%<E<50%); 3. moderately harmful (50%<E<75%); and 4. harmful (E>75%). Bolded values considered for risk assessment.

Table 12 Toxicity to Non-Target Aquatic Organisms

Organism	Exposure [Reference]	Test Substance	Endpoint Value	Degree of Toxicity[a]
Freshwater species				
Daphnia magna	Acute (48 h) [15852058]	Flonicamid	EC_{50} >98.6 mg a.i./L; NOEC: 98.6 mg a.i./L	Slightly toxic (based on measured concentration)
	Chronic (21 d) [1582060]	Flonicamid	LC_{50}: 45 mg/L, NOEC (mortality): 12.5 mg/L; NOEC (fecundity): 3.01 mg/L; NOEC (growth): 6.08 mg/L.	--
Rainbow trout	Acute (96 h) [1582067]	Flonicamid	LC_{50} > 98 mg/L NOEC: 98 mg/L	Slightly toxic (based on measured concentration)
Bluegill sunfish	Acute (96 h) [1582069]	Flonicamid	LC_{50} > 98.8 mg/L NOEC: 98.8 mg/L	Slightly toxic (based on measured concentration)
Fathead minnow (*Pimephales promelas*)	Chronic (28 d) [1582073]	Flonicamid	NOEC (hatch success): 20 mg/L; wet weight: 20 mg/L; NOEC (post-hatch larval survival): 20 mg/L; NOEC (dry weight): 9.5 mg/L; NOEC (length): 20 mg/L	--

Organism	Exposure [Reference]	Test Substance	Endpoint Value	Degree of Toxicity[a]
Freshwater alga (*Pseudokirchneriella subcapitata)*	Acute (72 h) [1582089]	Flonicamid	Cell density: EC_{50}>96.7 mg/L, NOEC: 96.7 mg/L; Growth rate and biomass (area under the curve): EC_{50}>96.7 mg/L, NOEC: 43.8 mg/L	--
Freshwater alga (*Pseudokirchneriella subcapitata)*	Acute (72 h) [1582087]	Flonicamid	NOEC (Cell density, growth rate and biomass (area under the curve)): 119 mg a.i./L EC_{50}> 119 mg a.i./L	--
Vascular plant (*Lemna gibba)*	Acute (7 d) [1582099]	Flonicamid	Growth rate and plant biomass: NOEC: 119 mg/L; EC_{50}: >119 mg/L; Number of fronds: NOEC: 7.3 mg/L, EC_{50}: >119 mg/L	--
Marine species				
Saltwater mysid (*Americamysis bahia*)	Acute (96 h) [1582062]	Flonicamid	LC_{50}: > 121 mg/L, NOEC (erratic swimming) : 44 mg/L	Practically non-toxic
Eastern oyster (*Crassostrea virginica*)	Acute (96 h) [1582065]	Flonicamid	EC_{50} > 128 mg/L; NOEC: 71 mg/L (shell growth)	--
Sheepshead minnow (*Cyprinodon variegates)*	Acute (96 h) [1582071]	Flonicamid	LC_{50}: > 120 mg/L, NOEC: 120 mg/L	Practically non-toxic

[a]US EPA classification, where applicable

Table 13 Screening Level Risk Assessment on Non-target Terrestrial Organisms

Organism	Exposure [Reference]	Test Substance	Endpoint Value	EEC	RQ (EEC / Endpoint)	LOC Exceeded
Terrestrial organisms						
Earthworm	Acute (14 d) [1582053]	Flonicamid	LC_{50}/2> 500 mg/kg	0.07 mg a.i./kg soil	0.0001	No
Bee	Oral (96 h) [1582055]	Flonicamid	LD_{50}: >60.5 µg a.i./bee (x 1.12) = 67.76 kg a.i./ha	1 application: 0.08 kg a.i./ha (on field) Cumulative: 0.21 kg a.i./ha (on field with 35 d dissipation)	0.001 0.003	No
	Contact (96 h) [1582055]	Flonicamid	LD_{50}: >100 µg a.i./bee (x 1.12) = 112 kg a.i./ha	1 application: 0.08 kg a.i./ha (on field) Cumulative: 0.21 kg a.i./ha (on field with 35 d dissipation)	<0.001 0.002	No
	Oral (96 h) [152367]	Flonicamid 50% (Beleaf insecticide)	LD_{50}: 13.6 µg EP/bee (x 1.12) = 15.2 kg EP/ha	1 application: 0.16 kg EP/ha (on field) Cumulative: 0.42 kg EP/ha (in field with 35 d dissipation)	0.01 0.03	No
	Contact (96 h) [1582367]	Flonicamid 50% (Beleaf insecticide)	LD_{50}: >100 µg EP /bee (x 1.12) = 112 kg EP/ha NOEC (sublethal effects): <100 EP µg/bee	1 application: 0.16 kg EP/ha (on field) Cumulative: 0.42 kg EP/ha (on field with 35 d dissipation)	0.001 0.004	No

Organism	Exposure [Reference]	Test Substance	Endpoint Value	EEC	RQ (EEC / Endpoint)	LOC Exceeded
Aphid parasitoid (*Aphidius rhopalosiphi*)	Contact (13 d) [1582369]	Flonicamid 50% (Beleaf insecticide)	LR_{50}: >85 g a.i./ha (170 g EP/ha). Reduction in E%: 13.6% ER_{50}: >85 g a.i./ha	On field: 1 application: 80 g a.i./ha	0.94	No
				On field: Cumulative application: 171.1 g a.i./ha	**<2**	Not able to determine; potential for risk
				Off field: Cumulative application (59% drift): 100.9 g a.i./ha	**<1.2**	Not able to determine; potential for risk
				Off field: Cumulative application (74% drift): 127 g a.i./ha	**<1.5**	Not able to determine; potential for risk
Predacious mite (*T. pyri*)	Contact (7 d) [1582375]	Flonicamid 50% (Beleaf insecticide)	LR_{50}: >85 g a.i./ha (170 g product/ha). Reduction in E%: 18.8% ER50: >85 g a.i./ha	On field: 1 application: 80 g a.i./ha	0.94	No
				On field: Cumulative application: 171.1 g a.i./ha	**<2**	Not able to determine; potential for risk
				Off field: Cumulative application (59% drift): 100.9 g a.i./ha	**<1.2**	Not able to determine; potential for risk
				Off field: Cumulative application (74% drift): 127 g a.i./ha	**<1.5**	Not able to determine; potential for risk

Organism	Exposure [Reference]	Test Substance	Endpoint Value	EEC	RQ (EEC / Endpoint)	LOC Exceeded
Green lacewing (*C. carnea*)	Contact (4 wk) [1582371]	Flonicamid 50% (Beleaf insecticide)	LR_{50}: >85 g a.i./ha (170 g product/ha). Reduction in E%: 3.65% ER_{50}: >85 g a.i./ha	On field: 1 application: 80 g a.i./ha	0.94	No
				On field: Cumulative application: 171.1 g a.i./ha	**<2**	Not able to determine; potential for risk
				Off field: Cumulative application (59% drift): 100.9 g a.i./ha	**<1.2**	Not able to determine; potential for risk
				Off field: Cumulative application (74% drift): 127 g a.i./ha	**<1.5**	Not able to determine; potential for risk
Carabid beetle (*Poecilus cupreus*)	Contact (14 d) [1582373]	Flonicamid 50% (Beleaf insecticide)	LR_{50}: >45 g a.i./ha (90 g product/ha). Mortality: 3.3% ER_{50}: >85 g a.i./ha	On field soil: 1 application: 80 g a.i./ha	**<1.8**	Not able to determine; potential for risk
				On field soil: Cumulative application: 157 g a.i./ha	**<3.5**	Not able to determine; potential for risk
				Off field soil: Cumulative application (59% drift): 92.6 g a.i./ha	**<2.1**	Not able to determine; potential for risk
				Off field soil: Cumulative application (74% drift): 116.2 g a.i./ha	**<2.6**	Not able to determine; potential for risk

Organism	Exposure [Reference]	Test Substance	Endpoint Value	EEC	RQ (EEC / Endpoint)	LOC Exceeded
Terrestrial plants						
Vascular plant	Seedling emergence [1582094]	Flonicamid 50% (Beleaf insecticide)	EC_{25}: >150 g a.i./ha. (300 g EP/ha)	Cumulative: 78.5 g a.i./ha (on field with field half life of 9.6 days) Cumulative: 4.7 g a.i./ha (off field with field half life of 9.6 days) On field: 1 application: 80 g a.i./ha On field soil: Cumulative application: 157 g a.i./ha	0.52 0.03 0.52 1.05	No No No No
	Vegetative vigour [1582096]	Flonicamid 50% (Beleaf insecticide)	EC_{25}: >150 g a.i./ha (300 g EP/ha),	In field cumulative: 210 g a.i./ha (35 day half life) Off-field cumulative: 12.6 g a.i./ha (35 d half life; 6% drift) Off field cumulative: 123.9 g a.i./ha (35 d half life; 59% drift) Off field cumulative: 155.4 g a.i./ha (35 d half life; 74% drift)	**<1.4** 0.08 0.83 **<1.04**	Not able to determine; potential for risk No No Not able to determine; potential for risk

Beneficial capacity (E%)= 100-(100-M(%))*R (fecundity in treatment (7.36)/fecundity in control (8.14)). IOBC categories are as follows: 1. harmless (E<25%); 2. slightly harmful (25%<E<50%); 3. moderately harmful (50%<E<75%); and 4. harmful (E>75%).

LD_{50} for bees foraging in treated field was calculated by multiplying laboratory LD_{50} (µg a.i./bee) x 1.12 (Atkins et al. 1981).

Organism	Exposure [Reference]	Test Substance	Endpoint Value	EEC	RQ (EEC / Endpoint)	LOC Exceeded

Exceeded risk quotients are **bolded**
EECs for bees, predators and parasites and vegetative vigour are calculated with a foliar half life of 12.5 days since exposure is from treated leaves. For seedling emergence, a half life for soil was used (9.6 days) since seeds are exposed to ground application with no foliar interception.

Table 14 Screening Level Risk Assessment: Effects of Flonicamid on Birds in Field

Generic Body Weight (kg)	Toxicity Endpoint (mg a.i./kg bw/d)	Feeding Guild (food item)	On-Field	
			EDE [1] (mg a.i./kg bw)	RQ
Small Bird (0.02 kg)				
Acute	159	Insectivore (small insects)	10.596	0.067
	159	Granivore (grain and seeds)	2.649	0.017
	159	Frugivore (fruit)	5.298	0.033
Dietary	28.5	Insectivore (small insects)	10.596	0.37
	28.5	Granivore (grain and seeds)	2.649	0.09
	28.5	Frugivore (fruit)	5.298	0.19
Reproduction	56.4	Insectivore (small insects)	10.596	0.188
	56.4	Granivore (grain and seeds)	2.649	0.047
	56.4	Frugivore (fruit)	5.298	0.094
Medium Sized Bird (0.1 kg)				
Acute	159	Insectivore (small insects)	8.269	0.052
	159	Insectivore (large insects)	2.067	0.013
	159	Granivore (grain and seeds)	2.067	0.013
	159	Frugivore (fruit)	4.134	0.026
Dietary	28.5	Insectivore (small insects)	8.269	0.29
	28.5	Insectivore (large insects)	2.067	0.07
	28.5	Granivore (grain and seeds)	2.067	0.07
	28.5	Frugivore (fruit)	4.134	0.15
Reproduction	56.4	Insectivore (small insects)	8.269	0.147
	56.4	Insectivore (large insects)	2.067	0.037
	56.4	Granivore (grain and seeds)	2.067	0.037
	56.4	Frugivore (fruit)	4.134	0.073
Large Sized Bird (1 kg)				
Acute	159	Insectivore (small insects)	2.414	0.015
	159	Insectivore (large insects)	0.604	0.004
	159	Granivore (grain and seeds)	0.604	0.004
	159	Frugivore (fruit)	1.207	0.008
	159	Herbivore (short grass)	8.628	0.054
	159	Herbivore (long grass)	5.268	0.033
	159	Herbivore (forage crops)	7.983	0.050
	159	Herbivore (leafy foliage)	16.261	0.102
Dietary	28.5	Insectivore (small insects)	2.414	0.08
	28.5	Insectivore (large insects)	0.604	0.02
	28.5	Granivore (grain and seeds)	0.604	0.02

Generic Body Weight (kg)	Toxicity Endpoint (mg a.i./kg bw/d)	Feeding Guild (food item)	On-Field	
			EDE [1] (mg a.i./kg bw)	RQ
	28.5	Frugivore (fruit)	1.207	0.04
	28.5	Herbivore (short grass)	8.628	0.30
	28.5	Herbivore (long grass)	5.268	0.18
	28.5	Herbivore (forage crops)	7.983	0.28
	28.5	Herbivore (leafy foliage)	16.261	0.57
Reproduction	56.4	Insectivore (small insects)	2.414	0.043
	56.4	Insectivore (large insects)	0.604	0.011
	56.4	Granivore (grain and seeds)	0.604	0.011
	56.4	Frugivore (fruit)	1.207	0.021
	56.4	Herbivore (short grass)	8.628	0.153
	56.4	Herbivore (long grass)	5.268	0.093
	56.4	Herbivore (forage crops)	7.983	0.142
	56.4	Herbivore (leafy foliage)	16.261	0.288

1. Estimated daily exposure (EDE) = FIR/BW*EEC

Note: DT_{50} of 35 days for screening level assessment.

Dietary exposure was converted to a daily dose exposure using the following: for mallard dietary: The FIR is 61.2 g/day, the BW is 1082 g, thus the LD_{50} based on dose is [5037 mg a.i./kg diet x (61.2 g/day/1082 g) = *285 mg a.i./kg bw*. Reproductive exposure was converted to a daily dose exposure using the following: for mallard duck from the study for the adult: NOEC based on dose = 415 mg a.i./kg diet x (149 g/day/1085 g) = *56.4 mg a.i./kg bw*

Table 15 Tier I level risk of 59% drift of flonicamid to mammals (using mean and maximum nomogran residues)

Risk Assessment			Max On-Field		Max Off Field (59%)[1]		Mean On-Field		Mean Off Field (59%)	
Toxicity Endpoint (mg a.i./kg bw/d)		Food Guild	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ
Small Mammal (0.015 kg)										
Acute	88.4	Insectivore (small insects)	4.96	0.06	2.93	0.03	2.77	0.03	1.63	0.02
	88.4	Granivore (grain and seeds)	1.24	0.01	0.73	0.01	0.59	0.01	0.35	0.00
	88.4	Frugivore (fruit)	2.48	0.03	1.46	0.02	1.18	0.01	0.70	0.01
Dietary	72.3	Insectivore (small insects)	4.96	0.07	2.93	0.04	2.77	0.04	1.63	0.02
	72.3	Granivore (grain and seeds)	1.24	0.02	0.73	0.01	0.59	0.01	0.35	0.00
	72.3	Frugivore (fruit)	2.48	0.03	1.46	0.02	1.18	0.02	0.70	0.01
Reproduction	3.7	Insectivore (small insects)	4.96	**1.34**	2.93	0.79	2.77	0.75	1.63	0.44
	3.7	Granivore (grain and seeds)	1.24	0.34	0.73	0.20	0.59	0.16	0.35	0.09
	3.7	Frugivore (fruit)	2.48	0.67	1.46	0.40	1.18	0.32	0.70	0.19

Risk Assessment			Max On-Field		Max Off Field (59%)[1]		Mean On-Field		Mean Off Field (59%)	
Toxicity Endpoint (mg a.i./kg bw/d)		Food Guild	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ
Reproduction	133	Insectivore (small insects)	4.96	0.037	2.93	0.022	Not applicable since RQs do not exceed LOC for maximum EECs			
	133	Granivore (grain and seeds)	1.24	0.009	0.73	0.006				
	133	Frugivore (fruit)	2.48	0.019	1.46	0.011				
Medium Sized Mammal (0.035 kg)										
Acute	88.4	Insectivore (small insects)	4.35	0.05	2.56	0.03	2.42	0.03	1.43	0.02
	88.4	Insectivore (large insects)	1.09	0.01	0.64	0.01	0.52	0.01	0.31	0.00
	88.4	Granivore (grain and seeds)	1.09	0.01	0.64	0.01	0.52	0.01	0.31	0.00
	88.4	Frugivore (fruit)	2.17	0.02	1.28	0.01	1.04	0.01	0.61	0.01
	88.4	Herbivore (short grass)	15.53	0.18	9.17	0.10	5.52	0.06	3.25	0.04
	88.4	Herbivore (long grass)	9.48	0.11	5.60	0.06	3.10	0.04	1.83	0.02
	88.4	Herbivore (forage crops)	14.37	0.16	8.48	0.10	4.75	0.05	2.80	0.03
	88.4	Herbivore (leafy foliage)	29.28	0.33	17.27	0.20	9.68	0.11	5.71	0.06
Dietary	72.3	Insectivore (small insects)	4.35	0.06	2.56	0.04	2.42	0.03	1.43	0.02
	72.3	Insectivore (large insects)	1.09	0.02	0.64	0.01	0.52	0.01	0.31	0.00
	72.3	Granivore (grain and seeds)	1.09	0.02	0.64	0.01	0.52	0.01	0.31	0.00
	72.3	Frugivore (fruit)	2.17	0.03	1.28	0.02	1.04	0.01	0.61	0.01
	72.3	Herbivore (short grass)	15.53	0.21	9.17	0.13	5.52	0.08	3.25	0.05
	72.3	Herbivore (long grass)	9.48	0.13	5.60	0.08	3.10	0.04	1.83	0.03
	72.3	Herbivore (forage crops)	14.37	0.20	8.48	0.12	4.75	0.07	2.80	0.04
	72.3	Herbivore (leafy foliage)	29.28	0.40	17.27	0.24	9.68	0.13	5.71	0.08
Reproduction	3.7	Insectivore (small insects)	4.35	**1.17**	2.56	0.69	2.42	0.66	1.43	0.39
	3.7	Insectivore (large insects)	1.09	0.29	0.64	0.17	0.52	0.14	0.31	0.08
	3.7	Granivore (grain and seeds)	1.09	0.29	0.64	0.17	0.52	0.14	0.31	0.08
	3.7	Frugivore (fruit)	2.17	0.59	1.28	0.35	1.04	0.28	0.61	0.17
	3.7	Herbivore (short grass)	15.53	**4.20**	9.17	**2.48**	5.52	**1.49**	3.25	0.88
	3.7	Herbivore (long grass)	9.48	**2.56**	5.60	**1.51**	3.10	0.84	1.83	0.49
	3.7	Herbivore (forage crops)	14.37	**3.88**	8.48	**2.29**	4.75	**1.28**	2.80	0.76
	3.7	Herbivore (leafy foliage)	29.28	**7.91**	17.27	**4.67**	9.68	**2.62**	5.71	**1.54**

Risk Assessment			Max On-Field		Max Off Field (59%)[1]		Mean On-Field		Mean Off Field (59%)	
Toxicity Endpoint (mg a.i./kg bw/d)		Food Guild	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ
Reproduction	133	Insectivore (small insects)	4.35	0.033	2.56	0.019	Not applicable since RQs do not exceed LOC for maximum EECs			
	133	Insectivore (large insects)	1.09	0.008	0.64	0.0048				
	133	Granivore (grain and seeds)	1.09	0.008	0.64	0.0048				
	133	Frugivore (fruit)	2.17	0.016	1.28	0.0096				
	133	Herbivore (short grass)	15.53	0.12	9.17	0.069				
	133	Herbivore (long grass)	9.48	0.071	5.60	0.042				
	133	Herbivore (forage crops)	14.37	0.11	8.48	0.064				
	133	Herbivore (leafy foliage)	29.28	0.22	17.27	0.13				
Large Sized Mammal (1 kg)										
Acute	88.4	Insectivore (small insects)	2.32	0.03	1.37	0.02	1.30	0.01	0.76	0.01
	88.4	Insectivore (large insects)	0.58	0.01	0.34	0.00	0.28	0.00	0.16	0.00
	88.4	Granivore (grain and seeds)	0.58	0.01	0.34	0.00	0.28	0.00	0.16	0.00
	88.4	Frugivore (fruit)	1.16	0.01	0.69	0.01	0.55	0.01	0.33	0.00
	88.4	Herbivore (short grass)	8.30	0.09	4.90	0.06	2.95	0.03	1.74	0.02
	88.4	Herbivore (long grass)	5.07	0.06	2.99	0.03	1.65	0.02	0.98	0.01
	88.4	Herbivore (forage crops)	7.68	0.09	4.53	0.05	2.54	0.03	1.50	0.02
	88.4	Herbivore (leafy foliage)	15.64	0.18	9.23	0.10	5.17	0.06	3.05	0.03
Dietary	72.3	Insectivore (small insects)	2.32	0.03	1.37	0.02	1.30	0.02	0.76	0.01
	72.3	Insectivore (large insects)	0.58	0.01	0.34	0.00	0.28	0.00	0.16	0.00
	72.3	Granivore (grain and seeds)	0.58	0.01	0.34	0.00	0.28	0.00	0.16	0.00
	72.3	Frugivore (fruit)	1.16	0.02	0.69	0.01	0.55	0.01	0.33	0.00
	72.3	Herbivore (short grass)	8.30	0.11	4.90	0.07	2.95	0.04	1.74	0.02
	72.3	Herbivore (long grass)	5.07	0.07	2.99	0.04	1.65	0.02	0.98	0.01
	72.3	Herbivore (forage crops)	7.68	0.11	4.53	0.06	2.54	0.04	1.50	0.02
	72.3	Herbivore (leafy foliage)	15.64	0.22	9.23	0.13	5.17	0.07	3.05	0.04
Reproduction	3.7	Insectivore (small insects)	2.32	0.63	1.37	0.37	1.30	0.35	0.76	0.21
	3.7	Insectivore (large insects)	0.58	0.16	0.34	0.09	0.28	0.07	0.16	0.04
	3.7	Granivore (grain and seeds)	0.58	0.16	0.34	0.09	0.28	0.07	0.16	0.04
	3.7	Frugivore (fruit)	1.16	0.31	0.69	0.19	0.55	0.15	0.33	0.09
	3.7	Herbivore (short grass)	8.30	**2.24**	4.90	**1.32**	2.95	0.80	1.74	0.47
	3.7	Herbivore (long grass)	5.07	**1.37**	2.99	0.81	1.65	0.45	0.98	0.26
	3.7	Herbivore (forage crops)	7.68	**2.08**	4.53	**1.22**	2.54	0.69	1.50	0.40
	3.7	Herbivore (leafy foliage)	15.64	**4.23**	9.23	**2.49**	5.17	**1.40**	3.05	0.82

Risk Assessment			Max On-Field		Max Off Field (59%)[1]		Mean On-Field		Mean Off Field (59%)	
Toxicity Endpoint (mg a.i./kg bw/d)		Food Guild	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ
Reproduction	133	Insectivore (small insects)	2.32	0.018	1.37	0.01	Not applicable since RQs do not exceed LOC for maximum EECs			
	133	Insectivore (large insects)	0.58	0.0044	0.34	0.0026				
	133	Granivore (grain and seeds)	0.58	0.0044	0.34	0.0026				
	133	Frugivore (fruit)	1.16	0.0087	0.69	0.0052				
	133	Herbivore (short grass)	8.30	0.062	4.90	0.037				
	133	Herbivore (long grass)	5.07	0.038	2.99	0.023				
	133	Herbivore (forage crops)	7.68	0.058	4.53	0.034				
	133	Herbivore (leafy foliage)	15.64	0.12	9.23	0.069				

1 Estimated daily exposure (EDE) = FIR/BW*EEC
2 59 % drift is based on application with an airblast for late season using ASAE fine
Note: DT_{50} of 12.5 days for tier I assessment
Bolded values for RQ exceed LOC.

Table 16 Tier I level risk of 74% drift of flonicamid to mammals (using mean and maximum nomogran residues)

Risk Assessment			Max On-Field		Max Off Field (74% drift)		Mean On-Field		Mean Off Field (74% drift)	
Toxicity Endpoint (mg a.i./kg bw/d)		Food Guild	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ
Small Mammal (0.015 kg)										
Acute	88.4	Insectivore (small insects)	4.96	0.056	3.669	0.041	2.765	0.031	2.04	0.023
	88.4	Granivore (grain and seeds)	1.24	0.014	0.917	0.010	0.591	0.006	0.437	0.0049
	88.4	Frugivore (fruit)	2.48	0.028	1.834	0.020	1.182	0.013	0.874	0.0099
Dietary	72.3	Insectivore (small insects)	4.96	0.068	3.669	0.050	2.765	0.038	2.04	0.0283
	72.3	Granivore (grain and seeds)	1.24	0.017	0.917	0.013	0.591	0.0082	0.437	0.0061
	72.3	Frugivore (fruit)	2.48	0.034	1.834	0.025	1.182	0.016	0.874	0.0121
Reproduction	3.7	Insectivore (small insects)	4.96	**1.34**	3.669	0.992	2.765	0.747	2.04	0.55
	3.7	Granivore (grain and seeds)	1.24	0.335	0.917	0.248	0.591	0.159	0.437	0.11
	3.7	Frugivore (fruit)	2.45	0.670	1.834	0.496	1.182	0.319	0.874	0.23

Risk Assessment			Max On-Field		Max Off Field (74% drift)		Mean On-Field		Mean Off Field (74% drift)	
Toxicity Endpoint (mg a.i./kg bw/d)		Food Guild	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ
Reproduction	133	Insectivore (small insects)	4.96	0.034	3.669	0.028	Not applicable since RQs do not exceed LOC for maximum EECs			
	133	Granivore (grain and seeds)	1.24	0.0093	0.917	0.0069				
	133	Frugivore (fruit)	2.45	0.019	1.834	0.014				
Medium Sized Mammal (0.035 kg)										
Acute	88.4	Insectivore (small insects)	4.35	0.049	3.216	0.0364	2.424	0.0274	1.79	0.0203
	88.4	Insectivore (large insects)	1.087	0.012	0.804	0.0091	0.518	0.0059	0.383	0.0043
	88.4	Granivore (grain and seeds)	1.087	0.012	0.804	0.0091	0.518	0.0059	0.383	0.0043
	88.4	Frugivore (fruit)	2.173	0.024	1.608	0.018	1.036	0.0117	0.767	0.0087
	88.4	Herbivore (short grass)	15.53	0.175	11.49	0.130	5.516	0.0624	4.08	0.0462
	88.4	Herbivore (long grass)	9.48	0.107	7.018	0.079	3.097	0.0350	2.29	0.0259
	88.4	Herbivore (forage crops)	14.37	0.162	10.63	0.120	4.751	0.0537	3.51	0.0398
	88.4	Herbivore (leafy foliage)	29.27	0.331	21.66	0.245	9.678	0.109	7.16	0.0810
Dietary	72.3	Insectivore (small insects)	4.34	0.060	3.216	0.044	2.424	0.0335	1.79	0.0248
	72.3	Insectivore (large insects)	1.09	0.015	0.804	0.011	0.518	0.0072	0.383	0.0053
	72.3	Granivore (grain and seeds)	1.087	0.015	0.804	0.011	0.518	0.0072	0.383	0.0053
	72.3	Frugivore (fruit)	2.17	0.030	1.61	0.022	1.036	0.0143	0.767	0.0106
	72.3	Herbivore (short grass)	15.53	0.214	11.49	0.159	5.516	0.0763	4.08	0.0565
	72.3	Herbivore (long grass)	9.48	0.131	7.0187	0.097	3.097	0.0428	2.29	0.0317
	72.3	Herbivore (forage crops)	14.37	0.198	10.63	0.147	4.751	0.0657	3.51	0.0486
	72.3	Herbivore (leafy foliage)	29.28	0.404	21.66	0.299	9.678	0.133	7.16	0.0991
Reproduction	3.7	Insectivore (small insects)	4.35	**1.17**	3.21	0.869	2.424	0.655	1.79	0.484
	3.7	Insectivore (large insects)	1.09	0.293	0.80	0.217	0.518	0.140	0.383	0.103
	3.7	Granivore (grain and seeds)	1.09	0.293	0.80	0.217	0.518	0.140	0.383	0.103

Risk Assessment			Max On-Field		Max Off Field (74% drift)		Mean On-Field		Mean Off Field (74% drift)	
Toxicity Endpoint (mg a.i./kg bw/d)		Food Guild	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ
	3.7	Frugivore (fruit)	2.17	0.587	1.60	0.434	1.036	0.280	0.76	0.207
	3.7	Herbivore (short grass)	15.53	**4.20**	11.49	**3.10**	5.516	**1.49**	4.08	**1.10**
	3.7	Herbivore (long grass)	9.48	**2.56**	7.019	**1.89**	3.097	0.8370	2.29	0.614
	3.7	Herbivore (forage crops)	14.37	**3.89**	10.64	**2.87**	4.751	**1.28**	3.51	0.950
	3.7	Herbivore (leafy foliage)	29.28	**7.91**	21.67	**5.85**	9.678	**2.616**	7.16	**1.94**
Reproduction	133	Insectivore (small insects)	4.35	0.033	3.21	0.024	Not applicable since RQs do not exceed LOC for maximum EECs			
	133	Insectivore (large insects)	1.09	0.0082	0.80	0.006				
	133	Granivore (grain and seeds)	1.09	0.0082	0.80	0.006				
	133	Frugivore (fruit)	2.17	0.016	1.60	0.012				
	133	Herbivore (short grass)	15.53	0.12	11.49	0.086				
	133	Herbivore (long grass)	9.48	0.07	7.019	0.053				
	133	Herbivore (forage crops)	14.37	0.11	10.64	0.08				
	133	Herbivore (leafy foliage)	29.28	0.22	21.67	0.16				
Large Sized Mammal (1 kg)										
Acute	88.4	Insectivore (small insects)	2.32	0.026	1.719	0.0194	1.295	0.014	0.958	0.010
	88.4	Insectivore (large insects)	0.58	0.007	0.43	0.0049	0.276	0.0031	0.204	0.0023
	88.4	Granivore (grain and seeds)	0.580	0.007	0.43	0.0049	0.276	0.0031	0.204	0.0023
	88.4	Frugivore (fruit)	1.16	0.013	0.85	0.009	0.553	0.0063	0.409	0.0046
	88.4	Herbivore (short grass)	8.30	0.094	6.14	0.069	2.947	0.0333	2.18	0.0247
	88.4	Herbivore (long grass)	5.07	0.057	3.75	0.042	1.654	0.0187	1.22	0.0139
	88.4	Herbivore (forage crops)	7.68	0.087	5.68	0.06	2.538	0.0287	1.87	0.0213
	88.4	Herbivore (leafy foliage)	15.64	0.177	11.58	0.13	5.171	0.0585	3.82	0.0433

Risk Assessment			Max On-Field		Max Off Field (74% drift)		Mean On-Field		Mean Off Field (74% drift)	
Toxicity Endpoint (mg a.i./kg bw/d)		Food Guild	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ
Dietary	72.3	Insectivore (small insects)	2.32	0.032	1.72	0.02	1.295	0.0179	0.958	0.0133
	72.3	Insectivore (large insects)	0.58	0.008	0.429	0.0059	0.276	0.0038	0.204	0.0028
	72.3	Granivore (grain and seeds)	0.580	0.008	0.429	0.0059	0.276	0.0038	0.204	0.0028
	72.3	Frugivore (fruit)	1.16	0.016	0.859	0.011	0.553	0.0077	0.409	0.0057
	72.3	Herbivore (short grass)	8.30	0.115	6.14	0.085	2.947	0.0408	2.18	0.0302
	72.3	Herbivore (long grass)	5.07	0.07	3.75	0.051	1.65	0.0229	1.22	0.0169
	72.3	Herbivore (forage crops)	7.68	0.106	5.68	0.078	2.538	0.0351	1.87	0.0260
	72.3	Herbivore (leafy foliage)	15.64	0.22	11.58	0.160	5.171	0.0715	3.82	0.0529
Reproduction	3.7	Insectivore (small insects)	2.32	0.63	1.719	0.46	1.295	0.350	0.958	0.2590
	3.7	Insectivore (large insects)	0.58	0.16	0.429	0.116	0.276	0.0748	0.204	0.0554
	3.7	Granivore (grain and seeds)	0.58	0.16	0.429	0.12	0.276	0.0748	0.204	0.0554
	3.7	Frugivore (fruit)	1.16	0.31	0.859	0.23	0.553	0.149	0.409	0.1108
	3.7	Herbivore (short grass)	8.30	**2.24**	6.142	**1.66**	2.948	0.796	2.18	0.5896
	3.7	Herbivore (long grass)	5.07	**1.37**	3.750	**1.01**	1.654	0.447	1.22	0.3310
	3.7	Herbivore (forage crops)	7.67	**2.07**	5.68	**1.53**	2.538	0.686	1.87	0.5077
	3.7	Herbivore (leafy foliage)	15.64	**4.23**	11.58	**3.12**	5.171	**1.40**	3.82	**1.03**

Risk Assessment			Max On-Field		Max Off Field (74% drift)		Mean On-Field		Mean Off Field (74% drift)	
Toxicity Endpoint (mg a.i./kg bw/d)		Food Guild	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ	EDE (mg a.i./kg bw)	RQ
Reproduction	133	Insectivore (small insects)	2.32	0.018	1.719	0.013	Not applicable since RQs do not exceed LOC for maximum EECs			
	133	Insectivore (large insects)	0.58	0.0044	0.429	0.0032				
	133	Granivore (grain and seeds)	0.58	0.0044	0.429	0.0032				
	133	Frugivore (fruit)	1.16	0.0087	0.859	0.0065				
	133	Herbivore (short grass)	8.30	0.062	6.142	0.046				
	133	Herbivore (long grass)	5.07	0.038	3.750	0.03				
	133	Herbivore (forage crops)	7.67	0.058	5.68	0.043				
	133	Herbivore (leafy foliage)	15.64	0.12	11.58	0.087				

1 Estimated daily exposure (EDE) = FIR/BW*EEC
2 74% drift is based on application with an airblast for early season using ASAE fine
Note: DT_{50} of 12.5 days for tier I assessment
Bolded values for RQ exceed LOC.

Table 17 Effects on Aquatic Organisms

Organism	Exposure [Reference]	Endpoint value	EEC (80 cm depth unless stated otherwise)	RQ
Freshwater species				
Daphnia magna	Acute (48 h) [15852058]	EC_{50}/2 >49.3 mg a.i./L;	0.0273 mg a.i./L	0.0006
	Chronic (21 d) [1582060]	NOEC (fecundity): 3.01 mg/L	0.0273 mg a.i./L	0.009
Rainbow trout	Acute (96 h) [1582067]	LC_{50}/10 > 9.8 mg/L	0.0273 mg a.i./L	0.003
Bluegill sunfish	Acute (96 h) [1582069]	LC_{50}/10 > 9.9 mg/L	0.0273 mg a.i./L	0.003
Fathead minnow (*Pimephales promelas*)	Chronic (28 d) [1582073]	NOEC (dry weight): 9.5 mg/L	0.0273 mg a.i./L	0.003

Organism	Exposure [Reference]	Endpoint value	EEC (80 cm depth unless stated otherwise)	RQ
Amphibians	Acute	LC_{50}/10 > 9.8 mg/L (from rainbow trout)	0.145 mg a.i./L (15 cm depth)	0.015
	Chronic	NOEC (dry weight): 9.5 mg/L	0.145 mg a.i./L (15 cm depth)	0.015
Freshwater alga (*Pseudokirchneriella subcapitata)*	Acute (72 h) [1582089]	Cell density, Biomass: EC_{50}/2> 48.4 mg/L,	0.0273 mg a.i./L	0.0006
Freshwater alga (*Pseudokirchneriella subcapitata)*	Acute (72 h) [1582087]	Cell density, Biomass: EC_{50}/2> 59.5 mg a.i./L	0.0273 mg a.i./L	0.0005
Vascular plant (*Lemna gibba)*	Acute (7 d) [1582099]	Growth and Frond number: EC_{50}/2> 59.5 mg a.i./L	0.0273 mg a.i./L	0.0005
Marine species				
Saltwater mysid (*Americamysis bahia*)	Acute (96 h) [1582062]	LC_{50}/2: > 60.5 mg/L	0.0273 mg a.i./L	0.0005
Eastern oyster (*Crassostrea virginica*)	Acute (96 h) [1582065]	EC_{50}/2 > 64 mg/L	0.0273 mg a.i./L	0.0004
Sheepshead minnow (*Cyprinodon variegates)*	Acute (96 h) [1582071]	LC_{50}/10: > 12 mg/L	0.0273 mg a.i./L	0.002

Table 18 Tier I Level Risk of Flonicamid to Terrestrial Organisms, Excluding Birds and Mammals

Organism	Exposure [Reference]	Test substance	Endpoint value	EEC*	RQ (EEC/Endpoint)	Comment
Terrestrial plants						
Vascular plants	Vegetative vigour [1582096]	Flonicamid 50% (Beleaf 50SG Insecticide)	EC_{25}: >150 g a.i./ha (300 g product/ha),	On field Cumulative rate (12.5 day half life): 171.1 g a.i./ha	**<1.1**	**Not able to determine, potential risk**
Predators and parasites						
Carabid beetle (Poecilus cupreus)	Contact (14 d) [1582373]	Flonicamid 50% (Beleaf 50SG Insecticide)	LR_{50}: >45 g a.i./ha ER_{50}: >45 g a.i./ha	On field soil: Cumulative application (1.38 d half life: 82.45 g a.i./ha	**<1.8**	**Not able to determine, potential risk**
				Off field soil: Cumulative application (1.38 d half life; 59% drift): 48.6 g a.i./ha	**<1.1**	**Not able to determine, potential risk**
				Off field soil: Cumulative application (1.38 d half life; 74% drift): 61 g a.i./ha	**<1.4**	**Not able to determine, potential risk**

- EEC for soil based on 80th percentile of aerobic soil half lives (1.38 days).

Table 19 Tier I Level Risk of Flonicamid to Predator and Parasites Based on Foliar Interception and Soil Deposition

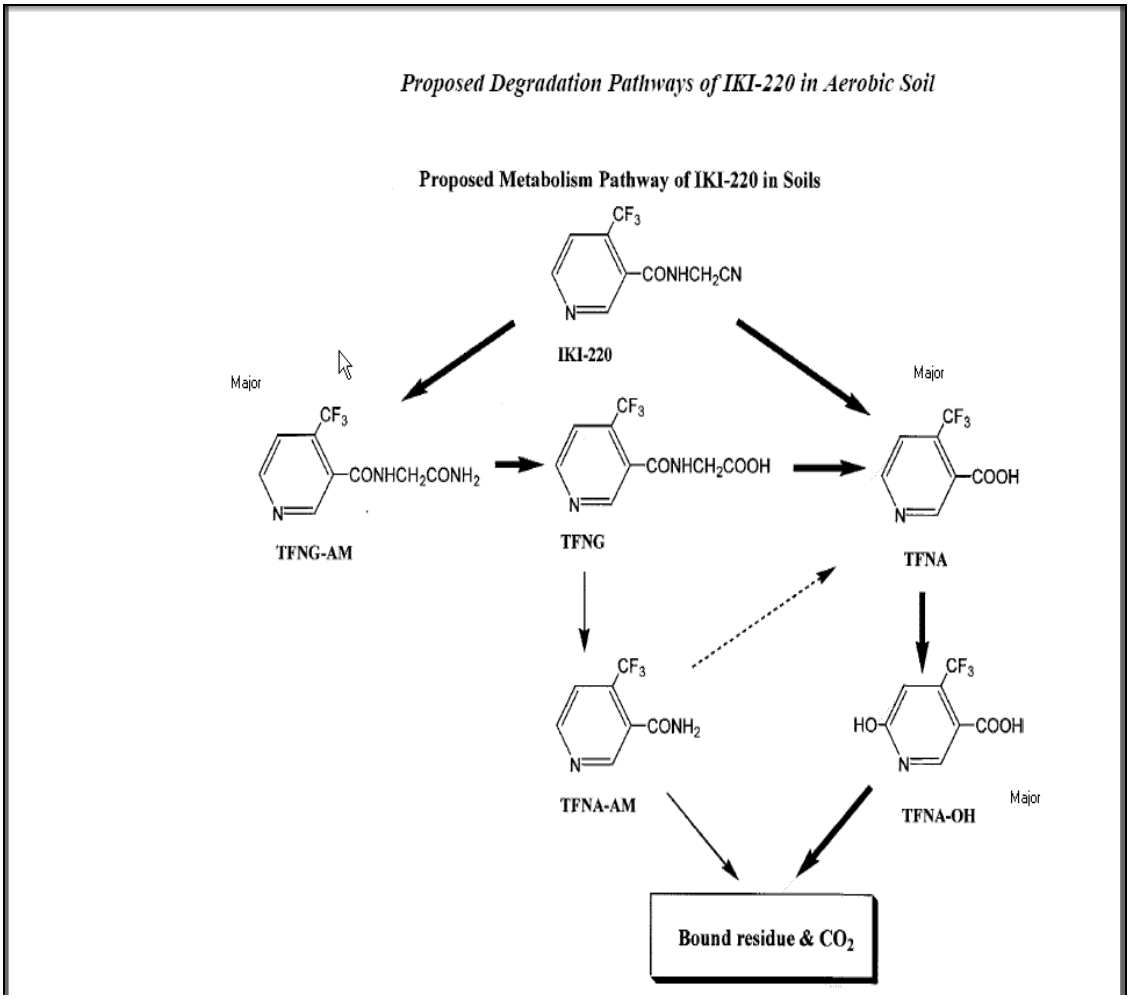
Organism	Exposure [Reference]	Test Substance	Endpoint Value	EEC*	RQ (EEC/Endpoint)	LOC Exceeded
Aphid parasitoid (Aphidius rhopalosiphi)	Contact (13 d) [1582369]	Flonicamid 50% (Beleaf 50SG Insecticide)	LR_{50}: >85 g a.i./ha ER_{50}: >85 g a.i./ha	On field: Cumulative application (12.5 d half life; 0.8 factor): 137 g a.i./ha	<1.6	Not able to determine, potential risk
				Off field: Cumulative application (59% drift; 0.1 factor): 10.1 g a.i./ha	0.12	No
				Off field: Cumulative application (74% drift; 0.1 factor): 12.7 g a.i./ha	0.15	No
Predacious mite (T. pyri)	Contact (7 d) [1582375]	Flonicamid 50% (Beleaf insecticide)	LR_{50}: >85 g a.i./ha ER_{50}: >85 g a.i./ha	On field: Cumulative application (12.5 d half life; 0.8 factor): 137 g a.i./ha	<1.6	Not able to determine, potential risk
				Off field: Cumulative application (59% drift; 0.1 factor): 10.1 g a.i./ha	0.12	No
				Off field: Cumulative application (74% drift; 0.1 factor): 12.7 g a.i./ha	0.15	No

Organism	Exposure [Reference]	Test Substance	Endpoint Value	EEC*	RQ (EEC/Endpoint)	LOC Exceeded
Green lacewing (C. carnea)	Contact (4 wk) [1582371]	Flonicamid 50% (Beleaf insecticide)	LR_{50}: >85 g a.i./ha ER_{50}: >85 g a.i./ha	On field: Cumulative application (12.5 d half life; 0.8 factor): 137 g a.i./ha	<1.6	Not able to determine, potential risk
				Off field: Cumulative application (59% drift; 0.1 factor): 10.1 g a.i./ha	0.12	No
				Off field: Cumulative application (74% drift; 0.1 factor): 12.7 g a.i./ha	0.15	No
Carabid beetle (Poecilus cupreus)	Contact (14 d) [1582373]	Flonicamid 50% (Beleaf insecticide)	LR_{50}: >45 g a.i./ha ER_{50}: >85 g a.i./ha	On field soil: Cumulative application (1.38 d half life; 0.2 factor): 16.5 g a.i./ha	0.4	No
				Off field soil: Cumulative application (1.38 d half life; 59% drift; 0.1 factor): 4.86 g a.i./ha	0.11	No
				Off field soil: Cumulative application (1.38 d half life; 74% drift; 0.1 factor): 6.1 g a.i./ha	0.14	No

EEC based on foliar interception and soil deposition values. Beleaf 50SG Insecticide is applied to a number of crops including stone and pome fruit, potatoes, tomatoes, and cabbage. According to table 6.5, foliar interception for the above listed crops ranges from 0.15 to 0.9; soil deposition ranges from 0.1 to 0.85, depending on growth phase of the plant.

** Sample calculation: Foliar interception for EEC of 100.9 g a.i./ha x 0.1=10.1 g a.i./ha

Figure 1 Environmental Transformation Pathway



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

Seventeen of the specified Canadian MRLs are the same as those in the U.S.

Appendix III Crop Groups: Numbers and Definitions

Crop Group Number	Name of the Crop Group	Commodity
1B	Root Vegetable (except sugar beet) Subgroup	garden beet roots edible burdock roots carrot roots celeriac roots turnip-rooted chervil roots chicory roots ginseng roots horseradish roots turnip-rooted parsley roots parsnip roots radish roots oriental radish roots rutabaga roots salsify roots black salsify roots Spanish salsify roots skirret roots turnip roots
1C	1C - Tuberous and Corm Vegetables Subgroup	arracacha arrowroot Chinese artichokes Jerusalum artichokes edible canna cassava roots chayote roots chufa taro corms ginger roots lerens potatoes sweet potato roots tanier corms turmeric roots yam bean roots true yam tubers

Crop Group Number	Name of the Crop Group	Commodity
4	Leafy Vegetables (except Brassica Vegetables) Group	amaranth arugula cardoon celery Chinese celery celtuce fresh chervil leaves edible leaved chrysanthemum garland chrysanthemum corn salad garden cress upland cress dandelion leaves dock endives fresh Florence fennel leaves and stalk head lettuce and leaf lettuce orach leaves fresh parsley leaves garden purslane winter purslane radicchio rhubarb spinach New Zealand spinach vine spinach Swiss chard
5A	Head and stem Brassica Subgroup	broccoli Chinese broccoli Brussels sprouts cabbages Napa Chinese cabbages Chinese mustard cabbages cauliflower kohlrabi
5B	Leafy Brassica greens subgroup	broccoli raab bok choy Chinese cabbages collards kale mustard greens mustard spinach rape greens

Crop Group Number	Name of the Crop Group	Commodity
8	Fruiting Vegetables (Except Cucurbits) Group	eggplants groundcherries pepinos bell peppers non-bell peppers tomatillos tomatoes African eggplants Bush tomatoes coconas currant tomatoes garden huckleberries Goji berries martynias naranjillas okras pea eggplants roselles Scarlet eggplants sunberries tree tomatoes
9	Cucurbit Vegetables Group	chayote fruit Chinese waxgourds citron melons cucumbers West Indian gherkins edible gourds (other than those listed in this item) balsam apples balsam pears Chinese cucumbers cantaloupes muskmelons (other than those listed in this item) pumpkins summer squash winter squash watermelons
11	Pome Fruits Group	apples crabapples loquats mayhaws pears Asian pears quinces azaroles medlars Chinese quinces Japanese quinces tejocotes

Crop Group Number	Name of the Crop Group	Commodity
12	Stone Fruits Group	apricots sweet cherries tart cherries nectarines peaches plums Chickasaw plums Damson plums Japanese plums plumcots fresh prune plums Japanese apricots capulins black cherries Nanking cherries chokecherries American plums beach plums Canada plums cherry plums Klamath plums sloes

References

A. List of Studies/Information Submitted by Registrant

1.0 Chemistry

PMRA Document Number	Reference
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1581852	2002, Discussion of Impurities/Technical Flonicamid Insecticide (IKI-220), DACO: 2.11.4 CBI
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1581865 1999, IKI-220 - Vapor Pressure, DACO: 2.14.9 CBI

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1591044 Chemistry Requirements for Technical Flonicamid Insecticide, DACO: 2.1, 2.10, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9 CBI

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1630623 2006, 5-Batch Analysis of IKI-220 Technical of Commercial - India Production, DACO: 2.13.3 CBI

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4.0 Value

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1506740 2002, Control of aphid (Aphis, green peach, potato) in potato with flonicamid, DACO: 10.2.3.3(D)

1506741 2002, Control of aphid (Aphis, green peach, potato) in potato with flonicamid, DACO: 10.2.3.3(D)

1506742 2002, Control of aphid (green peach, potato) in potato with flonicamid, DACO: 10.2.3.3(D)

1506743 2002, Control of aphid (potato) in potato with flonicamid, DACO: 10.2.3.3(D)

1506744 2003, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.3(D)

1506745 2003, Control of aphid (potato) in potato with flonicamid, DACO: 10.2.3.3(D)

1506746 2003, Control of aphid (potato) in potato with flonicamid, DACO: 10.2.3.3(D)

1506747 2003, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.3(D)

1506748 2003, Control of aphid (potato) in potato with flonicamid, DACO: 10.2.3.3(D)

1506749 2003, Control of aphid (cowpea) in potato with flonicamid, DACO: 10.2.3.3(D)

1506750 2003, Control of aphid (potato) in potato with flonicamid, DACO: 10.2.3.3(D)

1506751 2003, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.3(D)

1506752 2003, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.3(D)

1506753 2003, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.3(D)

1506754 2004, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.3(D)

1506755 2004, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.3(D)

1506756 2004, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.3(D)

1506757 2004, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.3(D)

1506758 2002, Control of leafhopper in potato with flonicamid, DACO: 10.2.3.3(D)

1506759 2002, Control of plant bug (tarnished) in sugar beet with flonicamid, DACO: 10.2.3.3(D)

1506760 2002, Control of aphid (bean) in carrot with flonicamid, DACO: 10.2.3.3(D)

1506761 2002, Control of aphid (green peach) in carrot with flonicamid, DACO: 10.2.3.3(D)

1506762 2004, Control of aphid (green peach) in carrot with flonicamid, DACO: 10.2.3.3(D)

1506764 2002, Control of aphid (green peach) in radish with flonicamid, DACO: 10.2.3.3(D)

1506765 2002, Control of aphid (cotton) in radish with flonicamid, DACO: 10.2.3.3(D)

1506766 2002, Control of aphid (turnip) in radish with flonicamid, DACO: 10.2.3.3(D)

1506767 2003, Control of aphid (cabbage) in radish with flonicamid, DACO: 10.2.3.3(D)

1506768 2002, Control of aphid (turnip) in turnip with flonicamid, DACO: 10.2.3.3(D)

1506769 2002, Control of aphid (turnip) in turnip with flonicamid, DACO: 10.2.3.3(D)

1506770 2001, Control of aphid (spirea) in apple with flonicamid, DACO: 10.2.3.3(D)

1506771 2002, Control of aphid (spirea) in apple with flonicamid, DACO: 10.2.3.3(D)

1506772 2002, Control of aphid (rosy apple) in apple with flonicamid, DACO: 10.2.3.3(D)

1506773 2002, Control of aphid (spirea) in apple with flonicamid, DACO: 10.2.3.3(D)

1506774 2002, Control of aphid (rosy apple) in apple with flonicamid, DACO: 10.2.3.3(D)

1506776 2003, Control of aphid (spirea) in apple with flonicamid, DACO: 10.2.3.3(D)

1506777 2003, Control of aphid (spirea) in apple with flonicamid, DACO: 10.2.3.3(D)

1506778 2003, Control of aphid (rosy apple) in apple with flonicamid, DACO: 10.2.3.3(D)

1506779 2003, Control of aphid (rosy apple) in apple with flonicamid, DACO: 10.2.3.3(D)

1506780 2003, Control of aphid (apple) in apple with flonicamid, DACO: 10.2.3.3(D)

1506781 2003, Control of aphid (rosy apple) in apple with flonicamid, DACO: 10.2.3.3(D)

1506782 2004, Control of aphid (rosy apple) in apple with flonicamid, DACO: 10.2.3.3(D)

1506783 2004, Control of aphid (spirea) in apple with flonicamid, DACO: 10.2.3.3(D)

1506784 2002, Control of aphid (spirea) in pear with flonicamid, DACO: 10.2.3.3(D)

1506785 2002, Control of rust mite in pear with flonicamid, DACO: 10.2.3.3(D)

1506786 2002, Control of aphid (green peach) in peach with flonicamid, DACO: 10.2.3.3(D)

1506787 2002, Control of plant bug (tarnished) in peach with flonicamid, DACO: 10.2.3.3(D)

1506788 2002, Control of aphid (mealy plum) in plum with flonicamid, DACO: 10.2.3.3(D)

1506789 2002, Control of aphid (mealy plum) in plum with flonicamid, DACO: 10.2.3.3(D)

1506790 2003, Control of aphid (mealy plum) in plum with flonicamid, DACO: 10.2.3.3(D)

1506791 2001, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.3(D)

1506792 2001, Control of aphid (Aphis) in alfalfa with flonicamid, DACO: 10.2.3.3(D)

1506793 2001, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.3(D)

1506794 2001, Control of aphid (cowpea and spotted alfalfa) in alfalfa with flonicamid, DACO: 10.2.3.3(D)

1506795 2002, Control of aphid (cowpea and blue alfalfa) in alfalfa with flonicamid, DACO: 10.2.3.3(D)

1506796 2002, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.3(D)

1506797 2002, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.3(D)

1506798 2001, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.3(D)

1506799 2002, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.3(D)

1506800 2001, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.3(D)

1506801 2003, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.3(D)

1506802 2003, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.3(D)

1506803 2003, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.3(D)

1506804 2004, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.3(D)

1506805 2004, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.3(D)

1506806 2001, Control of plant bug (western) in alfalfa with flonicamid, DACO: 10.2.3.3(D)

1506807 2002, Control of plant bug (western) in alfalfa with flonicamid, DACO: 10.2.3.3(D)

1506808 2001, Control of plant bug (tarnished) in alfalfa with flonicamid, DACO: 10.2.3.3(D)

1506809 2001, Control of plant bug (tarnished) in alfalfa with flonicamid, DACO: 10.2.3.3(D)

1506810 2001, Control of leafhopper (potato) in alfalfa with flonicamid, DACO: 10.2.3.3(D)

1506811 2002, Control of aphid (russian wheat and spotted alfalfa) in barley with flonicamid, DACO: 10.2.3.3(D)

1506812 2003, Control of aphid (russian wheat) in barley with flonicamid, DACO: 10.2.3.3(D)

1506813 2004, Control of aphid (russian wheat) in barley with flonicamid, DACO: 10.2.3.3(D)

1506814 2002, Control of aphid (bean) in bean (Lima) with flonicamid, DACO: 10.2.3.3(D)

1506815 2001, Control of plant bug (lygus) in bean (Lima) with flonicamid, DACO: 10.2.3.3(D)

1506816 2002, Control of aphid (soybean) in bean (Snap) with flonicamid, DACO: 10.2.3.3(D)

1506817 2003, Control of aphid (green peach) in bean (Snap) with flonicamid, DACO: 10.2.3.3(D)

1506818 2002, Control of plant bug (lygus) in canola with flonicamid, DACO: 10.2.3.3(D)

1506819 2002, Control of plant bug (western) and scale in citrus (orange) with flonicmid, DACO: 10.2.3.3(D)

1506927 2003, Crop Phytotoxicity with Flonicamid (Lettuce), DACO: 10.3.2(B) CBI

1506928 2003, Crop Phytotoxicity with Flonicamid (Cantaloupe), DACO: 10.3.2(B)

1506929 2003, Crop Phytoxicity with Flonicamid (Pumpkin), DACO: 10.3.2(B)

1506930 2003, Crop Phytotoxicity with Flonicamid (Carrot), DACO: 10.3.2(B)

1506931 2004, Crop Phytotoxicity with Flonicamid (Plum), DACO: 10.3.2(B)

1506932 2004, Crop Phytotoxicity with Flonicamid (Lettuce), DACO: 10.3.2(B)

1506933 2004, Crop Phytotoxicity with Flonicamid (Cucumber), DACO: 10.3.2(B)

1506934 2004, Crop Phytotoxicity with Flonicamid (Pepper), DACO: 10.3.2(B)

1506935 2004, Crop Phytotoxicity with Flonicamid (Pepper), DACO: 10.3.2(B)

1506936 2004, Crop Phytotoxicity with Flonicamid (Pea), DACO: 10.3.2(B)

1506937 2004, Crop Phytotoxicity with Flonicamid (Wheat), DACO: 10.3.2(B)

1506944 2007, 10.1 Value Summary - Flonicamid, DACO: 10.1

1506945 2007, 10.1 Value Summary - Flonicamid, DACO: 10.1,10.2.1,10.2.2

1506947 2007, 10.2.3.1 Brassica Vegetable Flonicamid Summary Table, DACO: 10.2, 10.2.3, 10.2.3.1

1506949 2007, 10.2.3.1 Curcurbit Vegetable Flonicamid Summary Table, DACO: 10.2, 10.2.3, 10.2.3.1

1506950 2007, 10.2.3.1 Fruiting Vegetable Flonicamid Summary Table, DACO: 10.2, 10.2.3, 10.2.3.1

1506951 2007, 10.2.3.1 Hop Flonicamid Summary Table, DACO: 10.2,10.2.3,10.2.3.1

1506953 2007, 10.2.3.1 Leafy Vegetable Flonicamid Summary Table, DACO: 10.2, 10.2.3, 10.2.3.1

1506954 2007, 10.2.3.1 Tuberous Vegetable Flonicamid Summary Table, DACO: 10.2, 10.2.3,1 0.2.3.1

1506955 2007, 10.2.3.1 Root Vegetable Flonicamid Summary Table, DACO: 10.2, 10.2.3, 10.2.3.1

1506956 2007, 10.2.3.1 Pome Fruit Flonicamid Summary Table, DACO: 10.2, 10.2.3, 10.2.3.1

1506957 2007, 10.2.3.1 Stone Fruit Flonicamid Summary Table, DACO: 10.2, 10.2.3, 10.2.3.1

1506958 2007, 10.2.3.1 Alfalfa Flonicamid Summary Table, DACO: 10.2,10.2.3,10.2.3.1

1506959 2007, 10.2.3.1 Canola Flonicamid Summary Table, DACO: 10.2,10.2.3,10.2.3.1

1506960 2007, 10.2.3.1 Pea Flonicamid Summary Table, DACO: 10.2,10.2.3,10.2.3.1

1506961 2007, 10.2.3.1 Sorghum Flonicamid Summary Table, DACO: 10.2,10.2.3,10.2.3.1

1506962 2007, 10.2.3.1 Wheat Flonicamid Summary Table, DACO: 10.2,10.2.3,10.2.3.1

1506963 2007, 10.2.3.1 Summary Flonicamid Efficacy Trials, DACO: 10.2.3.1

1506964 2007, 10.2.3.1 Competitive Standards Used in flonicamid trials, DACO: 10.2.3.1

1506965 2002, Control of aphid (cotton) in broccoli with flonicamid, DACO: 10.2.3.1

1506966 2003, Control of aphid (green peach) in broccoli with flonicamid, DACO: 10.2.3.1

1506967 2002, Control of whitefly in broccoli with flonicamid, DACO: 10.2.3.1

1506968 2002, Control of aphid (cabbage) in cabbage with flonicamid, DACO: 10.2.3.1

1506969 2002, Control of aphid (green peach) in cabbage with flonicamid, DACO: 10.2.3.1

1506970 2002, Control of aphid (green peach) in cabbage with flonicamid, DACO: 10.2.3.1

1506971 2002, Control of aphid (green peach) in cabbage with flonicamid, DACO: 10.2.3.1

1506972 2002, Control of aphid (green peach) in cabbage with flonicamid, DACO: 10.2.3.1

1506974 2002, Control of aphid (cabbage) in cabbage with flonicamid, DACO: 10.2.3.1

1506975 2002, Control of aphid (cabbage) in cabbage with flonicamid, DACO: 10.2.3.1

1506976 2003, Control of aphid (cabbage) in cabbage with flonicamid, DACO: 10.2.3.1

1506977 2004, Control of aphid (cabbage) in cabbage with flonicamid, DACO: 10.2.3.1

1506978 2002, Control of imported cabbageworm in cabbage with flonicamid, DACO: 10.2.3.1

1506979 2003, Control of aphid (green peach) in collard with flonicamid, DACO: 10.2.3.1

1506980 2003, Control of aphid (green peach) in collard with flonicamid, DACO: 10.2.3.1

1506982 2003, Control of aphid (green peach) in collard with flonicamid, DACO: 10.2.3.1

1506983 2003, Control of aphid (turnip) in mustard greens with flonicamid, DACO: 10.2.3.1

1506984 2003, Control of aphid (turnip) in mustard greens with flonicamid, DACO: 10.2.3.1

1506985 2004, Control of aphid (turnip) in mustard (yellow) with flonicamid, DACO: 10.2.3.1

1506986 2002, Control of aphid (cotton) in cantaloupe with flonicamid, DACO: 10.2.3.1

1506987 2002, Control of aphid (cotton) in muskmelon with flonicamid, DACO: 10.2.3.1

1506988 2004, Control of aphid (cotton) in cantaloupe with flonicamid, DACO: 10.2.3.1

1506989 2002, Control of aphid (cotton) in cantaloupe with flonicamid, DACO: 10.2.3.1

1506991 2007, Control of whitefly (silverleaf) in cantaloupe with flonicamid, DACO: 10.2.3.1

1506992 2002, Control of whitefly (silverleaf) in melon (mixed) with flonicamid, DACO: 10.2.3.1

1506993 2002, Control of aphid (pea) in cucumber with flonicamid, DACO: 10.2.3.1

1506994 2003, Control of aphid (Aphis) in cucumber with flonicamid, DACO: 10.2.3.1

1506995 2003, Control of aphid (Aphis) in cucumber with flonicamid, DACO: 10.2.3.1

1506996 2002, Control of aphid (pea) in pumpkin with flonicamid, DACO: 10.2.3.1

1506997 2002, Control of aphid (pea) in pumpkin with flonicamid, DACO: 10.2.3.1

1506999 2003, Control of aphid (green peach) in pumpkin with flonicamid, DACO: 10.2.3.1

1507000 2004, Control of aphid (pea) in pumpkin with flonicamid, DACO: 10.2.3.1

1507001 2001, Control of aphid (cotton) in squash with flonicamid, DACO: 10.2.3.1

1507002 2002, Control of aphid (pea) in squash with flonicamide, DACO: 10.2.3.1

1507004 2002, Control of aphid (pea) in squash with flonicamid, DACO: 10.2.3.1

1507007 2003, Control of squash bug in squash with flonicamid, DACO: 10.2.3.1

1507008 2002, Control of aphid (green peach) in pepper with flonicamid, DACO: 10.2.3.1

1507009 2007, Control of aphid (green peach) in pepper with flonicamid, DACO: 10.2.3.1

1507010 2002, Control of aphid (green peach) in pepper with flonicamid, DACO: 10.2.3.1

1507011 2003, Control of aphid (green peach) in pepper with flonicamid, DACO: 10.2.3.1

1507012 2004, Control of aphid (russian wheat) in wheat with flonicamid, DACO: 10.2.3.1

1507013 2003, Control of aphid (greenbug) in wheat (winter) with flonicamid, DACO: 10.2.3.1

1507015 2002, Control of aphid (potato) in lettuce with flonicamid, DACO: 10.2.3.1

1507016 2004, Control of aphid (potato, lettuce and foxglove) with lettuce, DACO: 10.2.3.1

1507017 2002, Control of aphid (potato, lettuce, foxglove) in lettuce, DACO: 10.2.3.1

1507018 2003, Control of aphid (lettuc) in lettuce with flonicamid, DACO: 10.2.3.1

1507019 2003, Control of aphid (potato) in lettuce, DACO: 10.2.3.1

1507020 2003, Control of aphid (russian wheat) in wheat with flonicamid, DACO: 10.2.3.1

1507021 2003, Control of aphid (pea) in pepper with flonicamid, DACO: 10.2.3.1

1507022 2004, Control of aphid (green peach) in pepper with flonicamid, DACO: 10.2.3.1

1507023 2004, Control of aphid (green peach) in pepper with flonicamid, DACO: 10.2.3.1

1507024 2002, Control of aphid (green peach) in tomato with flonicamid, DACO: 10.2.3.1

1507025 2004, Control of aphid (green peach) in tomato with flonicamid, DACO: 10.2.3.1

1507026 2003, Control of aphid (potato) in tomato with flonicamid, DACO: 10.2.3.1

1507027 2004, Control of stink bug in tomato with flonicamid, DACO: 10.2.3.1

1507028 2002, Control of whitefly (silverleaf) in tomato with flonicamid, DACO: 10.2.3.1

1507029 2002, Control of aphid (hop) in hop with flonicamid, DACO: 10.2.3.1

1507030 2002, Control of aphid (green peach) in lettuce with flonicamid, DACO: 10.2.3.1

1507035 2003, Control of aphid (potato) in lettuce with flonicamid, DACO: 10.2.3.1

1507036 2003, Control of aphid (cowpea) in lettuce with flonicamid, DACO: 10.2.3.1

1507037 2003, Control of aphid (cowpea) in lettuce with flonicamid, DACO: 10.2.3.1

1507038 2003, Control of aphid (green peach) in lettuce in flonicamid, DACO: 10.2.3.1

1507039 2004, Control of aphid (green peach) in lettuce with flonicamid, DACO: 10.2.3.1

1507040 2004, Control of cabbage looper in lettuce with flonicamid, DACO: 10.2.3.1

1507041 2002, Control of whitefly (silverleaf) in lettuce with flonicamid, DACO: 10.2.3.1

1507042 2004, Control of aphid (green peach) in spinach with flonicamid, DACO: 10.2.3.1

1507043 2001, Control of aphid (potato) in potato with flunicamid, DACO: 10.2.3.1

1507044 2001, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.1

1507045 2001, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.1

1507046 2002, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.1

1507047 2002, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.1

1507048 2002, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.1

1507049 2002, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.1

1507050 2002, Control of aphid (Aphis, green peach, potato) in potato with flonicamid, DACO: 10.2.3.1

1507051 2002, Control of aphid (potato) in potato with flonicamid, DACO: 10.2.3.1

1507052 2002, Control of aphid (Aphis, green peach, potato) in potato with flonicamid, DACO: 10.2.3.1

1507053 2002, Control of aphid (potato) in potato with flonicamid, DACO: 10.2.3.1

1507054 2002, Control of aphid (green peach, potato) in potato with flonicamid, DACO: 10.2.3.1

1507055 2001, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.1

1507056 2002, Control of aphid (potato) in potato with flonicamid, DACO: 10.2.3.1

1507057 2003, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.1

1507058 2003, Control of aphid (potato) in potato with flonicamid, DACO: 10.2.3.1

1507059 2003, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.1

1507060 2003, Control of aphid (potato) in potato with flonicamid, DACO: 10.2.3.1

1507061 2003, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.1

1507062 2003, Control of aphid (potato) in potato with flonicamid, DACO: 10.2.3.1

1507063 2003, Control of aphid (cowpea) in potato with flonicamid, DACO: 10.2.3.1

1507064 2003, Control of aphid (potato) in potato with flonicamid, DACO: 10.2.3.1

1507065 2003, Control of aphid (potato) in potato with flonicamid, DACO: 10.2.3.1

1507066 2003, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.1

1507067 2003, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.1

1507068 2003, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.1

1507069 2004, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.1

1507070 2004, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.1

1507071 2001, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.1

1507072 2004, Control of aphid (green peach) in potato with flonicamid, DACO: 10.2.3.1

1507073 2002, Control of leafhopper in potato with flonicamid, DACO: 10.2.3.1

1507074 2002, Control of plant bug (tarnished) in sugar beet with flonicamid, DACO: 10.2.3.1

1507075 2002, Control of plant bug (tarnished) in sugar beet with flonicamid, DACO: 10.2.3.1

1507076 2002, Control of aphid (bean) in carrot with flonicamid, DACO: 10.2.3.1

1507077 2001, Control of aphid (bean) in carrot with flonicamid, DACO: 10.2.3.1

1507078 2002, Control of aphid (green peach) in carrot with flonicamid, DACO: 10.2.3.1

1507079 2002, Control of aphid (green peach) in carrot with flonicamid, DACO: 10.2.3.1

1507080 2004, Control of aphid (green peach) in carrot with flonicamid, DACO: 10.2.3.1

1507081 2002, Control of aphid (green peach) in radish with flonicamid, DACO: 10.2.3.1

1507082 2002, Control of aphid (cotton) in radish with flonicamid, DACO: 10.2.3.1

1507083 2002, Control of aphid (turnip) in radish with flonicamid, DACO: 10.2.3.1

1507084 2001, Control of aphid (turnip) in radish with flonicamid, DACO: 10.2.3.1

1507085 2003, Control of aphid (cabbage) in radish with flonicamid, DACO: 10.2.3.1

1507086 2003, Control of aphid (cabbage) in radish with flonicamid, DACO: 10.2.3.1

1507087 2002, Control of aphid (turnip) in turnip with flonicamid, DACO: 10.2.3.1

1507088 2002, Control of aphid (turnip) in turnip with flonicamid, DACO: 10.2.3.1

1507089 2002, Control of aphid (turnip) in turnip with flonicamid, DACO: 10.2.3.1

1507090 2001, Control of aphid (turnip) in turnip with flonicamid, DACO: 10.2.3.1

1507091 2001, Control of aphid (spirea) in apple with flonicamid, DACO: 10.2.3.1

1507092 2002, Control of aphid (rosy apple) in apple with flonicamid, DACO: 10.2.3.1

1507093 2002, Control of aphid (spirea) in apple with flonicamid, DACO: 10.2.3.1

1507094 2002, Control of aphid (rosy apple) in apple with flonicamid, DACO: 10.2.3.1

1507095 2002, Control of aphid (spirea) in apple with flonicamid, DACO: 10.2.3.1

1507096 2002, Control of aphid (rosy apple) in apple with flonicamid, DACO: 10.2.3.1

1507097 2002, Control of aphid (rosy apple) in apple with flonicamid, DACO: 10.2.3.1

1507098 2003, Control of aphid (spirea) in apple with flonicamid, DACO: 10.2.3.1

1507099 2003, Control of aphid (spirea) in apple with flonicamid, DACO: 10.2.3.1

1507100 2003, Control of aphid (rosy apple) in apple with flonicamid, DACO: 10.2.3.1

1507101 2003, Control of aphid (rosy apple) in apple with flonicamid, DACO: 10.2.3.1

1507102 2003, Control of aphid (apple) in apple with flonicamid, DACO: 10.2.3.1

1507103 2003, Control of aphid (rosy apple) in apple with flonicamid, DACO: 10.2.3.1

1507104 2001, Control of aphid (rosy apple) in apple with flonicamid, DACO: 10.2.3.1

1507105 2004, Control of aphid (rosy apple) in apple with flonicamid, DACO: 10.2.3.1

1507106 2004, Control of aphid (spirea) in apple with flonicamid, DACO: 10.2.3.1

1507107 2002, Control of aphid (spirea) in pear with flonicamid, DACO: 10.2.3.1

1507108 2002, Control of rust mite in pear with flonicamid, DACO: 10.2.3.1

1507109 2002, Control of aphid (green peach) in peach with flonicamid, DACO: 10.2.3.1

1507110 2001, Control of aphid (green peach) in peach with flonicamid, DACO: 10.2.3.1

1507111 2002, Control of plant bug (tarnished) in peach with flonicamid, DACO: 10.2.3.1

1507112 2002, Control of aphid (mealy plum) in plum with flonicamid, DACO: 10.2.3.1

1507113 2002, Control of aphid (mealy plum) in plum with flonicamid, DACO: 10.2.3.1

1507114 2003, Control of aphid (mealy plum) in plum with flonicamid, DACO: 10.2.3.1

1507116 2001, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.1

1507117 2001, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.1

1507118 2001, Control of aphid (Aphis) in alfalfa with flonicamid, DACO: 10.2.3.1

1507119 2001, Control of aphid (Aphis) in alfalfa with flonicamid, DACO: 10.2.3.1

1507120 2001, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.1

1507121 2002, Control of aphid (spotted alfalfa) in alfalfa with flonicamid, DACO: 10.2.3.1

1507122 2002, Control of aphid (cowpea) in alfalfa with flonicamid, DACO: 10.2.3.1

1507123 2001, Control of aphid (cowpea and spotted alfalfa) in alfalfa with flonicamid, DACO: 10.2.3.1

1507124 2002, Control of aphid (cowpea and blue alfalfa) in alfalfa with flonicamid, DACO: 10.2.3.1

1507125 2002, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.1

1507126 2002, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.1

1507127 2001, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.1

1507128 2002, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.1

1507129 2002, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.1

1507130 2002, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.1

1507131 2001, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.1

1507132 2003, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.1

1507133 2003, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.1

1507134 2003, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.1

1507135 2004, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.1

1507136 2004, Control of aphid (pea) in alfalfa with flonicamid, DACO: 10.2.3.1

1507137 2001, Control of plant bug (western) in alfalfa with flonicamid, DACO: 10.2.3.1

1507138 2002, Control of plant bug (western) in alfalfa with flonicamid, DACO: 10.2.3.1

1507139 2001, Control of plant bug (tarnished) in alfalfa with flonicamid, DACO: 10.2.3.1

1507140 2003, Control of plant bug (lygus) in alfalfa with flonicamid, DACO: 10.2.3.1

1507141 2001, Control of plant bug (tarnished) in alfalfa with flonicamid, DACO: 10.2.3.1

1507142 2001, Control of leafhopper (potato) in alfalfa with flonicamid, DACO: 10.2.3.1

1507143 2002, Control of aphid (russian wheat and spotted alfalfa) in barley with flonicamid, DACO: 10.2.3.1

1507144 2002, Control of aphid (russian wheat) in barley with flonicamid, DACO: 10.2.3.1

1507145 2003, Control of aphid (russian wheat) in barley with flonicamid, DACO: 10.2.3.1

1507146 2004, Control of aphid (russian wheat) in barley with flonicamid, DACO: 10.2.3.1

1507147 2002, Control of aphid (bean) in bean (Lima) with flonicamid, DACO: 10.2.3.1

1507148 2001, Control of plant bug (lygus) in bean (Lima) with flonicamid, DACO: 10.2.3.1

1507149 2002, Control of aphid (soybean) in bean (Snap) with flonicamid, DACO: 10.2.3.1

1507150 2003, Control of aphid (green peach) in bean (Snap) with flonicamid, DACO: 10.2.3.1

1507151 2002, Control of plant bug (lygus) in canola with flonicamid, DACO: 10.2.3.1

1507152 2002, Control of plant bug (lygus) in canola with flonicamid, DACO: 10.2.3.1

1507153 2002, Control of plant bug (western) and scale in citrus (orange) with flonicmid, DACO: 10.2.3.1

1507154 2002, Control of thrips (citrus) in citrus (lemon) with flonicamid, DACO: 10.2.3.1

1507155 2003, Control of aphid (corn leaf) in corn (sweet) with flonicamid, DACO: 10.2.3.1

1507156 2001, Control of aphid (corn leaf) in corn (sweet) with flonicamid, DACO: 10.2.3.1

1507157 2001, Control of aphid (cotton) in cotton with flonicamid, DACO: 10.2.3.1

1507158 2001, Control of aphid (cotton) in cotton with flonicamid, DACO: 10.2.3.1

1507159 2002, Control of aphid (cotton) in cotton with flonicamid, DACO: 10.2.3.1

1507160 2002, Control of aphid (cotton) in cotton with flonicamid, DACO: 10.2.3.1

1507161 2002, Control of aphid (cotton) in cotton with flonicamid, DACO: 10.2.3.1

1507162 2002, Control of aphid (cotton) in cotton with flonicamid, DACO: 10.2.3.1

1507163 2002, Control of aphid (cotton) in cotton with flonicamid, DACO: 10.2.3.1

1507164 2002, Control of aphid (cotton) in cotton with flonicamid, DACO: 10.2.3.1

1507165 2002, Control of aphid (cotton) in cotton with flonicamid, DACO: 10.2.3.1

1507166 2002, Control of aphid (cotton) in cotton with flonicamid, DACO: 10.2.3.1

1507167 2002, Control of aphid (cotton) in cotton with flonicamid, DACO: 10.2.3.1

1507168 2002, Control of aphid (cotton) in cotton with flonicamid, DACO: 10.2.3.1

1507169 2002, Control of aphid (cotton) in cotton with flonicamid, DACO: 10.2.3.1

1507170 2003, Control of aphid (green peach) in tobacco, DACO: 10.2.3.1

1507171 2001, Control of plant bug (tarnished) in cotton with flonicamid, DACO: 10.2.3.1

1507172 2001, Control of plant bug (tarnished) in cotton with flonicamid, DACO: 10.2.3.1

1507173 2001, Control of plant bug (western) in cotton with flonicamid, DACO: 10.2.3.1

1507174 2001, Control of plant bug (western) in cotton with flonicamid, DACO: 10.2.3.1

1507175 2002, Control of plant bug (tarnished) in cotton with flonicamid, DACO: 10.2.3.1

1507176 2002, Control of plant bug (tarnished) in cotton with flonicamid, DACO: 10.2.3.1

1507177 2002, Control of plant bug (tarnished) in cotton with flonicamid, DACO: 10.2.3.1

1507178 2002, Control of plant bug (lygus) in cotton with flonicamid, DACO: 10.2.3.1

1507179 2002, Control of plant bug (western) in cotton with flonicamid, DACO: 10.2.3.1

1507180 2002, Control of plant bug (cotton) in cotton with flonicamid, DACO: 10.2.3.1

1507181 2002, Control of plant bug (western) in cotton with flonicamid, DACO: 10.2.3.1

1507182 2002, Control of plant bug (western) in cotton with flonicamid, DACO: 10.2.3.1

1507183 2002, Control of plant bug (cotton) in cotton with flonicamid, DACO: 10.2.3.1

1507184 2002, Control of plant bug (lygus) in cotton with flonicamid, DACO: 10.2.3.1

1507185 2002, Control of plant bug (lygus) in cotton with flonicamid, DACO: 10.2.3.1

1507186 2002, Control of plant bug (lygus) in cotton with flonicamid, DACO: 10.2.3.1

1507187 2002, Control of plant bug (lygus) in cotton with flonicamid, DACO: 10.2.3.1

1507188 2002, Control of plant bug (tarnished) in cotton with flonicamid, DACO: 10.2.3.1

1507189 2002, Control of plant bug (western) in cotton with flonicamid, DACO: 10.2.3.1

1507190 2003, Control of plant bug (western) in cotton with flonicamid, DACO: 10.2.3.1

1507191 2003, Control of plant bug (lygus) in cotton with flonicamid, DACO: 10.2.3.1

1507192 2003, Control of plant bug (lygus) in cotton with flonicamid, DACO: 10.2.3.1

1507193 2003, Control of plant bug (lygus) in cotton with flonicamid, DACO: 10.2.3.1

1507194 2003, Control of plant bug (lygus) in cotton with flonicamid, DACO: 10.2.3.1

1507195 2003, Control of plant bug (lygus) in cotton with flonicamid, DACO: 10.2.3.1

1507196 2003, Control of plant bug (lygus) in cotton with flonicamid, DACO: 10.2.3.1

1507197 2003, Control of plant bug (lygus) in cotton with flonicamid, DACO: 10.2.3.1

1507198 2003, Control of aphid (cotton) in cotton with flonicamid, DACO: 10.2.3.1

1507199 2003, Control of aphid (lygus) in cotton with flonicamid, DACO: 10.2.3.1

1507200 2003, Control of plant bug (stink bug) in cotton with flonicamid, DACO: 10.2.3.1

1507201 2003, Control of plant bug (tarnished) in cotton with flonicamid, DACO: 10.2.3.1

1507202 2003, Control of plant bug (lygus) in cotton with flonicamid, DACO: 10.2.3.1

1507203 2004, Control of plant bug (tarnished) in cotton with flonicamid, DACO: 10.2.3.1

1507204 2004, Control of plant bug (tarnished) in cotton with flonicamid, DACO: 10.2.3.1

1507205 2004, Control of plant bug (lygus) in cotton with flonicamid, DACO: 10.2.3.1

1507206 2001, Control of plant bug (lygus) in cotton with flonicamid, DACO: 10.2.3.1

1507207 2004, Control of plant bug (tarnished) in cotton with flonicamid, DACO: 10.2.3.1

1507208 2004, Control of plant bug (tarnished) in cotton with flonicamid, DACO: 10.2.3.1

1507209 2002, Control of thrip (WFT) in cotton with flonicamid, DACO: 10.2.3.1

1507210 2002, Control of thrip (tobacco) in cotton with flonicamid, DACO: 10.2.3.1

1507211 2002, Control of thrip (tobacco) in cotton with flonicamid, DACO: 10.2.3.1

1507212 2002, Control of thrip (tobacco) in cotton with flonicamid, DACO: 10.2.3.1

1507213 2001, Control of whitefly (silverleaf) in cotton with flonicamid, DACO: 10.2.3.1

1507214 2001, Control of leafhopper (variegated) in grape with flonicamid, DACO: 10.2.3.1

1507216 2002, Control of thrip (WFT) in onion (Dry bulb) with flonicamid, DACO: 10.2.3.1

1507217 2002, Control of thrips in onion (Dry bulb) with flonicamid, DACO: 10.2.3.1

1507218 2002, Control of thrip (WFT) in onion with flonicamid, DACO: 10.2.3.1

1507219 2002, Control of thrip in onion with flonicamid, DACO: 10.2.3.1

1507220 2002, Control of thrip in onion with flonicamid, DACO: 10.2.3.1

1507221 2002, Control of aphid (pea) in pea (sweet) with flonicamid, DACO: 10.2.3.1

1507222 2001, Control of aphid (pea) in pea (sweet) with flonicamid, DACO: 10.2.3.1

1507223 2001, Control of aphid (corn leaf) in sorghum with flonicamid, DACO: 10.2.3.1

1507224 2001, Control of aphid (corn leaf) in sorghum with flonicamid, DACO: 10.2.3.1

1507226 2001, Control of aphid(greenbug) iin sorghum with flonicamid, DACO: 10.2.3.1

1507227 2001, Control of aphid (greenbug) in sorghum with flonicamid, DACO: 10.2.3.1

1507228 2002, Control of aphid (corn leaf) in sorghum with flonicamid, DACO: 10.2.3.1

1507229 2002, Control of aphid (corn leaf) in sorghum with flonicamid, DACO: 10.2.3.1

1507230 2002, Control of aphid (corn leaf) in sorghum with flonicamid, DACO: 10.2.3.1

1507231 2002, Control of aphid (corn leaf) in sorghum with flonicamid, DACO: 10.2.3.1

1507232 2003, Control of aphid (greenbug) in sorghum with flonicamid, DACO: 10.2.3.1

1507233 2003, Control of aphid (greenbug) in sorghum with flonicamid, DACO: 10.2.3.1

1507234 2003, Control of aphid (greenbug) in sorghum with flonicamid, DACO: 10.2.3.1

1507235 2003, Control of aphid (greenbug) in sorghum with flonicamid, DACO: 10.2.3.1

1507236 2001, Control of aphid (soybean) in soybean with flonicamid, DACO: 10.2.3.1

1507237 2001, Control of aphid (soybean) in soybean with flonicamid, DACO: 10.2.3.1

1507238 2001, Control of aphid (soybean) in soybean with flonicamid, DACO: 10.2.3.1

1507239 2001, Control of aphid (soybean) in soybean with flonicamid, DACO: 10.2.3.1

1507240 2001, Control of aphid (bean) in soybean with flonicamid, DACO: 10.2.3.1

1507241 2001, Control of aphid (bean) in soybean with flonicamid, DACO: 10.2.3.1

1507242 2001, Control of aphid (bean) in soybean with flonicamid, DACO: 10.2.3.1

1507243 2001, Control of aphid (bean) in soybean with flonicamid, DACO: 10.2.3.1

1507244 2001, Control of aphid (bean) in soybean with flonicamid, DACO: 10.2.3.1

1507245 2001, Control of aphid (bean) in soybean with flonicamid, DACO: 10.2.3.1

1507247 2002, Control of aphid (Aphis) in soybean with flonicamid, DACO: 10.2.3.1

1507248 2002, Control of aphid (Aphis) in soybean with flonicamid, DACO: 10.2.3.1

1507249 2002, Control of aphid (Aphis) in soybean with flonicamid, DACO: 10.2.3.1

1507250 2002, Control of aphid (Aphis) in soybean with flonicamid, DACO: 10.2.3.1

1507251 2002, Control of aphid (Aphis) in soybean with flonicamid, DACO: 10.2.3.1

1507252 2002, Control of aphid (Aphis) in soybean with flonicamid, DACO: 10.2.3.1

1507253 2002, Control of aphid (Aphis) in soybean with flonicamid, DACO: 10.2.3.1

1507254 2002, Control of aphid (Aphis) in soybean with flonicamid, DACO: 10.2.3.1

1507255 2002, Control of aphid (Aphis) in soybean with flonicamid, DACO: 10.2.3.1

1507256 2002, Control of aphid (Aphis) in soybean with flonciamid, DACO: 10.2.3.1

1507258 2002, Control of aphid (Aphis) in soybean with flonicamid, DACO: 10.2.3.1

1507259 2002, Control of aphid (soybean) in soybean with flonicamid, DACO: 10.2.3.1

1507260 2002, Control of aphid (soybean) in soybean with flonicamid, DACO: 10.2.3.1

1507261 2003, Control of aphid (soybean) in soybean with flonicamid, DACO: 10.2.3.1

1507262 2003, Control of aphid (soybean) in soybean with flonicamid, DACO: 10.2.3.1

1507263 2003, Control of aphid (soybean) in soybean with flonicamid, DACO: 10.2.3.1

1507264 2003, Control of aphid (soybean) in soybean with flonicamid, DACO: 10.2.3.1

1507265 2001, Control of aphid (tobacco) in tobacco with flonicamid, DACO: 10.2.3.1

1507266 2002, Control of aphid (green peach) in tobacco with flonicamid, DACO: 10.2.3.1

1507267 2002, Control of aphid (tobacco) in tobacco with flonicamid, DACO: 10.2.3.1

1507270 2001, Control of aphid (green peach) in tobacco with flonicamid, DACO: 10.2.3.1

1507271 2002, Control of aphid (green peach) in tobacco with flonicamid, DACO: 10.2.3.1

1507272 2002, Control of aphid (green peach) in tobacco with flonicamid, DACO: 10.2.3.1

1507273 2003, Control of aphid (green peach) in tobacco with flonicamid, DACO: 10.2.3.1

1507275 2003, Control of aphid (green peach) in tobacco with flonicamid, DACO: 10.2.3.1

1507276 2003, Control of aphid (green peach) in tobacco with flonicamid, DACO: 10.2.3.1

1507277 2001, Control of aphid (english grain) in wheat with flonicamid, DACO: 10.2.3.1

1507278 2001, Control of aphid (english grain) in wheat with flonicamid, DACO: 10.2.3.1

1507279 2002, Control of aphid (russian wheat) in wheat with flonicamid, DACO: 10.2.3.1

1507280 2002, Control of aphid (russian wheat) in wheat with flonicamid, DACO: 10.2.3.1

1507281 2002, Control of aphid (english grain) in wheat with flonicamid, DACO: 10.2.3.1

1507282 2003, Control of aphid (russian wheat) in wheat with flonicamid, DACO: 10.2.3.1

1507283 2007, 10.3.1 Summary, DACO: 10.3,10.3.1

1507284 2003, Phytotoxicity of flonicamid to lettuce, DACO: 10.3.1

1507285 2003, Phytotoxicity of flonicamid to pumpkin, DACO: 10.3.1

1507286 2003, Phytotoxicity of flonicamid to carrot, DACO: 10.3.1

1507287 2003, Phytotoxicity of flonicamid to cantaloupe, DACO: 10.3.1

1507288 2003, Phytotoxicity of flonicamid to pepper, DACO: 10.3.1 CBI

1507289 2004, Phytotoxicity of flonicamid to plum, DACO: 10.3.1

1507290 2004, Phytotoxicity of flonicamid to lettuce (head), DACO: 10.3.1

1507291 2004, Phytotoxicity of flonicamid to cucumber, DACO: 10.3.1

1507293 2004, Phytotoxicity of flonicamid to pepper (Bell), DACO: 10.3.1

1507294 2004, Phytotoxicity of flonicamid to pea (succulent), DACO: 10.3.1

1507295 2004, Phytotoxicity of flonicamid to wheat (spring), DACO: 10.3.1

1630662 2008, 10.2.3.3 Carbine Demo Program 2006 Aerial and Ground, DACO: 10.2.3.3

1630663 2008, 10.2.3.3 Carbine Cotton Demo Protocol 2006, DACO: 10.2.3.3

1630664 2008, 10.2.3.1 Efficacy Summary Beleaf 50SG (all crops), DACO: 10.2.3.1

1630665 2008, 10.3.1 Phytotoxicity Summary Beleaf 50SG (all crops), DACO: 10.3.1

1630668 2008, 10.2.3.3 d. Beleaf 50SG and Beleaf 50WG Formulation Comparison, DACO: 10.2.3.3 CBI

1825714 2002, Activity of IKI-220 against the adults of Myzus persicae by aphid-spray and leaf-spray treatment, DACO: 10.2.1

1825715 2007, Flonicamid, a novel insecticide with a rapid inhibitory effect on aphid feeding, DACO: 10.2.1

B. Additional Information Considered

i) Published Information

1.0 Human and Animal Health

USDA Pesticide Data Monitoring Program (PDP 2008, 2007, and 2006).

2.0 Environment

Linders J, H. Mensink, G. Stephenson, D. Wauchope, and K. Racke. 2000. Foliar interception and retention values after pesticide application. A proposal for standardized values for environmental risk assessment (technical report). *Pure Appl Chem* 72 (11): 2199-2218.